REQUEST FOR COMPETITIVE SEALED PROPOSALS

BRENHAM FIRE STATION #2

TABLE OF CONTENTS:

REQUEST FOR COMPETITIVE SEALED PROPOSALS

PROJECT: Brenham Fire Station #2

LOCATION: 3007 James Nutt Blvd., Brenham, TX 77833

SCOPE OF WORK: Project consists of new construction of a 10,335 square foot fire station. Site work will include earthwork, paving, sidewalks, parking, site utilities, storm drainage, and landscaping. Building construction will include structural slab on piers, structural steel superstructure, CFMS and CMU framing, brick / siding / metal panel exterior, metal stud interior partitions, standing seam metal & modified bitumen roofing systems, storefront windows & entry doors, hollow metal & wood doors, hardware, ceilings, flooring, painting, millwork, fire suppression, mechanical systems, plumbing systems, and electrical systems.

RECEIPT OF PROPOSALS: Pursuant to Chapter 2269, subchapter D of the Texas Government Code and other applicable law, competitive sealed proposals for the construction of the new Brenham Fire Station #2 will be received by the City of Brenham **until 2:00 p.m. CST, Wednesday, November 20, 2024**. In this Request for Competitive Sealed Proposals and associated documents, the terms "bid," "bidder" and all variations thereof shall be used interchangeably with and construed to mean "proposal," "proposer," and all variations thereof.

The address for delivery is:

City of Brenham – Purchasing Department (Attn: Kyle Branham)
200 W. Vulcan St.
Brenham, TX 77833

All Proposals will be opened and publicly read aloud at 2:00 pm, in Conference Room 2A at 200 W. Vulcan St., Brenham, TX 77833.

Within forty-five (45) days after opening the Proposals, the Owner will score and rank each proposal to select the Proposal that offers the best value to the City based on:

1. The Bidder's cost proposal.
2. The Bidder's technical proposal.
3. The Bidder's demonstrated administrative ability and financial resources to perform the work.
4. The qualifications and experience of the project team the Bidder proposes to manage the project.
5. The Bidder's demonstrated experience and past performance in constructing similar projects.
6. The Bidder's demonstrated ability to suitably schedule the project and to meet schedules on other similar projects.
7. The Bidder's safety record supported by accurate and verifiable data.
8. The methodologies for the Bidder's quality assurance program.
9. The Bidder's ability to start construction of the project in a timely manner.

The Owner will then attempt to negotiate a contract with the selected offeror. The Owner may discuss with the selected offeror options for a scope or time modification and any price change associated with the modification. If the Owner is unable to negotiate a contract with the selected offeror, the Owner may end negotiations with that offeror and proceed to the next offeror in the order of the selection ranking until a contract is reached or all proposals are rejected.

INFORMATION AND BIDDING DOCUMENTS: Documents will be available in electronic PDF format and available for download at BRW Architects website at https://brwarch.filegenius.com/. A login will be required to download the documents and can be requested at https://www.brwarch.com/ftp/. Please contact BRW Architects if assistance is necessary: Justin Dreyer, 979-694-1791, jdreyer@brwarch.com.

PRE-PROPOSAL MEETING: A pre-proposal meeting shall be held at 2:00 p.m. CST, Wednesday, November 6, 2024, in Conference Room 2A at 200 W. Vulcan St., Brenham, Texas, 77833. General Contractor and major subcontractor attendance is recommended, but not mandatory.

INSTRUCTIONS TO PROPOSERS

1. RECEIPT AND OPENING OF BIDS:

1.1. Competitive Sealed Proposals will be received at the time, place and under the conditions set forth in the Request for Competitive Sealed Proposals.

1.2. The Owner may consider informal bids which are any bids not prepared and submitted in accordance with the provisions herein and may waive any informalities or reject any and all bids. Any bid may be withdrawn prior to the scheduled opening time. Any bid received after the specified time and date will not be considered. No bidder may withdraw a bid within 90 days after the actual date of opening.

1.3. Information and bidding documents may be obtained from the Architect under the conditions set forth in the Request for Competitive Sealed Proposals.

1.4. Plans will be available on the Architect's web site.

2. PREPARATION OF BID:

2.1. Each bid must be submitted with the Bid Security. See Instructions to Proposers, paragraph 4. (Forms are provided on pages 6 through 9).

2.2. Each bid must be submitted on the prescribed Bid Proposal Form. See pages 10 through 12. All blank spaces for bid prices must be filled in, using ink or typewriter, in both words and figures. In case of discrepancy, the amount shown in words will govern.

2.3. Each bid must be accompanied by a Contractors Qualification Statements (pages 13 through 16) and the Technical Proposal (Section 1.2 of the Supplemental Information to Proposers (Competitive Sealed Proposals), pages 17 through 20).

2.4. Each bid must be submitted in separately labeled envelopes; each bearing the name and address of the bidder, the Project Name for which the Proposal is submitted, and the contents of the envelope. This is further explained herein:

2.4.1. Bid Security: One sealed envelope shall contain the Bid Security (check, or bid bond as shown on pages 6 through 9) and shall be marked on the outside in bold letters: "Bid Security."

2.4.2. Bid Proposal: An additional sealed envelope shall contain the Bid Proposal (pages 10 through 12) and shall be clearly marked on the outside in bold letters: "Bid Proposal."

2.4.3. Contractors Qualifications: An additional sealed package shall contain 5 complete copies of: the Contractors Qualification Statements (pages 13 through 16) and the Technical Proposal (pages 17 through 20) and shall be marked on the outside in bold letters: "Contractors Qualifications".

3. QUALIFICATION OF BIDDERS:

3.1. The Owner may make such investigations as it deems necessary to determine the ability of the bidder to perform the work, and the bidder shall furnish the Owner all such information and data for this purpose as the Owner may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of, such bidder fails to satisfy the Owner that such bidder is properly qualified to carry out the obligations of the contract and to complete the work contemplated therein. Conditional bids will not be accepted.

4. BID SECURITY:

4.1. Each bid must be accompanied by a Cashier's Check or Certified Check of the bidder on a State or National Bank in the State of Texas, or a bid bond prepared on the standard form of bid bond, duly executed by the bidder as principal and having as surety thereon a surety company, approved by the Owner, in the amount of 5% of the bid. Such checks or bid bonds will be returned to all except the three (3) lowest bidders within three (3) days after the opening of bids and the remaining checks or bid bonds will be returned promptly after the Owner and the accepted bidder have executed the contract, or, if no award has been made within 90 days after the date of the opening of bids, upon demand of the bidder at any time thereafter, so long as he has not been notified of the acceptance of his bid.

4.2. Certified Check, Cashier's Check, or Bid Bond shall be made payable, without condition, to City of Brenham.

4.3. Each proposal shall remain in force until 90 days after the actual date of the opening thereof.

5. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT:

5.1. The successful bidder, upon his failure or refusal to execute and deliver the contract and bonds required within ten (10) days after he has received notice of the acceptance of his bid, shall forfeit to the Owner the security deposited with his bid.

6. TIME OF COMPLETION AND LIQUIDATED DAMAGES:

6.1. Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" of the Owner and to fully complete the project in **365** consecutive calendar days. Bidder must agree also to pay as liquidated damages, the sum of **$500.00** for each consecutive calendar day thereafter that the work has not reached Substantial Completion as hereinafter provided in the General Conditions.

7. ADDENDA AND INTERPRETATIONS:

7.1. No interpretation of the meaning of plans, specification or other pre-bid documents will be made to any bidder orally.

7.2. Submit all requests for interpretation in writing to the Architect, BRW Architects. Inquiries must be emailed to Justin Dreyer at jdreyer@brwarch.com. To be given consideration, inquiries must be received by 5:00 p.m., CST, November 15, 2024, five (5) days prior to the proposal opening date. All such interpretations and any supplemental instructions will be included in an addendum to the Contract Documents and will be posted on the website at https://brwarch.filegenius.com/. Failure of any bidder to receive any such addendum or interpretations shall not relieve such bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

8. POWER OF ATTORNEY:

8.1. Attorneys-in-fact who sign bid bonds or contract bonds must file with each bond a certified and effectively dated copy of their power of attorney.

9. NOTICE OF SPECIAL CONDITIONS:

9.1. Attention is particularly called to those parts of the Contract Documents and specifications which deal with the following.

9.1.1. Insurance requirements

9.1.2. Wage rates

10. SECURITY FOR FAITHFUL PERFORMANCE:

10.1. Simultaneously with his delivery of the executed contract, the Contractor shall furnish Payment and Performance Bonds as security for faithful performance of this contract and for the payment of all persons performing labor on the project under this contract and furnishing materials in connection with this contract, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner.

10.2. The Performance Bond shall cover 100% of the contract sum; the Payment Bond shall cover 100% of the contract sum.

11. ALTERNATES:

11.1. Any alternatives listed in the bid form are described in detail in the Specifications. Contract award could be on the basis of the base bid or any combination of the base bid and those alternatives which produce a total within available funds.

12. STATE SALES TAX:

12.1. The Owner qualifies for exemption from State and Local Sales Tax pursuant to Section 151.311 of the Texas Tax Code for material incorporated into the project, if the contract between the contractor and Owner separates the contract price into charges of material (to be incorporated into the project) and charges for labor (including material not incorporated into the project such as form-work used in the process of installation).

13. GENERAL REQUIREMENTS:

13.1. At the time of the opening of bids each bidder will be presumed to have inspected the site and to have read and to have become thoroughly familiar with the Plans and Specifications (including all addenda). The failure or omission of any bidder to examine any form, instrument or document or the site shall in no way relieve any bidder from any obligation in respect to his bid or be cause for adjusting the contract amount.

13.2. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other contractor.

13.3. Federal and State Laws, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the contract throughout, and they will be deemed to be included in the contract the same as though herein written out in full.

13.4. The bidder is specifically advised that any person, firm or other party to whom it is proposed to award a subcontract under this contract must be acceptable to the Owner.

PERFORMANCE BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF _____ §

That we, _____ [Contractor], as Principal herein, and _____ [Surety], a corporation organized and existing under the laws of the State of _____ and who is authorized and admitted to issue surety bonds in the State of Texas, Surety herein, are held and firmly bound unto the **Brenham, Texas**, located in **Washington County, Texas**, Obligee herein, in the sum of _____ Dollars ($_____) for the payment of which sum we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, Principal has entered into a certain written contract with the Obligee dated the ___ day of _____, 20___, herein referred to as "the Contract" and incorporated herein and made a part hereof for all purposes, for the construction of _____ [Project].

NOW, THEREFORE, the condition of this obligation is such, if the said Principal shall faithfully perform the work in accordance with the plans, specifications, and other Contract Documents and shall fully indemnify and hold harmless the Obligee from all costs and damages which Obligee may suffer by reason of Principal's failure to perform the Work in conformity with the Contract Documents, and reimburse and repay Obligee for all outlay and expense that Obligee may incur in making good such default, then this obligation shall be void; otherwise, to remain in full force and effect.

Whenever Principal shall be declared by Obligee to be in default under the Contract, the Surety shall, upon request of Obligee and within ten (10) calendar days from receipt of Obligee's notice of Principal's default, commence and thereafter complete performance of Contractor's obligations under the Contract. Surety acknowledges that its obligations under this bond and as detailed herein and in the Contract Documents are not conditioned on a termination of the Principal by the Obligee. Surety further acknowledges and agrees that Surety shall obtain the Obligee's approval and consent with respect to the contractor(s) that Surety may retain to replace defaulted Principal or otherwise honor the obligations under this Bond.

This Bond covers all contractual obligations of Contractor under the Contract, including, without limitation, the indemnity, warranty and guaranty obligations. The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of any of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto. The penal limit of this bond shall automatically be increased by the amount of any change order, supplemental agreement or amendment which increases the price of the Contract.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of such statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this _____ day of _____, 20____.

The date of bond shall not be prior to date of Contract.

_____
PRINCIPAL

ATTEST:

By: _____

_____
(Principal) Secretary

Name: _____

Title: _____

Address: _____
_____
_____

(S E A L)

_____
Witness as to Principal

Telephone Number: _____

_____
SURETY

ATTEST:

By: _____

_____
Secretary

Name: _____
Attorney in Fact

Address: _____
_____
_____

(S E A L)

_____
Witness as to Principal

Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

City of Brenham, Texas
200 W. Vulcan
Brenham, Texas 77833

By: _____

Title: _____

Date: _____

PAYMENT BOND

THE STATE OF TEXAS §
§ KNOW ALL BY THESE PRESENTS:
COUNTY OF _____ §

That we, _____, as Principal herein, and _____ _____, a corporation organized and existing under the laws of the State of Texas and who is authorized and admitted to use surety bonds in the State of Texas, as surety, are held and firmly bound unto the **City of Brenham, Texas** so located in **Washington County, Texas**, Obligee herein, in the amount of _____ Dollars ($_____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents:

WHEREAS, the Principal has entered into a certain written contract with the Obligee dated the ____day of _____, 20___, which contract is hereby referred to herein as "the Contract" and is incorporated herein to the same extent as if copied at length, for the following project: _____ _____ [Project].

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall directly or indirectly timely make payment to each and every claimant (as defined in Chapter 2253, Texas Government Code, as amended) supplying labor or materials in the prosecution of the work under the Contract, then this obligation shall be void; otherwise, to remain in full force and effect. *This obligation may be enforced by the Obligee in the event of bankruptcy or default by Principal in payments to suppliers of labor or materials in the prosecution of the work under the Contract, in either of which events the Surety shall make such payments as Principal has failed to pay and as may be required to complete the work under the contract.* The Surety stipulates and agrees that no change, extension of time, alteration, omission, addition or other modification to the terms of the Contract will affect its obligations on this bond, and it hereby waives notice of any such changes, extensions of time, alterations, omissions, additions, or other modifications, to the Contract or to related subcontracts, purchase orders or other obligations, and any notices provided in such regard shall not create as to any party a duty related thereto.

PROVIDED, HOWEVER, that this bond is executed pursuant to Chapter 2253 of the Texas Government Code, as amended, and all rights and liabilities on this bond shall be determined in accordance with the provisions of said statute, to the same extent as if it were copied at length herein. All notices shall be delivered in writing to the addresses shown below or to addresses provided in the Contract Documents.

IN WITNESS WHEREOF, the duly authorized representatives of the Principal and the Surety have executed this instrument.

SIGNED and SEALED this ____ day of _____, 20___.

The date of bond shall not be prior to date of Contract.

_____
PRINCIPAL

ATTEST:

By: _____

_____
(Principal) Secretary

Name: _____

Title: _____

Address: _____
_____
_____

(S E A L)

_____
Witness as to Principal

Telephone Number: _____

_____
SURETY

ATTEST:

By: _____

_____
Secretary

Name: _____
Attorney in Fact

Address: _____
_____
_____

(S E A L)

_____
Witness as to Principal

Telephone Number: _____

An original copy of Power of Attorney shall be attached to Bond by the Attorney-in-Fact.

Approved as to Form:

City of Brenham, Texas
200 W. Vulcan
Brenham, Texas 77833

By: _____

Title: _____

Date: _____

Date:

Proposal of:

COMPETITIVE SEALED PROPOSAL

to

CITY OF BRENHAM

for

BRENHAM FIRE STATION #2

The undersigned, as bidder, declares that the only person or parties interested in this proposal as principals are those named herein; that this proposal is made, without collusion with any other person, firm, corporation; that he has carefully examined the form of contract, instructions to bidder, profiles, grades, specifications, and the drawings therein referred to, and has carefully examined the locations, conditions and classes of materials of the proposed work; and agrees that he will provide all the necessary machinery, tools, apparatus, and other means of construction, and will do all the work and furnish all the materials called for in the contract, specifications, and drawings, in the manner prescribed therein and according to the requirements of the Architect or Engineer therein set forth.

It is further agreed that the quantities of work to be done and materials to be furnished may be increased or diminished as may be considered necessary, in the opinion of the Architect, Engineer or Owner's Representative, to complete the work fully as planned and contemplated. Adjustment for changes in work will be in accordance with the General Conditions.

Proposal amounts shall be shown in both words and figures. In case of discrepancy the amount shown in words shall govern.

The bidder acknowledges receipt and incorporation in this Bid of the following addenda:

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

No. _____ Dated _____

PROPOSAL FORM
CITY OF BRENHAM - FIRE STATION #2

1. **BASE PROPOSAL** Amount

   a. Total BASE PROPOSAL sum to include all work described within the project Drawings and Specifications for the construction of BRENHAM FIRE STATION #2. $_____

   _____

   _____

   Dollars

2. **ALLOWANCES**

   a. Allowance No. 1 – Quantity Allowance: Cost to include temporary casing of the following quantities of each diameter of drilled concrete pier as described in 01 21 00 "Allowances" and based on Unit Prices requirements in 01 22 00 "Unit Prices".

Item	Quantity	Amount
i. 18" Diameter Pier	(51) Fifty-One	$_____
ii. 24" Diameter Pier	(19) Nineteen	$_____
iii. 30" Diameter Pier	(5) Five	$_____
Total for Allowance No. 1:		$_____

   b. Allowance No. 2 – Contingency Allowance: Include a contingency allowance for use according to Owner's written instructions.

   $ 250,000.00

3. **UNIT PRICES**

   a. Unit Price No. 1 – Temporary Casing: Cost per linear foot to include temporary casing of each diameter of drilled concrete pier as described in 01 22 00 "Unit Prices".

Item	Amount
i. Cost per linear foot for 18" Diameter Piers	$_____
ii. Cost per linear foot for 24" Diameter Piers	$_____
iii. Cost per linear foot for 30" Diameter Piers	$_____

In preparing the proposal form, bidders should list below major subcontractors whose prices are incorporated in the bid. Generally, trades listed should be those involving major money amounts or special technical items.

Trade	Subcontractor
Concrete	_____
Framing	_____
Plumbing	_____
Mechanical	_____
Electrical	_____

The undersigned agrees and pledges himself to complete the work in full in the following specified calendar days. **365** Consecutive Calendar Days

The performance and payment bonds, as required by the specifications and the laws of Texas, will be submitted with the executed contract if this proposal is accepted.

Accompanying this proposal is a certified or cashier's check on a State or National Bank of the State of Texas or a Bidder's Bond in the amount of not less than 5% of the greatest total amount of this proposal payable without recourse to the order of City of Brenham, said check or bond to be returned to the bidder, unless in case of the acceptance of the proposal he shall fail to execute a contract and file performance and payment bonds within ten (10) days of its acceptance, in which case the check or bond shall become the property of said Owner and shall be considered as payment for liquidated damages due to delay and other inconveniences suffered by said Owner on account of failure of the bidder to execute contract. It is understood that the Owner reserves the right to reject any or all bids, to accept or reject any or all alternates, or to accept any combination of alternates considered advantageous.

The undersigned certifies that the bid prices contained in this proposal have been carefully checked and are submitted as correct and final.

The undersigned agrees that he will not withdraw this proposal for a period of 90 days.

The Bidder further agrees to pay as Liquidated Damages the sum of **$500.00** for each calendar day that the work shall remain substantially incomplete after the expiration of the calendar days specified and any extended days allowed by the Owner's Representative in accordance with the Specifications, not as a penalty, but as liquidated damages and added expense for supervision and delay in obtaining the use of the work.

(Seal--if Bidder is a Corporation)

Bidder: _____

By: _____

Title: _____

Address: _____

CONTRACTOR'S QUALIFICATION STATEMENT

(Required with all Bid Proposals)

Full, exact, legal name of firm _____ Date Completed _____

Trade name(s) of firm _____

Address with Zip Code _____

Telephone _____Corporation _____ Partnership _____ Individual _____

Construction Capabilities: General _____ Electrical _____ Plumbing _____

Heating, Air Conditioning and Ventilation _____ Other _____

FOR CORPORATION OR LIMITED LIABILITY COMPANY:

Date of incorporation: _____Name of State(s) in which incorporated or organized: _____

President's Name _____Vice President's Name _____

Secretary's Name _____ Treasurer's Name _____

FOR PARTNERSHIP:

Is the partnership: General _____ Limited _____ Association _____

Date of organization _____

Names and addresses of all partners with zip codes:

_____

_____

_____

Use additional sheets if necessary

GENERAL INFORMATION:

_____ _____ _____

Percent (%) of work done by own forces No. of permanent employees Geographical limits of operation

_____ _____

Number of years in business If bidder has done business under different name, please give name and location.

Has your firm ever failed to complete project or defaulted on a contract? _____If so, state where and why:
_____

Has your firm ever been engaged in litigation over any contract with a Project Owner? _____If so, explain.
_____

Has your firm been involved in any lawsuits in the past 5 years? _____ If so, explain. _____
_____

PRESENT PROJECTS:

List the major construction projects your organization presently has under construction:
(use separate sheet if necessary)

PROJECT	OWNER	ARCHITECT/ ENGINEER	CONTRACT AMOUNT	ESTIMATED DATE OF COMPLETION
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

COMPLETED PROJECTS: (Past Five Years)

List the major construction projects your organization has completed in the past five years:
(use separate sheet if necessary)

PROJECT	OWNER	ARCHITECT/ ENGINEER	CONTRACT AMOUNT	ESTIMATED DATE OF COMPLETION
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

FINANCIAL CONDITION:

_____ _____

Bonding Capacity Per Job Maximum Aggregate Bonding Capacity Bonding Company

Bonding Company Agent Address and Zip Code

Attach Statement of Financial Condition, including Contractor's latest regular dated financial statement or balance sheet which must contain the following items: (Only required of the low bidder after Bid Opening)

Current Assets: (cash, joint venture accounts, accounts receivable, notes receivable, accrued interest on notes, deposits, and materials and prepaid expenses), net fixed assets and other assets.

Current Liabilities: (accounts payable, notes payable, accrued interest on notes, provision for income taxes, advances received from owners, accrued salaries, accrued payroll taxes), other liabilities and capital, (capital stock, authorized and outstanding shares par values, earned surplus).

Date of statement or balance sheet Name and address with zip code of firm preparing statement

REFERENCES:

REFERENCES (Bank and trade) with addresses and zip codes

1. _____

2. _____

3. _____

CERTIFICATION:

STATE OF _____)

COUNTY OF _____)

_____ being duly sworn deposes and says that he/she is the

_____ (title) of _____ (firm's name),

and that all of the answers to the foregoing questions and all statements therein contained are within his/her knowledge and are true and correct.

Signed under oath before me on the _____day of _____, 2024.

_____

Notary Public seal

SUPPLEMENTAL INFORMATION TO PROPOSERS (COMPETITIVE SEALED PROPOSALS)

1.0 PURPOSE AND SCOPE. This document provides general information about the requirements for Competitive Sealed Proposals and sets forth the selection criteria and procedures for implementation.

2.0 CONTRACT AWARD PROCESS

A) The respondent selected for award of the contract will be the Bidder whose proposal is most advantageous to the Owner pursuant to Chapter 2269, subchapter D of the Texas Government Code and other applicable law. The Owner is not bound to accept the lowest priced proposal if that proposal is not in the best interest of the Owner, as determined by the Owner.

B) Proposals will be opened publicly and read aloud to identify the names of the respondents and their respective cost proposals, only. To the extent allowed by applicable law, other contents of the proposals will be afforded confidentiality sufficient to preclude disclosure of the contents prior to award.

C) The Owner and the Architect will evaluate proposals. The criteria for evaluation and selection of the successful respondent for this award may be based upon:

1. The Bidder's cost proposal.
2. The Bidder's technical proposal.
3. The Bidder's demonstrated administrative ability and financial resources to perform the work.
4. The qualifications and experience of the project team the Bidder firm proposes to manage the project.
5. The Bidder's demonstrated experience and past performance in constructing similar projects.
6. The Bidder's demonstrated ability to suitably schedule the project and to meet schedules on other similar projects.
7. The qualifications and experience of major subcontractors the Bidder firm proposes to use for the project.
8. The Bidder's safety record supported by accurate and verifiable data.
9. The methodologies for the Bidder's quality assurance program.
10. The Bidder's ability to start construction of the project in a timely manner.

D) Within forty-five (45) days after the date of opening the proposals, the Owner will evaluate and rank each proposal with respect to the selection criteria contained in this Competitive Sealed Proposals document. After opening and ranking, an award may be made on the basis of the proposals initially submitted, without discussion, clarification or modification, or, the Owner may discuss with the selected bidder, offers for cost reduction and other elements of the bidder's proposal. If the Owner determines that it is unable to reach a contract satisfactory to the Owner with the selected bidder, then the Owner will terminate discussions with the selected bidder and proceed to the next bidder in order of selection ranking until a contract is reached or the Owner has rejected all proposals.

E) Proposer shall provide five (5) copies of its Contractors Qualifications Statement and Technical Proposal.

3.0 TECHNICAL PROPOSAL FORMAT

A) Economy of Preparation. Technical Proposals should be prepared simply and economically, providing a straightforward, concise description of the bidder's ability to meet the requirements for

the proposal. Elaborate bindings, colored displays, promotional materials and so forth are not desired. Emphasis should be on completeness and clarity of content. Vague and equivocal statements will be viewed unfavorably.

B) Confidentiality. The bidder may designate any portion of its technical proposal that contains trade secrets, or other proprietary data as confidential. If a bidder includes data that is not to be disclosed to the public for any purpose or used by the Owner except for evaluation purposes, the bidder shall:

1) Mark the title page of the technical proposal with the following legend: This proposal includes data that shall not be disclosed outside of the review of this proposal and shall not be duplicated, used or disclosed in whole or in part for any purpose other than to evaluate this proposal.
2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.
3) Bidders should note that despite such restrictions, the disclosure of such restricted information may be required under applicable laws, including, without limitation, applicable freedom of information laws such as the Texas Public Information Act.

C) Format. Technical proposal must be organized and submitted in the eight-section format as follows:

1) Bidder Firm

1.1 Organization:

i. Give the legal name, address, and telephone number of Bidder firm.
ii. State whether the Bidder firm is an individual, partnership, corporation, or a joint venture. If Bidder firm is a corporation, give state of incorporation.
iii. Give number of years Bidder firm has been in business as a construction contractor.
iv. Give number of years Bidder firm has been in business under its present business name.
v. Give any other names under which Bidder firm has operated.

1.2 Claims and Suits: (If the answer to any of the questions below is yes, attach details.)

i. Has Bidder firm ever failed to complete any work it was awarded?
ii. Are there any judgments, claims, arbitration proceedings or lawsuits pending or outstanding against Bidder firm or its officers?
iii. Has Bidder firm filed any lawsuits or requested arbitration with regard to construction contracts within the last five years?

1.3 Financial Status:

i. Provide a letter from Bidder firm's Surety stating Bidder firm’s ability to acquire bonding in the full amount of the contract.
ii. Provide a photocopy of the current Dunn & Bradstreet report showing Bidder's financial rating for the Bidder firm.

2) Bidder's Project Team:

2.1 Provide an organization chart showing the Bidder firm's key personnel positions and lines of authority.

2.2 Give names, qualifications, and experience of Bidder firm's key personnel positions proposed for the project. Provide proposed personnels' experience with projects of similar size/scope/project type.

3) Bidder's Experience with Other Similar Projects:

3.1 Give examples of Bidder firm's experience in constructing other similar projects within the last five (5) years. Provide examples as follows:

Owner's Name:
Project Name:
Construction Cost:
Year of Completion:
Location (City and State):

3.2 Give references for Bidder firm's experience in constructing other similar projects. Provide references as follows:

Full Name and Title:
Firm Name:
Mailing address:
Telephone Number:

4) Bidder's Project Schedules for Proposed Project and Other Similar Projects:

5.1 Provide a summary level schedule for the project indicating the Bidder firm's proposed construction schedule. Base the schedule on calendar days, starting with the Owner's notice to proceed and end with final completion of the work.

5.2 Provide a summary level schedule for each similar project given under 3.1 comparing the Bidder firm's initial construction schedules with the final construction schedules. Base the schedules on calendar days, starting with the Owner's notice to proceed and end with final completion of the work. If the comparison reveals a disparity between the initial and final construction schedules explain why.

5) Subcontractor Support and Experience:

5.1 Provide a schedule of proposed major subcontractors to be used for this project. Major trades to be included are Concrete, Steel, Metal Framing, Plumbing, Mechanical, and Electrical.

5.2 Provide qualifications and examples of relevant experience in similar project types for each requested major subcontractor trade.

6) Bidder's Safety Program

6.1 Give the Bidder firm's primary insurance provider as follows:

Full Name:
Mailing Address:
Telephone Number:

6.2 Give the Bidder firm's Experience Modifier Rate (EMR) and Recordable Incident Rate (RIR).

6.3 Summarize the Bidder firm's safety program execution plan (1 page).

7) Bidder's Quality Assurance Program

7.1 Summarize the Bidder firm's quality assurance program (1 page).

8) Bidder's Current Workload

8.1 Summarize the Bidder firm's current workload and state the Bidder's availability to start construction of the project.

4.0 EVALUATION CRITERIA

The evaluation criteria for all proposals is as follows:

Cost Proposal	50%
Firm's Qualifications, Relevant Experience, & References	20%
Relevant Experience and Qualifications of Key Project Personnel	15%
Subcontractor Support and Experience	15%

5.0 ACCEPTANCE OF EVALUATION METHODOLOGY

Submission of a proposal indicates Bidder's acceptance of the evaluation technique and Bidder's recognition that some subjective judgments must be made by the Owner during the evaluation.

DRAFT

AIA® Document A101™ – 2007

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

« »
« »
« »

The Architect:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

AIA Document A201™–2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

« »

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

« »

§ 3.2 The Contract Time shall be measured from the date of commencement.

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than « » (« ») days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

« »

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

« »

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

« »

§ 4.3 Unit prices, if any:
(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price Per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

ARTICLE 5 PAYMENTS

§ 5.1 PROGRESS PAYMENTS

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « » day of a month, the Owner shall make payment of the certified amount to the Contractor not later than the « » day of the « » month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than « » (« ») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of « » percent (« » %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of « » percent (« » %);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

« »

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 FINAL PAYMENT

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 BINDING DISPUTE RESOLUTION

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

« »

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

« » % « »

§ 8.3 The Owner's representative:
(Name, address and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 The Contractor's representative:
(Name, address and other information)

« »
« »
« »
« »

« »
« »

§ 8.5 Neither the Owner's nor the Contractor's representative shall be changed without ten days written notice to the other party.

§ 8.6 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

« »

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

« »

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding requirements are not part of the Contract Documents unless the bidding requirements are also enumerated in this Article 9.

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

« »

.2 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract

Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

« »

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	Limit of liability or bond amount ($0.00)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	CONTRACTOR *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

DRAFT

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

« » « »
« »

THE OWNER:
(Name, legal status and address)

« »« »
« »

THE ARCHITECT:
(Name, legal status and address)

« » « »
« »
« »

TABLE OF ARTICLES

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

INDEX
(Topics and numbers in bold are section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct,

but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled

to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce

other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the

Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be

furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the

Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a separate contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents; or
.3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

.4 Claims for damages insured by usual personal injury liability coverage;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

.7 Claims for bodily injury or property damage arising out of completed operations; and

.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's

risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The

party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

BRENHAM FIRE STATION #2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

BRW PROJECT NO.: 223102.00
10/24/2024

RENDERINGS

RENDERINGS ARE FOR INFORMATION ONLY.
THESE RENDERINGS ARE AN ARTISTIC REPRESENTATION OF THE PROJECT. THESE IMAGES ARE INTENDED FOR CONCEPTUAL PURPOSES ONLY. THEY ARE NOT TO BE USED FOR CONSTRUCTION. ANY MASSING, DETAILS, MATERIALS, COLORS, ETC. ARE SUBJECT TO CHANGE.

OWNER
CITY OF BRENHAM
200 W. VULCAN ST.
BRENHAM, TX 77833
979.337.7200

ARCHITECT
BROWN REYNOLD WATFORD ARCHITECTS, INC.
175 CENTURY SQUARE DRIVE, SUITE 350
COLLEGE STATION, TEXAS 77840
979.694.1791

RAY W. HOLLIDAY — REGISTERED ARCHITECT — 18834 — STATE OF TEXAS
10/24/2024

CIVIL/ STRUCTURAL ENGINEER
GESSNER ENGINEERING
401 W 26TH ST.
BRYAN, TEXAS 77803
979.680.8840

STATE OF TEXAS — PEDRO HICO, JR. — 133608 — LICENSED PROFESSIONAL ENGINEER — 10/24/2024
STATE OF TEXAS — EVAN J. ROE — 141174 — LICENSED PROFESSIONAL ENGINEER — 10/24/2024

MECHANICAL ELECTRICAL PLUMBING ENGINEER
DBR ENGINEERING CONSULTANTS, INC.
2500 S. HIGHWAY 183, SUITE 500
AUSTIN, TEXAS 78744
512.637.4393

STATE OF TEXAS — EDWARD PUENTES — 102338 — LICENSED PROFESSIONAL ENGINEER — 10/24/2024

SYMBOL LEGEND

- **VIEW TITLE** — 1 TITLE, 1/8" = 1'-0"
- **SHEET NUMBERING:** SHEET NUMBER; SHEET TYPE DESIGNATION; DISCIPLINE DESIGNATION — A1.1
- **VIEW REFERENCES:** SHEET NUMBER; DETAIL NUMBER — RE: 1 / A1.1
- REVISIONS — 1
- NORTH ARROWS — PLAN NORTH; TRUE NORTH
- PROPERTY LINE / LIMITS OF CONSTRUCTION
- BUILDING SETBACK / EASEMENT
- EXISTING CONTOURS — 100
- REVISED CONTOURS — 100
- EXISTING SPOT GRADE — 100
- REVISED SPOT GRADE — 100
- WORKING, CONTROL, OR DATUM POINT
- NEW CONSTRUCTION
- DEMOLITION
- EXISTING WALL TO REMAIN
- GLAZING
- TEMPERED GLAZING
- ROOM NAME AND NUMBER — ROOM NAME 100
- COLUMN DESIGNATION — 20.2
- MATCHLINE — RE: 1 / A1.1A
- BUILDING SECTION — 1 A2.1 SIM
- WALL SECTION — 1 A2.1 SIM
- EXTERIOR ELEVATION — A2.1 1
- INTERIOR ELEVATION — A5.1 1
- DETAIL CALLOUT — 1 A1.1 SIM
- FACE OF FINISH DIMENSION — 1'- 0"
- ALIGN FACE OF FINISH — ALIGN
- DIMENSION TO CENTERLINE
- KEYNOTE — 0220.01
- WALL TYPE — A1
- DOOR NUMBER — 101
- WINDOW / CURTAINWALL / STOREFRONT TYPE — S1
- FINISH — P1

ARCHITECTURAL ABBREVIATIONS

A.F.F.	ABOVE FINISH FLOOR	**MNTD.**	MOUNTED
B.O.	BOTTOM OF	**NOM.**	NOMINAL
C.J.	CONTROL JOINT	**N.I.C.**	NOT IN CONTRACT
CLR.	CLEAR	**O.C.E.W.**	ON CENTER EACH WAY
DIA.	DIAMETER	**O.H.**	OPPOSITE HAND
DN	DOWN	**RE:/REF:**	REFERENCE
E.J.	EXPANSION JOINT	**REQ./REQD.**	REQUIRED
EQ.	EQUAL	**R.O.**	ROUGH OPENING
F.F.	FINISH FLOOR	**SIM.**	SIMILAR
F.V.	FIELD VERIFY	**T.O.**	TOP OF
GA.	GAUGE	**TYP.**	TYPICAL
M.O.	MASONRY OPENING	**W/**	WITH
MAX.	MAXIMUM	**W.B.**	WIND BRACE
MIN.	MINIMUM	**W.P.**	WORKING POINT

NOTE: ADDITIONAL SYMBOLS OR ABBREVIATIONS MAY BE INCLUDED IN SHEET SPECIFIC LEGENDS. NOT ALL SYMBOLS OR ABBREVIATIONS LISTED ABOVE MAY BE USED IN THE PROJECT

CODE INFORMATION

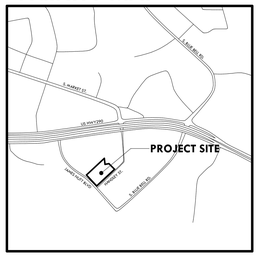
BUILDING CODES AND STANDARDS

BUILDING:	2018 INTERNATIONAL BUILDING CODE
EXISTING:	2018 INTERNATIONAL EXISTING BUILDING CODE
FIRE:	2018 INTERNATIONAL FIRE CODE
LIFE SAFETY:	2018 INTERNATIONAL BUILDING CODE
ENERGY:	2018 INTERNATIONAL ENERGY CONSERVATION CODE
PLUMBING:	2018 INTERNATIONAL PLUMBING CODE
MECHANICAL:	2018 INTERNATIONAL MECHANICAL CODE
ELECTRICAL:	2017 NATIONAL ELECTRIC CODE

ACCESSIBILITY STANDARDS

2012 TEXAS ACCESSIBILITY STANDARDS (TAS)

VICINITY MAP



AREA TABULATION

ALL SITE AND BUILDING AREA TABULATIONS SHOWN ARE FOR OWNER AND GOVERNING AUTHORITY REFERENCE ONLY. CONTRACTOR IS RESPONSIBLE FOR MAKING THEIR OWN QUANTITY AND AREA CALCULATIONS.

INDEX OF DRAWINGS

BROWN REYNOLDS WATFORD ARCHITECTS
3333 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

DATE 10/24/2024
DRAWN BY SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

G1.1
TITLE SHEET AND DRAWING INDEX

MASTER KEYNOTE LIST

0100	DIVISION 01 - GENERAL REQUIREMENTS
0200	DIVISION 02 - EXISTING CONDITIONS (TO REMAIN, U.N.O.) & DEMOLITION
0220.01	EXISTING TREE
0300	DIVISION 03 - CONCRETE
0310.02	3/4" CHAMFER
0310.04	SOIL RETENTION PANELS
0310.05	VOID FORMS
0310.09	SAWCUT CONTROL JOINT (RE: CIVIL)
0310.10	CONCRETE EXPANSION JOINT, FILL WITH SEALANT TO WITHIN 1/4" OF SURFACE
0310.11	EXPANSION JOINT PREMOLDED EXPANSION FILLER
0320.01	DOWEL INTO CONCRETE SLAB
0320.02	STEEL REINFORCING (RE: CIVIL)
0320.03	DOWEL SLEEVE AND END CAP
0330.01	CONCRETE
0330.02	CONCRETE SLAB
0330.05	CONCRETE GRADE BEAM
0330.06	CONCRETE GRADE BEAM ON VOID FORMS
0330.12	CONCRETE BOLLARD
0360.02	CEMENT GROUT
0360.03	FILL WITH GROUT
0400	DIVISION 04 - MASONRY
0405.01	FLASHING END DAM
0405.02	MORTAR NET
0405.05	MASONRY VENEER WEEP / VENT
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.04	BRICK SOLDIER COURSE
0420.13	6" CONCRETE MASONRY UNITS
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0420.26	MORTAR BED ON METAL LATH
0470.01	CAST STONE
0470.05	CAST STONE SILL WITH DRIP
0500	DIVISION 05 - METALS
0510.01	STEEL STRUCTURE (RE: STRUCTURAL)
0510.02	STEEL COLUMN (RE: STRUCTURAL)
0510.03	STEEL TUBE COLUMN (RE: STRUCTURAL)
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0510.05	STEEL CHANNEL (RE: STRUCTURAL)
0510.07	STEEL TUBE (RE: STRUCTURAL)
0510.08	STEEL BENT PLATE (RE: STRUCTURAL)
0510.10	STEEL BEAM (RE: STRUCTURAL)
0510.12	STEEL PLATE (RE: STRUCTURAL)
0520.01	STEEL JOIST (RE: STRUCTURAL)
0530.02	METAL ROOF DECK (RE: STRUCTURAL)
0540.01	COLD-FORMED METAL FRAMING
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0540.06	2" COLD-FORMED METAL FURRING CHANNEL
0540.08	SILL GASKET
0540.11	STUD CLIP
0540.12	COLD-FORMED METAL HEADER
0550.19	6" STEEL PIPE BOLLARD, FILL WITH CONCRETE (GALVANIZED AT EXTERIOR LOCATIONS)
0550.32	STEEL TREAD
0550.33	METAL LADDER
0550.34	METAL SHIPS LADDER
0550.62	1.5" VERTICAL FURRING CHANNEL @ 16" O.C.
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0600	DIVISION 06 - WOOD, PLASTICS, & COMPOSITES
0610.01	SHIM AS REQUIRED
0610.02	1X WOOD BLOCKING
0610.03	2X WOOD BLOCKING
0610.04	2X PRESSURE TREATED WOOD BLOCKING
0610.05	1/2" EXTERIOR GRADE PLYWOOD
0610.07	3/4" EXTERIOR GRADE PLYWOOD
0610.08	2 LAYERS 3/4" EXTERIOR GRADE PLYWOOD BLOCKING
0610.09	2 X 4 WOOD STUDS AT 16" O.C.
0610.36	INSULATED ROOF NAIL BASE PANEL
0640.03	PLASTIC LAMINATE CLAD BASE CABINETS WITH ADJUSTABLE SHELVES
0640.04	PLASTIC LAMINATE CLAD WALL CABINETS WITH ADJUSTABLE SHELVES
0640.05	PLASTIC LAMINATE CLAD TALL CABINET
0640.07	3/4" PLYWOOD
0640.15	CABINET CAM LOCK
0640.17	DRAWER GLIDE
0640.18	ADJUSTABLE SHELVING
0640.21	WIRE GROMMET
0640.22	CABINET PULLS
0640.24	ADJUSTABLE METAL SHELF STANDARDS. PROVIDE BLOCKING IN WALL AS REQUIRED
0640.30	1/4" CLEAR TEMPERED GLASS SHELVES
0640.38	1/2" PLASTIC LAMINATE CLAD PLYWOOD
0640.39	3/4" PLASTIC LAMINATE CLAD PLYWOOD DRAWER WITH 1/4" HARDWOOD BOTTOM
0640.40	PLASTIC LAMINATE CLAD DESK
0640.42	PLASTIC LAMINATE CLAD WARDROBE
0640.44	3/4" PLASTIC LAMINATE CLAD PLYWOOD REMOVABLE ACCESS PANEL
0640.45	1/4" HARDWOOD CABINET BACK
0640.46	3/4" PLASTIC LAMINATE CLAD PLYWOOD CABINET DOOR
0640.48	HEAVY DUTY COAT ROD
0640.49	COAT OR BACKPACK HOOK
0640.50	PLASTIC LAMINATE CLAD END PANEL
0640.55	1/4" PLASTIC LAMINATE CLAD CABINET BACK
0640.57	3/4" HARDWOOD VENEER PLYWOOD TOE KICK
0640.59	CONCEALED COUNTERTOP BRACKET WITH IN-WALL CONFIGURATION HARDWARE. PROVIDE BLOCKING IN WALL AS REQUIRED
0640.60	1/4" RUBBER MAT AT PULL OUT TRASH / RECYCLING DRAWER
0640.65	METAL WORK SURFACE SUPPORT
0700	DIVISION 07 - THERMAL & MOISTURE PROTECTION
0710.01	BITUMINOUS DAMPPROOFING
0720.01	3 1/2" BATT INSULATION
0720.02	6 1/4" BATT INSULATION
0720.04	1 1/2" CONTINUOUS INSULATION
0720.05	2" CONTINUOUS INSULATION
0720.07	SPRAY FOAM INSULATION
0720.12	CONTINUOUS ADHESIVE BASE COAT
0720.14	GRANULAR INSULATING FILL IN CMU BLOCKS
0725.01	UNDERSLAB VAPOR BARRIER
0725.02	SELF-ADHERING SHEET AIR BARRIER SYSTEM
0725.03	PLASTIC FILM AIR BARRIER SYSTEM
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0725.05	SELF-ADHERING DETAIL TRANSITION MEMBRANE
0730.04	SELF-ADHERING, HIGH-TEMPERATURE ROOFING SHEET UNDERLAYMENT
0740.01	PREFINISHED METAL ROOF PANEL SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0750.01	ROOFING BASE FLASHING SYSTEM
0750.03	4" CANT STRIP
0750.06	WRAP HIGH TEMPERATURE SELF-SEALING UNDERLAYMENT MEMBRANE TO OUTSIDE FACE OF BLOCKING
0750.07	MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM
0750.08	TWO (2) LAYERS OF 2.2" RIGID ROOF INSULATION (R-25)
0750.10	TAPERED ROOF INSULATION
0750.12	WALKWAY PAD
0750.13	LIQUID ROOF FLASHING SYSTEM
0750.14	1/2" ROOF COVER BOARD
0750.17	HEAT-WELDED LAP
0760.01	THROUGH-WALL FLASHING WITH WEEPS AT 2'-0" O.C. AND MORTAR NET
0760.02	THROUGH-WALL FLASHING (WITH WEEPS AT 2'-0" O.C. AS REQUIRED)
0760.03	PREFINISHED METAL GUTTER
0760.04	PREFINISHED METAL DOWNSPOUT
0760.05	PREFINISHED METAL DOWNSPOUT WITH FABRICATED TRANSITION TO DOWNSPOUT BOOT
0760.07	HOT-DIPPED GALVANIZED METAL OVERFLOW SCUPPER (8" H X 12" W CLEAR) WITH PREFINISHED METAL FACING
0760.10	GALVANIZED STRAP
0760.11	PREFINISHED METAL CONDUCTOR HEAD (14" W X 12" H X 6" D)
0760.13	PREFINISHED METAL FASCIA
0760.18	METAL PIPE JACK FLASHING
0760.30	PREFINISHED EAVE TRIM
0760.31	PREFINISHED METAL COPING SYSTEM
0760.32	CONTINUOUS CLEAT
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0760.35	PREFINISHED METAL THROUGH WALL FLASHING WITH HEMMED DRIP EDGE
0760.37	CONTINUOUS STEEL STRAP ATTACHED TO EACH STUD
0760.40	TERMINATION BAR AND PREFINISHED FLASHING CAP
0770.02	PIPE BOOT
0770.04	PREFINISHED METAL REGLET WITH SEALANT AND COUNTERFLASHING
0770.05	GALVANIZED METAL REGLET WITH SEALANT AND COUNTERFLASHING
0770.08	EQUIPMENT CURB WITH GALVANIZED COUNTERFLASHING
0770.12	24 GAUGE HOODED PAN. FILL WITH 1" POURABLE SEALANT OVER ROOFING GRANULES
0770.13	24 GAUGE GALVANIZED CAP. MITER, RIVET AND SOLDER ENDS WATERTIGHT. ANCHOR 12" O.C. (ONE MIN. PER SIDE)
0770.14	PRESSURE BAR WITH MECHANICAL FASTENERS
0770.16	4 LB. LEAD FLASHING. SET IN PLASTIC CEMENT AND EXTEND 2'-0" FROM DRAIN
0770.17	PREFABRICATED PIPE PORTAL SYSTEM WITH METAL COLLAR
0770.21	STAINLESS STEEL CLAMP
0770.22	PIPE UMBRELLA WITH SEALANT
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0790.02	CAULKING
0790.07	SET IN BED OF SEALANT
0800	DIVISION 08 - OPENINGS
0810.02	HOLLOW METAL FRAME
0810.04	HOLLOW METAL DOOR AND FRAME
0810.05	JAMB ANCHOR (3 PER JAMB)
0810.06	HOLLOW METAL DOOR
0810.08	SOLID CORE WOOD DOOR
0830.02	WALL ACCESS PANEL
0830.14	OVERHEAD COILING DOOR
0830.16	SECTIONAL DOOR PREFINISHED METAL INFILL PANEL
0830.17	UPWARD ACTING SECTIONAL DOOR
0830.26	SOUND CONTROL DOOR ASSEMBLY
0840.01	ALUMINUM STOREFRONT
0840.02	ALUMINUM STOREFRONT DOOR
0840.05	CONTINUOUS ALUMINUM SILL PAN FLASHING WITH BACK AND END DAMS
0870.01	METAL THRESHOLD. SET IN BED OF SEALANT
0870.10	DOOR BOTTOM WITH DRIP SKIRT
0870.11	DRIP CAP
0880.01	GLASS TYPE MG#1A (MONOLITHIC CLEAR, ANNEALED)
0880.03	GLASS TYPE MG#1C (MONOLITHIC CLEAR, FULLY TEMPERED)
0880.08	GLASS TYPE MG#4 (MONOLITHIC, TINTED, FULLY TEMPERED)
0880.41	GLASS TYPE IG#7 (INSULATED TINTED, LOW-E)
0890.01	PREFINISHED FIXED ALUMINUM LOUVER (WITH BIRD SCREEN)
0900	DIVISION 09 - FINISHES
0920.01	1 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.02	2 1/2" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.05	4" METAL STUDS AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.08	STUD BRACE AT 4'-0" O.C. MAX.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.14	METAL SUPPORT SYSTEM
0920.16	ALUMINUM GYPSUM BOARD REVEAL
0920.18	1" PORTLAND CEMENT STUCCO ON METAL LATH
0920.23	5/8" MOLD AND MOISTURE RESISTANT GYPSUM BOARD
0920.26	5/8" CEMENTITIOUS BACKER BOARD
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.34	GYPSUM BOARD GUSSETS AT 16" O.C. VERTICALLY
0920.35	CORNER BEAD, TYPICAL
0920.36	J-MOULD, TYPICAL
0920.37	2" J-SHAPE TRACK
0930.01	CERAMIC TILE
0930.07	TILE WATERPROOFING MEMBRANE
0930.10	METAL TILE TRIM
0930.11	LINEAR SLOT DRAIN (PROVIDE 1"-2" WIDER THAN OPEN SIDE OF SHOWER, AND WITH METAL TILE TRANSITIONS AT PERIMETER)
0930.12	PRE-FABRICATED SHOWER TRAY BASE
0950.01	SUSPENDED ACOUSTICAL LAY-IN TILE CEILING
0950.09	SUSPENDED ACOUSTICAL BAFFLE CEILING SYSTEM
0960.01	FLOORING AS SCHEDULED
0960.03	METAL TRANSITION TRIM
0960.13	4" RESILIENT BASE
0970.02	WALL FINISH AS SCHEDULED
0980.01	3 1/2" FIBERGLASS SOUND ATTENUATION BATT INSULATION
1000	DIVISION 10 - SPECIALTIES
1010.12	BUILDING DEDICATION PLAQUE
1010.14	DIMENSIONAL SIGN LETTERS
1010.18	RAISED LETTERS AND SYMBOLS
1010.33	POLE MOUNTED SIGNAGE - "RESERVED PARKING VIOLATORS ARE SUBJECT TO FINE AND/OR TOWING"
1010.34	POLE MOUNTED SIGNAGE - "VAN-ACCESSIBLE"
1010.49	HIGH PIN-MOUNTED ALUMINUM SIGN LETTERS
1020.06	WALL MOUNTED SHOWER SHELF
1020.13	CORNER GUARD
1020.16	STAINLESS STEEL 1 1/2" DIAMETER GRAB BAR (36" LONG)
1020.17	STAINLESS STEEL 1 1/2" DIAMETER GRAB BAR (42" LONG)
1020.20	SOAP DISPENSER (SURFACE-MOUNTED)
1020.24	STAINLESS STEEL SURFACE MOUNTED TOILET PAPER DISPENSER
1020.30	STAINLESS STEEL SEMI-RECESSED PAPER TOWEL DISPENSER / TRASH RECEPTACLE
1020.32	STAINLESS STEEL FRAMED MIRROR
1020.34	VINYL-COATED PIPING WRAP
1020.35	ROBE / TOWEL HOOK
1020.38	STAINLESS STEEL SHOWER CURTAIN ROD WITH VINYL CURTAIN AND HOOKS
1070.02	PRE-MANUFACTURED EXTERIOR SUN CONTROL DEVICES
1070.03	GROUND-SET FLAGPOLE
1100	DIVISION 11 - EQUIPMENT
1130.01	MICROWAVE
1130.02	REFRIGERATOR
1130.05	DISHWASHER
1130.06	WASHING MACHINE
1130.07	CLOTHES DRYER
1130.09	GAS RANGE
1130.11	FOOD DISPOSAL
1130.12	RANGE HOOD
1130.13	UNDER-COUNTER ICE MAKER
1140.08	COMMERCIAL COFFEE MAKER
1140.09	ICE MACHINE
1180.01	DUMPSTER (N.I.C.)
1200	DIVISION 12 - FURNISHINGS
1220.06	MANUAL WINDOW SHADE
1230.25	QUARTZ SURFACE COUNTERTOP WITH SPLASH AS SHOWN
1230.28	QUARTZ WINDOW SILL
1240.03	TRASH OR RECYCLING RECEPTACLE
1250.03	BENCH
1250.11	MURPHY BED
1300	DIVISION 13 - SPECIAL CONSTRUCTION
1400	DIVISION 14 - CONVEYING EQUIPMENT
2100	DIVISION 21 - FIRE SUPPRESSION (RE: PLUMBING)
2110.03	FIRE HOSE VALVE IN SEMI-RECESSED CABINET
2200	DIVISION 22 - PLUMBING (RE: PLUMBING)
2210.01	PLUMBING VENT
2210.06	FLOOR DRAIN
2210.09	OIL AND SAND SEPARATOR
2210.13	ROOF DRAIN
2210.14	ROOF DRAIN PIPING
2210.15	OVERFLOW ROOF DRAIN
2240.01	WATER CLOSET. ORIENT FLUSH VALVE TOWARDS ACCESSIBLE SPACE AT ACCESSIBLE STALLS / RESTROOMS
2240.03	WALL-HUNG LAVATORY WITH CARRIER
2240.04	PORCELAIN LAVATORY
2240.05	STAINLESS STEEL UNDERMOUNT SINK
2240.07	SINK FITTINGS
2240.11	MOP SINK
2240.15	FREEZE-PROOF HOSE BIBB WITH SEALANT AROUND PERIMETER
2240.19	WATER FOUNTAIN
2300	DIVISION 23 - HEATING, VENTILATING, & AIR-CONDITIONING (HVAC) (RE: MECHANICAL)
2310.02	GAS METER
2320.03	REFRIGERANT PIPING
2330.18	RETURN AIR GRILLE
2350.01	METAL FLUE WITH BASE AND COLLAR
2360.02	HVAC CONDENSING UNIT
2600	DIVISION 26 - ELECTRICAL (RE: ELECTRICAL)
2620.01	CONDUIT
2620.04	ELECTRICAL OUTLET
2620.07	ELECTRICAL TRANSFORMER
2620.10	ELECTRICAL MAIN DISCONNECT
2630.01	EMERGENCY GENERATOR
2630.02	ELECTRICAL GENERATOR TRANSFER SWITCH
2650.03	SURFACE-MOUNTED LIGHT FIXTURE
2650.04	SUSPENDED LIGHT FIXTURE
2650.06	HIGH-BAY LIGHT FIXTURE
2650.09	UNDER / OVER CABINET LIGHT
2650.17	LIGHT POLE AND FIXTURE ON CONCRETE BASE
2650.19	CEILING FAN
2650.21	LIGHT BOLLARD
2700	DIVISION 27 - COMMUNICATIONS
2740.04	TELEVISION OR MONITOR
2800	DIVISION 28 - ELECTRONIC SAFETY & SECURITY
2810.05	PARKING ACCESS CONTROL ON METAL STANCHION AND CONCRETE FOOTING
3100	DIVISION 31 - EARTHWORK
3110.04	PROTECT EXISTING TREE OR TREES
3120.01	GRADE
3120.02	COMPACTED SELECT FILL
3120.03	COMPACTED SUBGRADE
3160.01	CONCRETE PIER (RE: STRUCTURAL)
3200	DIVISION 32 - EXTERIOR IMPROVEMENTS
3210.03	LIME STABILIZED BASE COURSE
3210.09	CONCRETE SIDEWALK (RE: CIVIL)
3210.10	CONCRETE CURB RAMP PER CITY REQUIREMENTS
3210.14	CONCRETE PAVING (RE: CIVIL)
3210.22	PAVING EXPANSION JOINT - FILL WITH JOINT SEALER 1/4" BELOW SURFACE
3210.24	PRE-CAST CONCRETE PAVING UNITS WITH TRUNCATED DOMES (ADA COMPLIANT)
3210.30	6" CONCRETE CURB (WITH GUTTER AS REQUIRED) (RE: CIVIL)
3210.33	4" PAVEMENT MARKING (DIAGONAL STRIPING AT 2'-0" O.C. TYPICAL)
3210.34	ACCESSIBLE PARKING SYMBOL PAVEMENT MARKING
3210.35	FIRE LANE STRIPING PER CITY REQUIREMENTS
3210.37	WHEEL STOP (6'-0" LONG). DRILL AND DOWEL INTO PAVING
3210.38	PAVER SETTING SAND
3210.39	7" CONCRETE PAVING WITH #4'S @ 18" O.C.E.W. OVER COMPACTED SUBGRADE
3210.40	3/4" DOWELS @ 18" O.C.
3230.10	2 1/2" MIN. DIAMETER SCHEDULE 40 STEEL PIPE (GALVANIZED)
3230.35	POST CAP
3230.36	THROUGH-BOLT
3230.38	DECORATIVE METAL FENCE
3230.39	DECORATIVE METAL GATE
3230.43	SLIDING GATE OPERATOR AND CONCRETE PAD
3230.47	MOTORIZED GATE VEHICLE DETECTION LOOP
3230.61	STEEL TROWEL FINISH
3230.62	LIGHT BROOM FINISH
3290.01	LANDSCAPE BED
3290.03	METAL EDGING
3290.08	MULCH
3290.10	RIVER ROCK
3290.14	PREPARED SOIL MIX
3290.15	DAYLILY
3290.16	KATIE'S RUELLIA
3290.17	YELLOW YUCCA
3290.18	RED YUCCA
3290.19	PINE MUHLY GRASS
3290.20	TEXAS SAGE
3290.21	VITEX CHASTE TREE
3290.22	LIVE OAK
3290.23	SOCIETY GARLIC
3290.24	LANDSCAPE BOULDER
3300	DIVISION 33 - UTILITIES (RE: CIVIL & MEP)
3310.01	FIRE HYDRANT (RE: CIVIL / PLUMBING)
3330.05	SANITARY SEWER MANHOLE AND COVER (RE: CIVIL)
3340.03	CURB INLET (RE: CIVIL)
3340.04	AREA DRAIN INLET (RE: CIVIL)
3340.05	CONCRETE CATCH BASIN (RE: CIVIL)
3340.14	STORM WATER MANHOLE AND COVER (RE: CIVIL)
3370.08	BARE COPPER GROUND
3370.09	COPPER GROUND ROD (8'-0" LONG)
3380.02	RADIO COMMUNICATIONS ANTENNA (N.I.C.)

MASTERFORMAT 2020

THE MASTER KEYNOTE LIST USES CSI MASTERFORMAT 2020 EDITION LEVEL 2 NUMBERS AND TITLES

EXAMPLE

KEYNOTE	DIVISION	LEVEL 2	IDENTIFIER
0960.01	09	60	.01

NOTE:
WHERE KEYNOTES REFERENCE OTHER DISCIPLINES, SUCH AS RE: STRUCTURAL, RE: CIVIL, RE: MEP, REFER TO ENGINEERING DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL DETAILS AND INFORMATION. ITEMS SO NOTED ARE TO BE INCLUDED IN THE CONTRACT WHETHER OR NOT ENGINEERING DRAWINGS AND SPECIFICATIONS CONTAIN ADDITIONAL INFORMATION OR REQUIREMENTS FOR EACH SPECIFIC ITEM KEYNOTES. IF DISCREPANCY OR APPARENT LACK OF COORDINATING INFORMATION IN ENGINEERING DRAWINGS OR SPECIFICATIONS IS FOUND, CONTRACTOR SHALL REQUEST ADDITIONAL INFORMATION FROM ARCHITECT IN ADVANCE TO AVOID COST OR TIME IMPACT.

DIVISION 01	**GENERAL REQUIREMENTS**
DIVISION 02	**EXISTING CONDITIONS (TO REMAIN, U.N.O.) & DEMOLITION**
DIVISION 03	**CONCRETE**
DIVISION 04	**MASONRY**
DIVISION 05	**METALS**
DIVISION 06	**WOOD, PLASTICS, & COMPOSITES**
DIVISION 07	**THERMAL & MOISTURE PROTECTION**
DIVISION 08	**OPENINGS**
DIVISION 09	**FINISHES**
DIVISION 10	**SPECIALTIES**
DIVISION 11	**EQUIPMENT**
DIVISION 12	**FURNISHINGS**
DIVISION 13	**SPECIAL CONSTRUCTION**
DIVISION 14	**CONVEYING EQUIPMENT**
DIVISION 21	**FIRE SUPPRESSION (RE: PLUMBING)**
DIVISION 22	**PLUMBING (RE: PLUMBING)**
DIVISION 23	**HEATING, VENTILATING, & AIR-CONDITIONING (HVAC) (RE: MECHANICAL)**
DIVISION 26	**ELECTRICAL (RE: ELECTRICAL)**
DIVISION 27	**COMMUNICATIONS**
DIVISION 28	**ELECTRONIC SAFETY & SECURITY**
DIVISION 31	**EARTHWORK**
DIVISION 32	**EXTERIOR IMPROVEMENTS**
DIVISION 33	**UTILITIES (RE: CIVIL & MEP)**

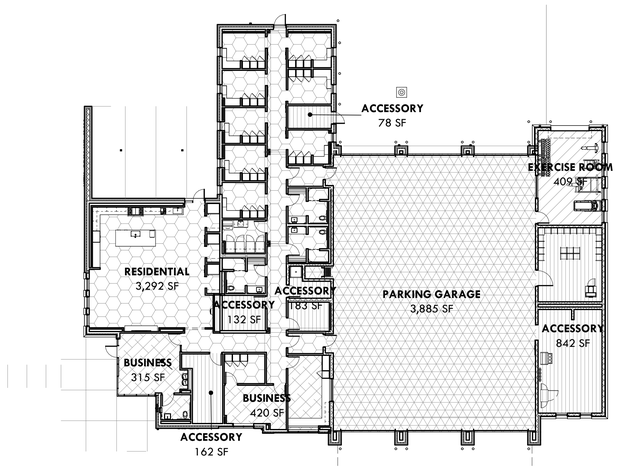
BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 200
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

10/24/2024
DATE
SF, LG, LT
DRAWN BY
JD, RH, MW
CHECKED BY
223102.00
BRW PROJECT NUMBER

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

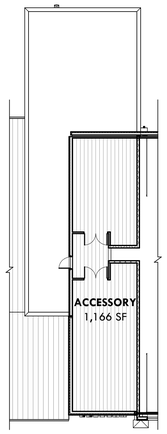
NO.	REVISION	DATE

G1.2
MASTER KEYNOTE LIST



1 FIRST FLOOR OCCUPANCY PLAN

1/16" = 1'-0"



2 SECOND FLOOR OCCUPANCY PLAN

1/16" = 1'-0"

OCCUPANCY LEGEND

- ACCESSORY
- BUSINESS
- EXERCISE ROOM
- PARKING GARAGE
- RESIDENTIAL

OCCUPANT LOAD SCHEDULE (IBC 2018)

NAME	FUNCTION OF SPACE	AREA	OCCUPANT LOAD FACTOR	OCCUPANT LOAD
ACCESSORY	Accessory storage ares, mechanical equipment room (gross)	1,398 SF	300 SF	7
BUSINESS	<varies>	735 SF	<varies>	5
EXERCISE ROOM	Exercise rooms (gross)	409 SF	50 SF	9
PARKING GARAGE	Parking garages (gross)	3,885 SF	200 SF	20
RESIDENTIAL	Residential (gross)	3,292 SF	200 SF	17
FIRST F.F.		9,719 SF		58
ACCESSORY	Accessory storage ares, mechanical equipment room (gross)	1,166 SF	300 SF	4
SECOND F.F.		1,166 SF		4
GRAND TOTAL		10,886 SF		62

CODE INFORMATION

BUILDING CODES AND STANDARDS

BUILDING:	2018 INTERNATIONAL BUILDING CODE
EXISTING:	2018 INTERNATIONAL EXISTING BUILDING CODE
FIRE:	2018 INTERNATIONAL FIRE CODE
LIFE SAFETY:	2018 INTERNATIONAL BUILDING CODE
ENERGY:	2018 INTERNATIONAL ENERGY CONSERVATION CODE
PLUMBING:	2018 INTERNATIONAL PLUMBING CODE
MECHANICAL:	2018 INTERNATIONAL MECHANICAL CODE
ELECTRICAL:	2017 NATIONAL ELECTRIC CODE

ACCESSIBILITY STANDARDS

2012 TEXAS ACCESSIBILITY STANDARDS (TAS)

SCOPE OF WORK

SCOPE OF WORK: NEW CONSTRUCTION

NUMBER OF FLOORS: 2 (WITH MEZZANINE)
ALLOWED NUMBER OF FLOORS: 4
CONSTRUCTION TYPE: TYPE II-B
OCCUPANCY CLASSIFICATION: B, R-2, and S-2
SPRINKLERED

OCCUPANCY CLASSIFICATION

IBC CHAPTER 3

2018 IBC

BUSINESS: GROUP B OCCUPANCY (304.1)

RESIDENTIAL: GROUP R-2 OCCUPANCY (310.3)

STORAGE: GROUP S-2 OCCUPANCY (311.3)

NFPA CHAPTER 3

2018 NFPA - NFPA - MIXED OCCUPANCE

BUSINESS OCCUPANCY (6.1.11)

RESIDENTIAL OCCUPANCY (6.1.8)

STORAGE OCCUPANCY (6.13.1)

BUILDING HEIGHTS AND AREAS

IBC CHAPTER 5

CONSTRUCTION TYPE:
NEW CONSTRUCTION TYPE IIB

ALLOWABLE BUILDING HEIGHT AND STORIES TABLES 504.3 & 504.4

OCCUPANCY	HEIGHT (FT)	STORIES
B	75	4
S-2	75	4
R-2	60	5

BUILDING HEIGHTS

	HEIGHT (FT)	STORIES
NEW:	25' 9"	2

ALLOWABLE AREA PER TABLE 506.2

OCCUPANCY	ALLOWABLE AREA FACTOR (SF)
B	69,000 SF
S-2	52,500 SF
R-2	48,000 SF

FRONTAGE INCREASE: 0.75

ALLOWABLE AREA PER STORY BASED ON MOST RESTRICTIVE
Aa = At + (NS x If) = AREA GSF
Aa = [At + (NS x If)] x Sa = AREA GSF
GROUP R-2 Aa = 48,000 + (16,000 x .75) = 60000 GSF

BUILDING AREAS

FIRST FLOOR:	10,335 GSF
SECOND FLOOR:	1,358 GSF
TOTAL:	**11,713 GSF**

MIXED USE AND OCCUPANCY

IBC CHAPTER 5

NONSEPERATED OCCUPANCIES PER 508.3
ALLOWABLE AREA CALCULATION BASED ON MOST RESTRICTIVE
RESIDENTIAL R-2a = 48,000 SF

TYPES OF CONSTRUCTION

IBC CHAPTER 6

FIRE-RESISTANCE RATING REQUIREMENTS

TYPE IIB	HOURS
PRIMARY STRUCTURAL FRAME	0
BEARING WALLS	
EXTERIOR	0
INTERIOR	0
NONBEARING WALLS	
INTERIOR	0
FLOOR CONSTRUCTION	0
ROOF CONSTRUCTION	0

INTERIOR FINISHES

IBC CHAPTER 8

INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY PER TABLE 803.13

SPRINKLERED
INTERIOR EXIT STAIRWAYS, RAMPS AND EXIT PASSAGEWAYS

GROUP	CLASS
B	B
R-2	C
S-2	C

CORRIDORS AND ENCLOSURE FOR EXIT ACCESS STAIRWAYS AND RAMPS

GROUP	CLASS
B	C
R-2	C
S-2	C

ROOMS AND ENCLOSED SPACES

GROUP	CLASS
B	C
R-2	C
S-2	C

FIRE PROTECTION SYSTEMS

IBC CHAPTER 9
REFERENCE MEP DRAWINGS FOR ADDITIONAL INFORMATION REGARDING FIRE PROTECTION SYSTEMS

AUTOMATIC SPRINKLER SYSTEM
FULLY SPRINKLERED

PORTABLE FIRE EXTINGUISHERS
REQUIRED AT GROUP B, R-2, AND S-2 OCCUPANCIES
REQUIRED WITHIN 30 FEET DISTANCE OF TRAVEL FROM COMMERCIAL COOKING EQUIPMENT

SIZE AND DISTRIBUTION FOR CLASS A FIRE HAZARDS
MAXIMUM
TRAVEL DISTANCE: 75 FEET
AREA PER UNIT OF A: 3,000 SF
AREA FOR EXTINGUISHER: 11,250 SF

SECTION 903.2.2: QUICK RESPONSE AND RESIDENTIAL SPRINKLERS. WHERE AUTOMATIC SPRINKLER SYSTEMS ARE REQUIRED BY THIS CODE, QUICK RESPONSE OR RESIDENTIAL AUTOMATIC SPRINKLERS SHALL BE INSTALLED IN ALL OF THE FOLLOWING AREAS IN ACCORDANCEW ITH SECTION 093.3.1 AND THEIR LISTINGS:
1. DWELLING UNITS AND SLEEPING UNITS IN R OCCUPANCIES.

SECTION 903.3.7: FIRE DEPARTMENT CONNECTIONS (FDC) SHALL BE INSTALLED PER SECTION 912.
912.2: APPROVED BY THE FIRE CODE OFFICIAL
912.2.2: STREETSIDE AND VISIBLE
913.2.1 FIRE PUMP ROOMS SEPARATED BY 1 HR FIRE BARRIERS

SECTION 903.4: SPRINKLER SUPERVISION AND ALARMS

903.1 MONITORING: ALARM, SUPERVISORY AND TROUBLE AUTOMATICALLY TRANSMITTED TO AN APPROVED SUPERVISING STATION OR, WHERE APPROVED BY THE FIRE CODE OFFICIAL, SHALL SOUND AN AUDIBLE SIGNAL AT A CONSTANTLY ATTENDED LOCATION.

903.2: ALARMS: ONE EXTERIOR APPROVED AUDIBLE DEVICE, LOCATED ON THE EXTERIOR OF THE BUILDING IN AN APPROVED LOCATION, SHALL BE CONNECTED TO EACH AUTOMATIC SPRINKLER SYSTEM. SUCH SPRINKLER WATER FLOW ALARM DEVICES SHALL BE ACTIVATED BY WATER FLOW EQUIVALENT TO THE FLOW OF A SINGLE SPRINKLER OF THE SMALLEST ORIFICE SIZE INSTALLED IN THE SYSTEM. WHERE A FIRE ALARM SYSTEM IS INSTALLED, ACTUATION OF THE AUTOMATIC SPRINKLER SYSTEM SHALL ACTUATE THE BUILDING FIRE SYSTEM.

SECTION 906: PORTABLE FIRE EXTINGUISHERS.
906.1 REQUIRED AT GROUP B, R-2 & S-2 OCCUPANCIES

WITHIN 30 FEET DISTANCE OF TRAVEL FROM COMMERCIAL COOKING EQUIPMENT AND FROM DOMESTIC EQUIPMENT IN GROUP I-1, I-2, CONDITION 1; AND R-2 COLLEGEDORMITORY OCCUPANCIES.

906.3 SIZE AND DISTRIBUTION: FOR CLASS A FIRE HAZARDS
MAXIMUM TRAVEL DISTANCE = 75 FT. MAX. DISTANCE
MAXIMUM FLOOR AREA PER UNIT OF A = 3,000 SF

906.5 CONSPICUOUS LOCATION: READILY ACCESSIBLE AND IMMEDIATELY AVAILABLE

SECTION 907: FIRE ALARM AND DETECTION SYSTEMS:
907.2 AN APPROVED FIRE ALARM SYSTEM INSTALLED IN ACCORDANCE WITH THE PROVISIONS OF THIS CODE SHALL BE PROVIDED IN NEW BUILDINGS AND STRUCTURES IN ACCORDANCE WITH SECTIONS 907.2.1 THROUGH 907.2.23 AND PROVIDE OCCUPANT NOTIFICATION IN ACCORDANCE WITH SECTION 907.5. GROUP R-2, FIRE ALARM SYSTEMS AND SMOKE ALARMS SHALL BE INSTALLED IN GROUP R-2 OCCUPANCIES AS REQUIRED IN SECTIONS 907.2.9.1 THROUGH 907.2.9.3. WHERE AUTOMATIC SPRINKLER SYSTEMS OR SMOKE DETECTORS ARE INSTALLED, SUCH SYSTEMS OR DETECTORS SHALL BE CONNECTED TO THE BUILDING FIRE ALARM SYSTEM.

MEANS OF EGRESS

IBC CHAPTER 10

OCCUPANT LOAD
REFERENCE OCCUPANT LOAD ANALYSIS PLANS AND OCCUPANT LOAD SCHEDULE

BUILDING AREA	OCCUPANTS
FIRST FLOOR	72
SECOND FLOOR	4
TOTAL	**76**

OCCUPANCY LOAD MIXED OCCUPANCY - SEE OCCUPANCY PLAN

MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE PER IBC 1006.2.1
REFERENCE LIFE SAFETY PLANS

OCCUPANCY	WITH SPRINKLER (FT.)
B	100
R-2	125
S-2	100

COMMON PATH OF EGRESS TRAVEL - FT (WORST CASE)
SEE LIFE SAFETY PLAN

MAXIMUM EXIT ACCESS TRAVEL DISTANCE PER IBC 1017.2
REFERENCE LIFE SAFETY PLANS

OCCUPANCY	WITH SPRINKLER (FT.)
B	300
R-2	250
S-2	400

ACCESSIBILITY

REFERENCE A5.0 FOR TYPICAL ACCESSIBILITY REQUIREMENTS

PLUMBING SYSTEMS

IBC CHAPTER 29

FIXTURE CALCULATIONS

Space Type	Occupants	Count	Type	Count	Type	Count	Type
R-2	**76**						
Worst case		**38 Male**		**38 Female**			
		3.8 total water closets		3.8 water closets		1 service sink	
		3.8 lavatories		3.8 lavatories		.76 drinking fountain	
Totals Required							
	76						
		Male		**Female**			
		4 water closets		4 water closets		1 service sink	
		2 urinals permitted					
		4 lavatories		4 lavatories		1 drinking fountain	

Totals Required				
	Unisex	**Female**		
	4 water closets	4 water closets	1 service sink	
	0 urinals			
	4 lavatories	4 lavatories	1 drinking fountain	

BUILDING ENVELOPE REQUIREMENTS

IECC SECTION C301
CLIMATE ZONE 2A

IECC SECTION C402
THERMAL ENVELOPE INSULATION COMPONENT MINMUM REQUIREMENTS, R-VALUE METHOD

TYPICAL WALL INSULATION:	R13+R6.5ci
TYPICAL ROOF INSULATION:	R25ci
TYPICAL FENESTRATION:	
U-FACTOR:	0.50
SHGC:	0.25
SHADING COEFFICIENT:	PF<0.2
VISIBLE TRANSMITTANCE:	TBD

BRWARCHITECTS
175 CENTURY SQUARE DRIVE SUITE 400
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY EM, SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

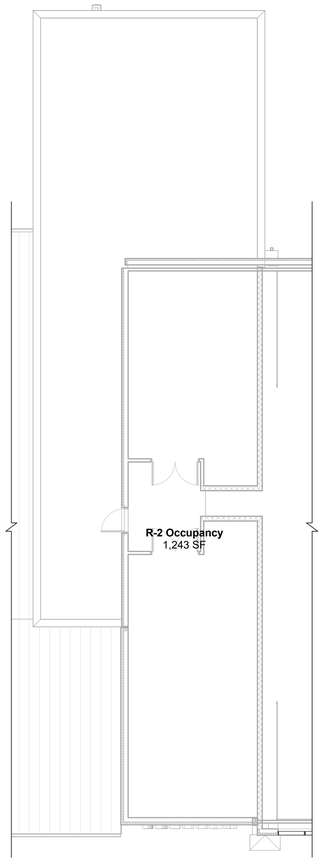
NO.	REVISION	DATE

G1.3

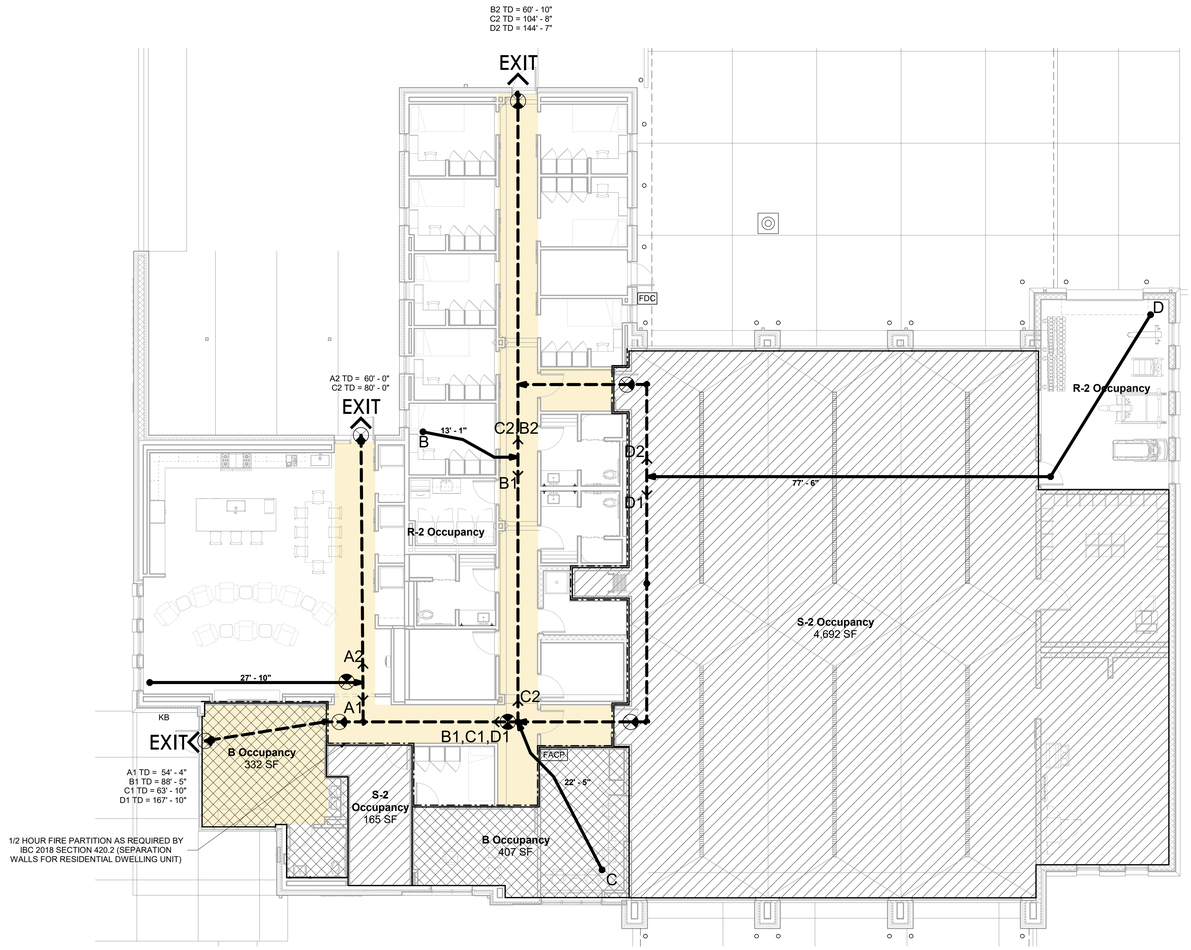
CODE COMPLIANCE INFORMATION

LIFE SAFETY LEGEND

PATTERN	DESCRIPTION
	EXISTING BUILDING NO RENOVATION SCOPE
	1/2 HOUR FIRE RATED CONSTRUCTION
	PATH OF EGRESS
	COMMON PATH OF TRAVEL (CP)
	EXIT ACCESS TRAVEL DISTANCE (TD)
	ILLUMINATED EXIT SIGN (RE: ELECTRICAL)
FE	FIRE EXTINGUISHER AND WALL BRACKET CLASS ABC, U.N.O.
FE-K	FIRE EXTINGUISHER AND WALL BRACKET CLASS K
FEC	FIRE EXTINGUISHER AND SEMI-RECESSED CABINET CLASS ABC, U.N.O.
FDC	FIRE DEPARTMENT CONNECTION
FACP	FIRE ALARM CONTROL PANEL
KB	LOCKBOX FOR FIRE DEPARTMENT KEY ACCESS (KNOX BOX)
	B-OCCUPANCY
	S-2 OCCUPANCY
	R-2 OCCUPANCY



2 SECOND FLOOR LIFE SAFETY PLAN
1/8" = 1'-0"



1 FIRST FLOOR LIFE SAFETY PLAN
1/8" = 1'-0"

AREA TABULATION

ALL SITE AND BUILDING AREA TABULATIONS SHOWN ARE FOR OWNER AND GOVERNING AUTHORITY REFERENCE ONLY. CONTRACTOR IS RESPONSIBLE FOR MAKING THEIR OWN QUANTITY AND AREA CALCULATIONS.

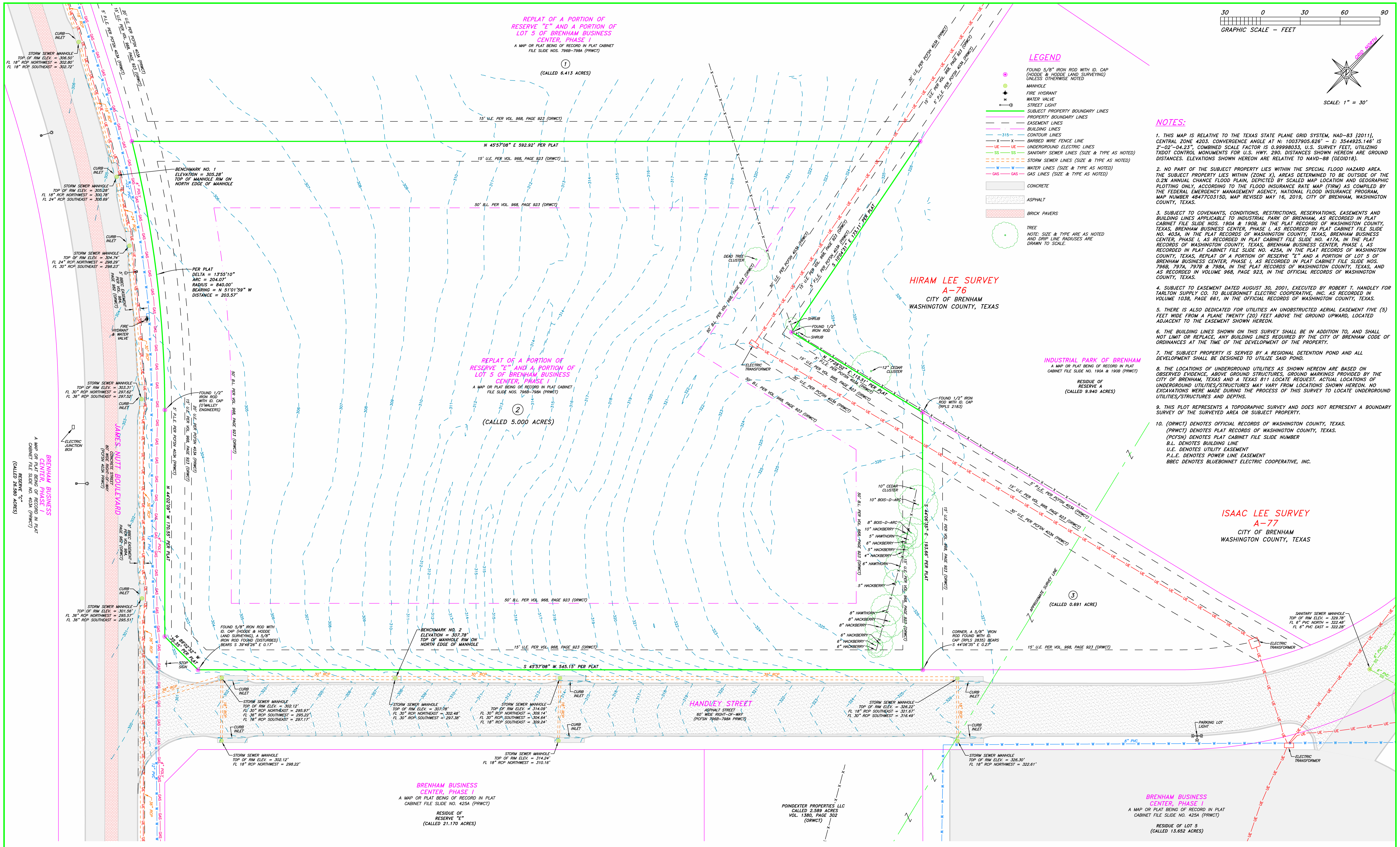
BRW ARCHITECTS
175 CENTURY SQUARE DRIVE SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

G1.4
LIFE SAFETY PLAN



SCALE: 1" = 30'

NOTES:

1. THIS MAP IS RELATIVE TO THE TEXAS STATE PLANE GRID SYSTEM, NAD-83 {2011}, CENTRAL ZONE 4203. CONVERGENCE ANGLE AT N: 10037905.626' – E: 3544925.146' IS 2°-02'-04.23", COMBINED SCALE FACTOR IS 0.99998033, U.S. SURVEY FEET, UTILIZING TXDOT CONTROL MONUMENTS FOR U.S. HWY. 290. DISTANCES SHOWN HEREON ARE GROUND DISTANCES. ELEVATIONS SHOWN HEREON ARE RELATIVE TO NAVD-88 (GEOID18).

2. NO PART OF THE SUBJECT PROPERTY LIES WITHIN THE SPECIAL FLOOD HAZARD AREA. THE SUBJECT PROPERTY LIES WITHIN (ZONE X), AREAS DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOOD PLAIN, DEPICTED BY SCALED MAP LOCATION AND GEOGRAPHIC PLOTTING ONLY, ACCORDING TO THE FLOOD INSURANCE RATE MAP (FIRM) AS COMPILED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY, NATIONAL FLOOD INSURANCE PROGRAM, MAP NUMBER 48477C0315D, MAP REVISED MAY 16, 2019, CITY OF BRENHAM, WASHINGTON COUNTY, TEXAS.

3. SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND BUILDING LINES APPLICABLE TO INDUSTRIAL PARK OF BRENHAM, AS RECORDED IN PLAT CABINET FILE SLIDE NOS. 190A & 190B, IN THE PLAT RECORDS OF WASHINGTON COUNTY, TEXAS, BRENHAM BUSINESS CENTER, PHASE I, AS RECORDED IN PLAT CABINET FILE SLIDE NO. 403A, IN THE PLAT RECORDS OF WASHINGTON COUNTY, TEXAS, BRENHAM BUSINESS CENTER, PHASE I, AS RECORDED IN PLAT CABINET FILE SLIDE NO. 417A, IN THE PLAT RECORDS OF WASHINGTON COUNTY, TEXAS, BRENHAM BUSINESS CENTER, PHASE I, AS RECORDED IN PLAT CABINET FILE SLIDE NO. 425A, IN THE PLAT RECORDS OF WASHINGTON COUNTY, TEXAS, REPLAT OF A PORTION OF RESERVE "E" AND A PORTION OF LOT 5 OF BRENHAM BUSINESS CENTER, PHASE I, AS RECORDED IN PLAT CABINET FILE SLIDE NOS. 796B, 797A, 797B & 798A, IN THE PLAT RECORDS OF WASHINGTON COUNTY, TEXAS, AND AS RECORDED IN VOLUME 968, PAGE 923, IN THE OFFICIAL RECORDS OF WASHINGTON COUNTY, TEXAS.

4. SUBJECT TO EASEMENT DATED AUGUST 30, 2001, EXECUTED BY ROBERT T. HANDLEY FOR TARLTON SUPPLY CO. TO BLUEBONNET ELECTRIC COOPERATIVE, INC. AS RECORDED IN VOLUME 1038, PAGE 661, IN THE OFFICIAL RECORDS OF WASHINGTON COUNTY, TEXAS.

5. THERE IS ALSO DEDICATED FOR UTILITIES AN UNOBSTRUCTED AERIAL EASEMENT FIVE (5) FEET WIDE FROM A PLANE TWENTY (20) FEET ABOVE THE GROUND UPWARD, LOCATED ADJACENT TO THE EASEMENT SHOWN HEREON.

6. THE BUILDING LINES SHOWN ON THIS SURVEY SHALL BE IN ADDITION TO, AND SHALL NOT LIMIT OR REPLACE, ANY BUILDING LINES REQUIRED BY THE CITY OF BRENHAM CODE OF ORDINANCES AT THE TIME OF THE DEVELOPMENT OF THE PROPERTY.

7. THE SUBJECT PROPERTY IS SERVED BY A REGIONAL DETENTION POND AND ALL DEVELOPMENT SHALL BE DESIGNED TO UTILIZE SAID POND.

8. THE LOCATIONS OF UNDERGROUND UTILITIES AS SHOWN HEREON ARE BASED ON OBSERVED EVIDENCE, ABOVE GROUND STRUCTURES, GROUND MARKINGS PROVIDED BY THE CITY OF BRENHAM, TEXAS AND A TEXAS 811 LOCATE REQUEST. ACTUAL LOCATIONS OF UNDERGROUND UTILITIES/STRUCTURES MAY VARY FROM LOCATIONS SHOWN HEREON. NO EXCAVATIONS WERE MADE DURING THE PROCESS OF THIS SURVEY TO LOCATE UNDERGROUND UTILITIES/STRUCTURES AND DEPTHS.

9. THIS PLOT REPRESENTS A TOPOGRAPHIC SURVEY AND DOES NOT REPRESENT A BOUNDARY SURVEY OF THE SURVEYED AREA OR SUBJECT PROPERTY.

10. (ORWCT) DENOTES OFFICIAL RECORDS OF WASHINGTON COUNTY, TEXAS.
(PRWCT) DENOTES PLAT RECORDS OF WASHINGTON COUNTY, TEXAS.
(PCFSN) DENOTES PLAT CABINET FILE SLIDE NUMBER
B.L. DENOTES BUILDING LINE
U.E. DENOTES UTILITY EASEMENT
P.L.E. DENOTES POWER LINE EASEMENT
BBEC DENOTES BLUEBONNET ELECTRIC COOPERATIVE, INC.

TOPOGRAPHIC SURVEY OF LOT 2 (CALLED 5.000 ACRES) OF REPLAT OF A PORTION OF RESERVE "E" AND A PORTION OF LOT 5 OF BRENHAM BUSINESS CENTER, PHASE I CITY OF BRENHAM, WASHINGTON COUNTY, TEXAS

(PRELIMINARY)
JON E. HODDE, RPLS NO. 5197
DATE: FEBRUARY 29, 2024
THE PURPOSE OF THIS DOCUMENT IS FOR PRELIMINARY REVIEW ONLY.
PRELIMINARY, THIS DOCUMENT SHALL NOT BE RECORDED FOR ANY PURPOSE.

W. O. NO. 8226 (BRW ARCH 8226.DWG/MVIEW) REF: COB 7991.LEICA

Hodde & Hodde Land Surveying, Inc.
Professional Land Surveying & Engineering
613 E. Blue Bell Road . Brenham, Texas 77833
979-836-5681 . 979-836-5683 (Fax)
www. hoddesurveying.com

SITE INFORMATION

THIS SURVEY IS FOR INFORMATION ONLY.
INFORMATION ABOUT THE SITE WAS TAKEN FROM PLANS PREPARED BY HODDE & HODDE LAND SURVEYING, INC. CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING INFORMATION AND CONDITIONS PRIOR TO CONSTRUCTION AND NOTIFYING ARCHITECT OF ANY DISCREPANCIES OR CONFLICTS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL COORDINATE EXACT LOCATION OF EXISTING AND NEW UTILITIES.

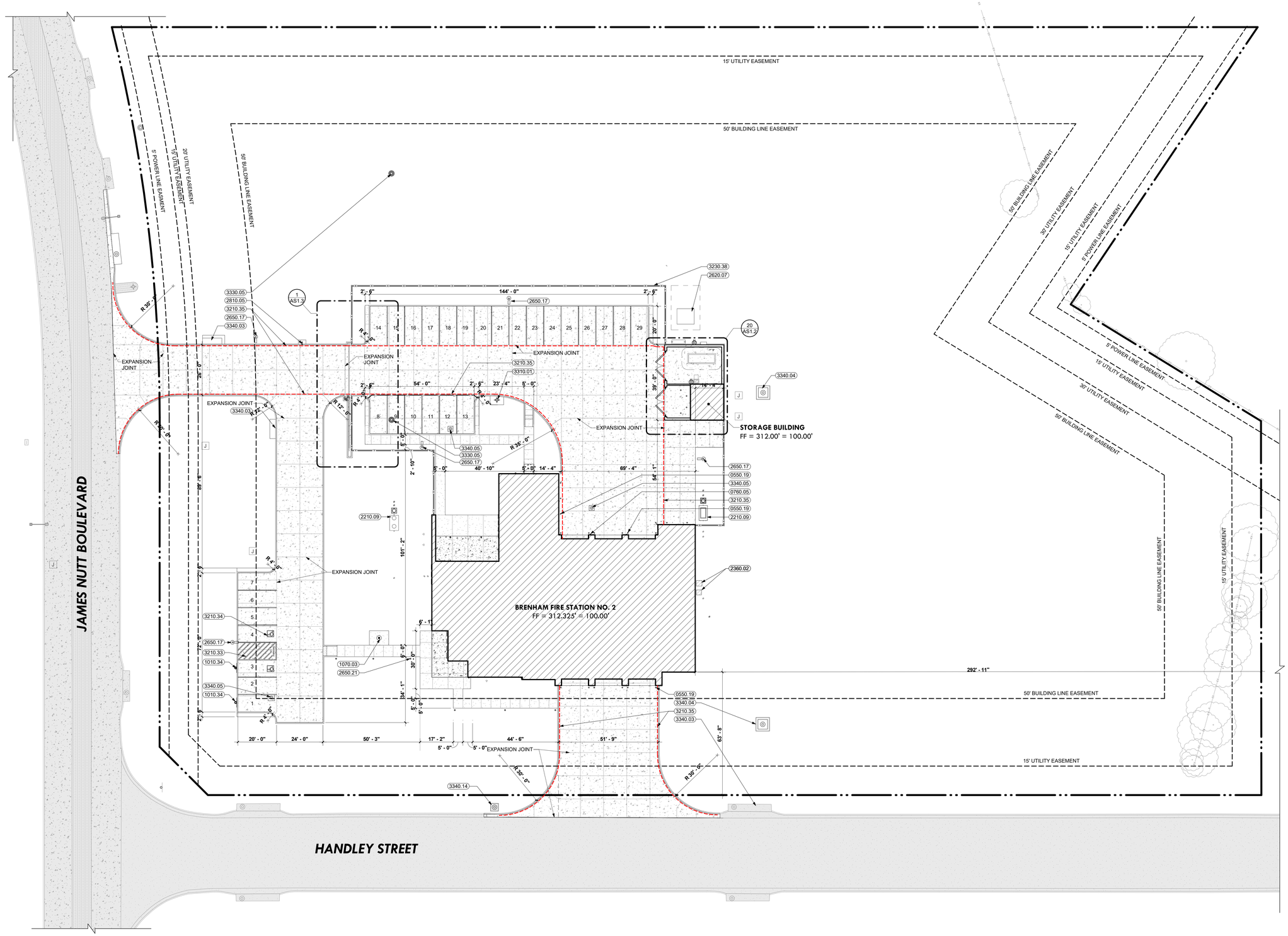
BRW ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	-
CHECKED BY	-
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C0.1
BOUNDARY AND TOPOGRAPHIC SURVEY



KEYNOTES

0550.19	6" STEEL PIPE BOLLARD. FILL WITH CONCRETE (GALVANIZED AT EXTERIOR LOCATIONS)
0760.05	PREFINISHED METAL DOWNSPOUT WITH FABRICATED TRANSITION TO DOWNSPOUT BOOT
1010.34	POLE MOUNTED SIGNAGE - "VAN-ACCESSIBLE"
1070.03	GROUND-SET FLAGPOLE
2210.09	OIL AND SAND SEPARATOR
2360.02	HVAC CONDENSING UNIT
2620.07	ELECTRICAL TRANSFORMER
2650.17	LIGHT POLE AND FIXTURE ON CONCRETE BASE
2650.21	LIGHT BOLLARD
2810.05	PARKING ACCESS CONTROL ON METAL STANCHION AND CONCRETE FOOTING
3210.33	4" PAVEMENT MARKING (DIAGONAL STRIPING AT 2'-0" O.C. TYPICAL)
3210.34	ACCESSIBLE PARKING SYMBOL PAVEMENT MARKING
3210.35	FIRE LANE STRIPING PER CITY REQUIREMENTS
3230.38	DECORATIVE METAL FENCE
3310.01	FIRE HYDRANT (RE: CIVIL / PLUMBING)
3330.05	SANITARY SEWER MANHOLE AND COVER (RE: CIVIL)
3340.03	CURB INLET (RE: CIVIL)
3340.04	AREA DRAIN INLET (RE: CIVIL)
3340.05	CONCRETE CATCH BASIN (RE: CIVIL)
3340.14	STORM WATER MANHOLE AND COVER (RE: CIVIL)

SITE LEGEND

PATTERN	DESCRIPTION
	PROPERTY LINE
	ZONING SETBACK
	FIRE LANE STRIPING
	ORNAMENTAL METAL FENCING
	BUILDING
	NEW CONSTRUCTION
	CONCRETE FOUNDATION
	PAVING (RE: CIVIL)
	CONCRETE PAVING
	CONCRETE PAVING (EXISTING)
	CONCRETE SIDEWALK
	ASPHALT PAVING
	STAMPED CONCRETE PAVING (EXISTING)
	LANDSCAPE (RE: LANDSCAPE)
	EXISTING TREE

TRUE NORTH PLAN NORTH

1 ARCHITECTURAL SITE PLAN

1" = 20'-0"

REGISTERED ARCHITECT RAYN HOLLIDAY STATE OF TEXAS 10/24/2024

BRWARCHITECTS
175 CENTURY SQUARE DRIVE SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

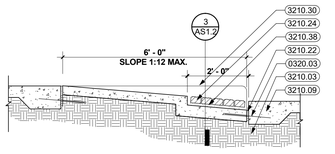
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

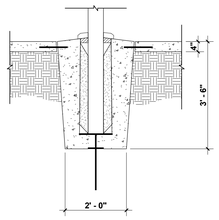
AS1.1
ARCHITECTURAL SITE PLAN

KEYNOTES

0310.02	3/4" CHAMFER
0310.09	SAWCUT CONTROL JOINT (RE: CIVIL)
0320.02	STEEL REINFORCING (RE: CIVIL)
0320.03	DOWEL SLEEVE AND END CAP
0330.01	CONCRETE
0330.12	CONCRETE BOLLARD
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.03	FACE BRICK
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0470.01	CAST STONE
0550.19	6" STEEL PIPE BOLLARD. FILL WITH CONCRETE (GALVANIZED AT EXTERIOR LOCATIONS)
0610.07	3/4" EXTERIOR GRADE PLYWOOD
0725.02	SELF-ADHERING SHEET AIR BARRIER SYSTEM
0740.01	PREFINISHED METAL ROOF PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0760.02	THROUGH-WALL FLASHING (WITH WEEPS AT 2'-0" O.C. AS REQUIRED)
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0920.02	2 1/2" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
1010.33	POLE MOUNTED SIGNAGE - "RESERVED PARKING VIOLATORS ARE SUBJECT TO FINE AND/OR TOWING"
1010.34	POLE MOUNTED SIGNAGE - "VAN-ACCESSIBLE"
1180.01	DUMPSTER (N.I.C.)
2310.02	GAS METER
2620.01	CONDUIT
2620.10	ELECTRICAL MAIN DISCONNECT
2630.01	EMERGENCY GENERATOR
2630.02	ELECTRICAL GENERATOR TRANSFER SWITCH
2650.17	LIGHT POLE AND FIXTURE ON CONCRETE BASE
3120.01	GRADE
3120.03	COMPACTED SUBGRADE
3210.03	LIME STABILIZED BASE COURSE
3210.09	CONCRETE SIDEWALK (RE: CIVIL)
3210.14	CONCRETE PAVING (RE: CIVIL)
3210.22	PAVING EXPANSION JOINT - FILL WITH JOINT SEALER 1/4" BELOW SURFACE
3210.24	PRE-CAST CONCRETE PAVING UNITS WITH TRUNCATED DOMES (ADA COMPLIANT)
3210.30	6" CONCRETE CURB (WITH GUTTER AS REQUIRED) (RE: CIVIL)
3210.37	WHEEL STOP (6'-0" LONG). DRILL AND DOWEL INTO PAVING
3210.38	PAVER SETTING SAND
3210.39	7" CONCRETE PAVING WITH #4'S @ 18" O.C.E.W. OVER COMPACTED SUBGRADE
3210.40	3/4" DOWELS @ 18" O.C.
3230.10	2 1/2" MIN. DIAMETER SCHEDULE 40 STEEL PIPE (GALVANIZED)
3230.35	POST CAP
3230.38	DECORATIVE METAL FENCE
3230.61	STEEL TROWEL FINISH
3230.62	LIGHT BROOM FINISH
3340.04	AREA DRAIN INLET (RE: CIVIL)
3370.08	BARE COPPER GROUND
3370.09	COPPER GROUND ROD (8'-0" LONG)

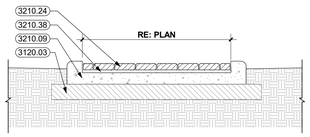


6 CURB RAMP SECTION
1/2" = 1'-0"

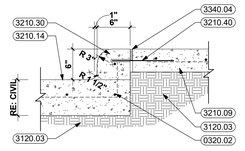


5 FLAGPOLE DETAIL
1/2" = 1'-0"

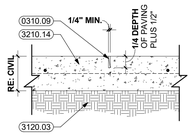
4 FIRE LANE DETAIL
1/2" = 1'-0"



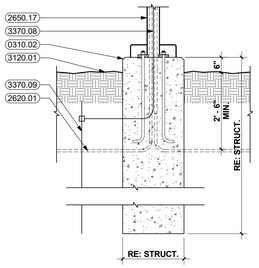
3 HC CURB RAMP SECTION
1/2" = 1'-0"



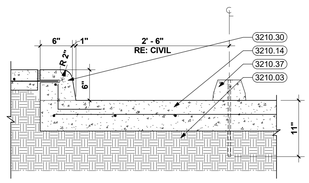
2 CURB DETAIL
1" = 1'-0"



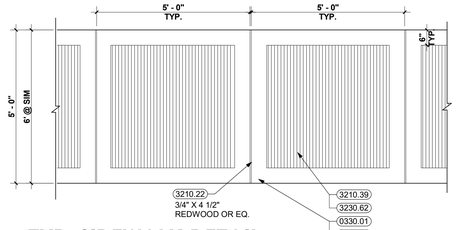
1 CONTROL JOINT
1 1/2" = 1'-0"



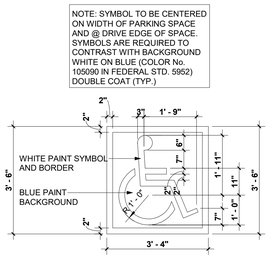
12 LIGHT POLE BASE
1/2" = 1'-0"



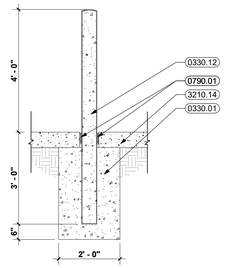
11 WHEEL STOP DETAIL
1" = 1'-0"



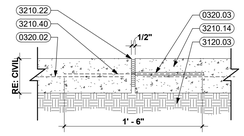
10 TYP. SIDEWALK DETAIL
1/2" = 1'-0"



9 HC PAVEMENT MARKING SYMBOL
1/2" = 1'-0"



8 BOLLARD DETAIL
1/2" = 1'-0"



7 EXPANSION JOINT
1 1/2" = 1'-0"

18 ACCESS. SIGNAGE
1/2" = 1'-0"

17 ENLARGED ACCESS. SIGN
3" = 1'-0"

16 PARKING STRIPE
1/2" = 1'-0"

15 SCREEN WALL
1/2" = 1'-0"

14 FENCE ELEVATION
1/2" = 1'-0"

13 GATE TRACK SECTION
1/2" = 1'-0"

21 SITE STORAGE SECTION
1/4" = 1'-0"

20 ENLARGED SITE PLAN
1/8" = 1'-0"

ELEVATION

19 ROLLING GATE DETAIL
1/2" = 1'-0"

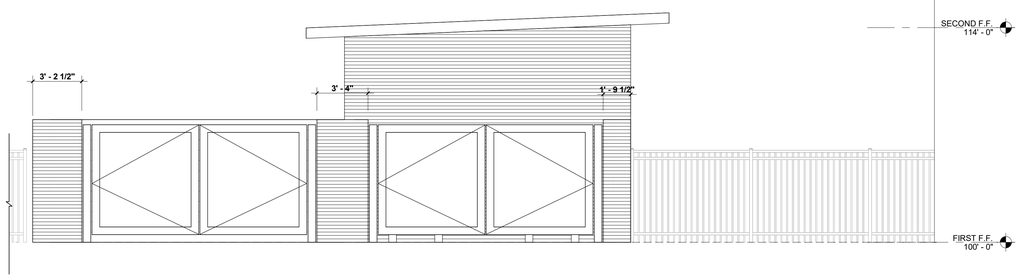
BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

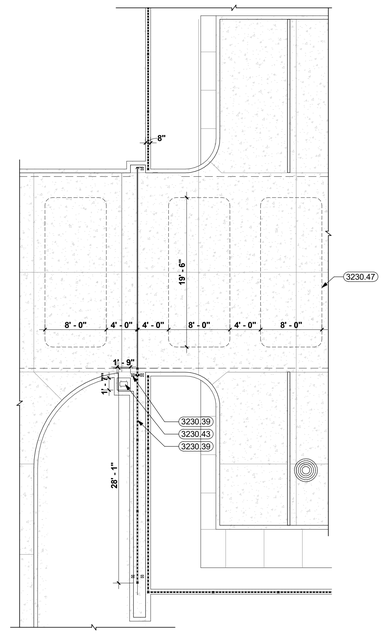
NO.	REVISION	DATE

AS1.2
ARCHITECTURAL SITE DETAILS



2 EE-STORAGE SHED-M01

1/4" = 1'-0"



1 ENLARGED SITE PLAN

1/8" = 1'-0"

KEYNOTES

3230.39	DECORATIVE METAL GATE
3230.43	SLIDING GATE OPERATOR AND CONCRETE PAD
3230.47	MOTORIZED GATE VEHICLE DETECTION LOOP

Registered Architect
RAFAEL HOLLIDAY
REGISTERED ARCHITECT
STATE OF TEXAS
10/24/2024

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

AS1.3
ARCHITECTURAL SITE DETAILS

GENERAL NOTES:

1. PRIOR TO CONSTRUCTION, THE CONTRACTOR MUST PROVIDE SUBMITTALS OF PROPOSED CONSTRUCTION MATERIALS FOR REVIEW BY THE DESIGN ENGINEER A MINIMUM OF 14 DAYS PRIOR TO REQUIRED USE.
2. A PRE-CONSTRUCTION MEETING WILL BE HELD PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. TIME AND LOCATION TO BE DETERMINED BY CITY OF BRENHAM.
3. ALL TOPOGRAPHIC INFORMATION AND SURVEY CONTROL WAS COMPLETED IN FEBRUARY 2024 BY HODDE & HODDE LAND SURVEYING, INC.. CHANGES IN SITE OR FIELD CONDITIONS MAY HAVE OCCURRED.
4. THE CONTRACTOR SHALL PROTECT ALL SURVEY MONUMENTATION, BENCHMARKS, AND MARKERS DURING CONSTRUCTION.
5. THE CONTRACTOR MUST PROVIDE CONSTRUCTION STAKING SERVICES BASED ON THE INFORMATION PROVIDED IN THE PLANS.
6. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH FACILITY/PROPERTY OWNERS. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE DONE TO EXISTING FACILITIES, PAVEMENT, ETC. AS A RESULT OF CONSTRUCTION ACTIVITIES.
7. ALL ITEMS SHOWN ON THESE PLANS ARE ASSUMED NEW/PROPOSED UNLESS DESIGNATED OR SHOWN AS EXISTING AND SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR INCLUSIVE OF ANY MATERIALS, LABOR, EQUIPMENT, AND OTHER REQUIREMENTS FOR A COMPLETE AND FUNCTIONING SITE ELEMENT. ALL ITEMS NECESSARY FOR PROPER COMPLETION OF THE WORK NOT SPECIFICALLY CALLED FOR OR SPECIFIED ON THE PLANS ARE THE RESPONSIBILITY OF THE CONTRACTOR AND CONSIDERED SUBSIDIARY TO THE WORK.
8. ALL UTILITIES AND SERVICE LINES SHOWN ARE TAKEN FROM RECORD INFORMATION SUPPLIED BY THE UTILITY OWNER OR HORIZONTALLY LOCATED BY INDEPENDENT LOCATORS. CONTRACTOR IS RESPONSIBLE TO REPORT ANY CONFLICTS BETWEEN PLAN AND ACTUAL CONDITIONS PRIOR TO CONSTRUCTION. OWNER, SURVEYOR, AND ENGINEER SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF INFORMATION OR DATA RELIED ON TO DEPICT UNDERGROUND FACILITIES. CONTRACTOR IS TO VERIFY THE EXACT LOCATION AND VERTICAL POSITIONING OF ALL PIPELINES, COMMUNICATION LINES, ELECTRICAL LINES, EXISTING UTILITIES, AND SERVICE LINES WITHIN THE PROJECT AREA, WHETHER SHOWN ON THE PLANS OR NOT, AT LEAST 48 HOURS PRIOR TO CONSTRUCTION. CONTRACTOR IS TO CONTACT OWNERS OF ALL UTILITIES AND SERVICE LINES WITHIN THE PROJECT AREA AND NOTIFY OF INTENT AT LEAST 1 WEEK PRIOR TO CONSTRUCTION.
9. CONTRACTOR IS TO MAINTAIN STRUCTURAL INTEGRITY OF ALL PIPELINES, ELECTRIC TRANSMISSION POLES AND LINES, PERMANENT AND TEMPORARY UTILITIES, AND UTILITY SERVICES.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROTECTION OF ALL EXISTING UTILITIES OR SERVICE LINES DURING THE CONSTRUCTION PROCESS. WHERE EXISTING UTILITIES OR SERVICE LINES ARE DAMAGED, THE CONTRACTOR SHALL REPAIR OR REPLACE THE UTILITY OR SERVICE LINE WITH THE SAME TYPE OF MATERIAL AND CONSTRUCTION, OR BETTER. ALL MATERIAL AND LABOR SHALL BE AT THE CONTRACTOR'S EXPENSE.
11. CONTRACTOR SHALL NOTIFY TEXAS811 AT LEAST 48 HOURS PRIOR TO COMMENCING CONSTRUCTION ACTIVITY AT 811 OR HTTP://WWW.TEXAS811.ORG. THE CONTRACTOR SHALL ALSO NOTIFY APPLICABLE UTILITY COMPANIES THAT HAVE UTILITY LINES ON OR IN THE GENERAL VICINITY OF THIS PROJECT SITE AT LEAST 48 HOURS PRIOR TO BEGINNING CONSTRUCTION. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL STANDARDS, SPECIFICATIONS, AND REGULATIONS. WHERE CONSTRUCTION DOCUMENTS CONFLICT WITH THOSE GUIDELINES, THE MORE STRINGENT REQUIREMENTS SHALL GOVERN.
12. CONTRACTOR SHALL NOTIFY THE ENGINEER OF ANY DISCREPANCIES BETWEEN THESE PLANS AND ONSITE FIELD CONDITIONS OR SPECIFICATIONS OF OTHER DISCIPLINES. CONTRACTOR IS RESPONSIBLE TO REPORT ANY CONFLICTS WITHIN PLANS OR SPECIFICATIONS AND AWAIT WRITTEN INSTRUCTION FROM ENGINEER OR ARCHITECT PRIOR TO STARTING CONSTRUCTION.
13. THE CONTRACTOR IS REQUIRED TO OBTAIN ALL NECESSARY PERMITS, AS WELL AS INSPECTION APPROVALS.
14. A COPY OF APPROVED CONSTRUCTION PLANS SHALL BE KEPT ON SITE AT ALL TIMES THROUGHOUT CONSTRUCTION. THE CONTRACTOR SHALL MAINTAIN A SET OF REDLINE DRAWINGS TO RECORD AS-BUILT CONDITIONS.
15. DURING CONSTRUCTION, THE CONTRACTOR SHALL MAINTAIN AN ORDERLY PROJECT SITE. THE CONTRACTOR SHALL CLEAN, REMOVE, AND PROPERLY DISPOSE OF ANY SURPLUS OR DISCARDED MATERIALS, TEMPORARY STRUCTURES, AND DEBRIS FROM THE PROJECT SITE.
16. THE CONTRACTOR IS RESPONSIBLE FOR STORAGE AND SAFE-GUARDING OF ALL MATERIALS AND EQUIPMENT AT THE PROJECT SITE TO MAINTAIN A SAFE AND SECURE PROJECT.
17. THE CONTRACTOR SHALL COORDINATE SITE STORAGE WITH THE PROPERTY OWNER.
18. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CONTAINMENT AND PROPER DISPOSAL OF ALL LIQUID AND SOLID WASTE ASSOCIATED WITH THIS PROJECT. THE CONTRACTOR SHALL USE ALL MEANS NECESSARY TO PREVENT THE OCCURRENCE OF WIND BLOWN LITTER FROM THE PROJECT SITE. THE SITE IS REQUIRED TO PROVIDE CONTAINMENT FOR WASTE PRIOR TO AND DURING DEMOLITION. SOLID WASTE ROLL OFF BOXES AND/OR METAL DUMPSTER SHALL BE SUPPLIED BY THE CONTRACTOR.
19. CONTRACTOR IS TO CONFINE ALL WORK TO OWNER'S PROPERTY. NO CONSTRUCTION ACTIVITY IS ALLOWED ON OR THROUGH PRIVATE PROPERTY UNLESS COVERED BY A PUBLIC UTILITY EASEMENT OR OTHER DOCUMENTED AGREEMENT. ANY ADJACENT RIGHT-OF-WAY (R.O.W.) OR PROPERTY AFFECTED DURING CONSTRUCTION SHALL BE RETURNED TO PRE-CONSTRUCTION CONDITION AT THE CONTRACTOR'S EXPENSE.
20. ALL EXISTING UTILITY APPURTENANCES (VALVE BOXES, FIRE HYDRANTS, MANHOLE RING AND COVER, JUNCTION BOX RING AND COVER, ETC) SHALL BE ADJUSTED TO FINAL GRADES.
21. ALL CONSTRUCTION OPERATIONS FOR THIS PROJECT SHALL BE ACCOMPLISHED IN ACCORDANCE WITH APPLICABLE REGULATIONS OF THE UNITED STATES OCCUPATIONAL AND HEALTH ADMINISTRATION (OSHA).
22. THE CONTRACTOR IS RESPONSIBLE FOR COMPLYING WITH ALL STATE AND FEDERAL REGULATIONS REGARDING CONSTRUCTION ACTIVITIES NEAR ENERGIZED OVERHEAD ELECTRIC LINES.
23. THESE PLANS, PREPARED BY GESSNER ENGINEERING, DO NOT EXTEND TO OR INCLUDE DESIGNS OR SYSTEMS PERTAINING TO THE SAFETY OF THE CONTRACTOR OR HIS EMPLOYEES, AGENTS OR REPRESENTATIVES IN THE PERFORMANCE OF THE WORK. THE SEAL HEREON DOES NOT EXTEND TO ANY SUCH SAFETY SYSTEMS THAT MAY NOW OR HEREAFTER BE INCORPORATED IN THE WORK.
24. CONTRACTOR SHALL BE RESPONSIBLE AND LIABLE FOR ALL JOB SITE SAFETY, FOR MANAGEMENT OF JOB SITE PERSONNEL. FOR SUPERVISION OF THE USE OF JOB SITE EQUIPMENT AND FOR DIRECTION OF ALL CONSTRUCTION PROCEDURES, METHODS, AND ELEMENTS REQUIRED TO COMPLETE THE CONSTRUCTION OF THE PROPOSED IMPROVEMENTS.

TRAFFIC CONTROL NOTES:

1. CONTRACTOR SHALL PROVIDE A TRAFFIC CONTROL PLAN, AS REQUIRED, FOR REVIEW IN THE SUBMITTAL PROCESS OR AS THE NEED ARISES.
2. ALL TRAFFIC CONTROL DEVICES AND TRAFFIC MANAGEMENT SHALL BE IN ACCORDANCE WITH THE LATEST VERSION OF TMUTCD PART VI.
3. ALL CONSTRUCTION BARRICADES, SIGNS, MARKINGS, CHANNELIZING DEVICES, AND SPACING SHALL BE IN ACCORDANCE TO THE LATEST VERSION OF TXDOT BARRICADE AND CONSTRUCTION STANDARDS BC (1-12).
4. ALL EXISTING TRAFFIC CONTROL SIGNS AND PAVEMENT MARKINGS SHALL BE MAINTAINED ON VISIBLE LOCATIONS DURING CONSTRUCTION UNLESS PRIOR WRITTEN APPROVAL IS OBTAINED FROM THE ENGINEER. THE CONTRACTOR SHALL RESTORE OR REPLACE (AT THE DISCRETION OF THE ENGINEER) SIGNS AND PAVEMENT MARKING OR SIGNALS DAMAGED DURING CONSTRUCTION OPERATIONS, INCLUDING RAISED PAVEMENT MARKERS (RPMS) AND CHIP SEAL MARKERS.
5. ACCESS TO DRIVEWAYS ADJACENT TO THE CONSTRUCTION WORK ZONE SHALL BE MAINTAINED AT ALL TIMES AS MUCH AS POSSIBLE. ADDITIONAL DELINEATORS MAY BE REQUIRED TO DELINEATE THE DRIVEWAY ACCESS ROUTE THROUGH THE CONSTRUCTION WORK ZONE. A MINIMUM OF ONE TRAVEL LANE SHALL BE MAINTAINED ACROSS THE DRIVEWAYS, UNLESS PRIOR WRITTEN APPROVAL IS OBTAINED FROM ENGINEER.
6. AT THE END OF EACH WORK DAY, DURING NON-ACTIVE CONSTRUCTION PERIODS, AND AT ANY TIME A FLAGGER IS NOT PRESENT, TCP DEVICES SHALL BE REMOVED.
7. CONTRACTOR TO COORDINATE ANY NECESSARY ROAD CLOSURES WITH LOCAL RESIDENTS, BUSINESSES, AND EMERGENCY SERVICES.

DEMOLITION NOTES:

1. AREAS BENEATH REMOVED PAVEMENT SHALL BE CLEARED OF ALL LOOSE OR DISTURBED MATERIAL AND WATER. THE AREA SHALL BE PROOF-ROLLED AND MANUALLY COMPACTED OR REPLACED WITH SIMILAR MATERIALS PRIOR TO NEW PAVEMENT PLACEMENT PER SPECIFICATIONS.
2. UNDER ALL IMPROVEMENTS, ALL ITEMS ARE TO BE REMOVED UNLESS OTHERWISE INDICATED. REMOVE NOT ONLY THE ABOVE GROUND ELEMENTS BUT ALL UNDERGROUND ELEMENTS FOR UTILITIES UNLESS OTHERWISE INDICATED. DURING CLEARING AND GRUBBING ACTIVITIES WHERE TREES AND BRUSH ARE TO BE REMOVED, REMOVE THE TOTAL EXTENT OF THEIR ROOT SYSTEMS.
3. UNLESS OTHERWISE DIRECTED BY THE OWNER, ALL MATERIALS AND DEBRIS DEMOLISHED AND/OR REMOVED SHALL BECOME PROPERTY OF THE CONTRACTOR AND SHALL BE REMOVED FROM THE SITE AND DISPOSED OF IN A MANNER SATISFACTORY TO THE OWNER, ARCHITECT, & ENGINEER. ON-SITE BURNING WILL NOT BE PERMITTED.
4. ALL EXCESS TOPSOIL AND CUT MATERIAL IS TO BE HAULED OFF AND DISPOSED OF OFF-SITE.
5. CONTRACTOR SHALL PREVENT TRANSPORT OF SEDIMENT TO ADJACENT PROPERTIES AND PUBLIC OR PRIVATE RIGHT OF WAYS AND IS RESPONSIBLE FOR CLEANUP IF SUCH OCCURS. CONTRACTOR IS TO ENSURE NO CONSTRUCTION DEBRIS OR MUD IS TRACKED OR DISCARDED ON TO ANY PUBLIC OR PRIVATE STREETS OR LAND AND IS RESPONSIBLE FOR SITE CLEANUP AFTER EACH DAYS WORK. CONTRACTOR IS TO MAKE USE OF BEST MANAGEMENT PRACTICES TO PREVENT SEDIMENT FROM LEAVING THE SITE OR ENTERING EXISTING STORM SEWER OR DOWNSTREAM CHANNEL AREAS. CONTRACTOR SHALL MAINTAIN EROSION CONTROL THROUGHOUT CONSTRUCTION PERIOD AND UNTIL GRASS IS ESTABLISHED.
6. CONTRACTOR TO PROTECT ALL OR INDICATED EXISTING TREES TO REMAIN DURING DEMOLITION AND CONSTRUCTION ACTIVITIES.
7. CONTRACTOR IS TO PROTECT ALL EXISTING TREES INDICATED TO REMAIN DURING DEMOLITION AND CONSTRUCTION ACTIVITIES UNLESS OTHERWISE NOTED IN THE PLANS.

DIMENSION CONTROL NOTES:

1. THE CONTRACTOR MAY OBTAIN AN ELECTRONIC COPY OF PROJECT PLANS FOR CONSTRUCTION PURPOSES, WITH THE PERMISSION OF THE OWNER. THE ELECTRONIC FILE AND INFORMATION GENERATED, BY GESSNER ENGINEERING, FOR THIS PROJECT IS CONSIDERED BY GESSNER ENGINEERING, TO BE CONFIDENTIAL. WHEN ISSUED, ITS USE IS INTENDED SOLELY FOR THE INDIVIDUAL OR ENTITY TO WHICH IT IS ADDRESSED. THE MATERIAL IS INTENDED FOR USE BY THE RECIPIENT NAMED, ONLY, AND PERMISSION IS NOT GRANTED TO THE RECIPIENT FOR DISTRIBUTION OF THIS DOCUMENTS IN ANY FORM OR FASHION. THE RECIPIENT UNDERSTANDS THAT THIS DATA IS AUTHORIZED "AS IS" WITHOUT ANY WARRANTY AS TO ITS PERFORMANCE, ACCURACY, FREEDOM FROM ERROR, OR AS TO ANY RESULTS GENERATED THROUGHOUT ITS USE. THE RECIPIENT ALSO UNDERSTANDS AND AGREES THAT GESSNER ENGINEERING, UPON RELEASE OF SUCH DATA, IS NOT LONGER RESPONSIBLE FOR THEIR USE OR MODIFICATION. THE USER AND RECIPIENT OF THE ELECTRONIC DATA ACCEPTS FULL RESPONSIBILITY AND LIABILITY FOR ANY CONSEQUENCES ARISING OUT OF THEIR USE.
2. ALL DIMENSIONS SHOWN ARE TO BE USED IN CONJUNCTION WITH THE PLANS FOR LOCATING ALL IMPROVEMENTS AND SHALL BE FIELD VERIFIED BY THE CONTRACTOR FOR WORKABILITY PRIOR TO CONSTRUCTION OF THE IMPROVEMENTS.
3. REFER TO ARCHITECTURAL PLANS FOR DETAILED BUILDING DIMENSIONS.

GRADING NOTES:

1. ALL UNPAVED AREAS SHALL BE ADEQUATELY GRADED TO DRAIN AT A MINIMUM OF 2.0% SLOPE, UNLESS OTHERWISE NOTED, SO THAT NO PONDING OCCURS.
2. WHEN TOP OF CURB ELEVATIONS ARE SHOWN, THE CURB IS A STANDARD 6" CURB, UNLESS OTHERWISE NOTED.
3. CONTRACTOR SHALL FOLLOW THE GENERAL INTENT OF THE GRADING PLANS. MINOR ADJUSTMENTS TO THE ACTUAL ELEVATIONS SHOWN ON THE GRADING PLAN MAY BE REQUIRED TO MATCH EXISTING GROUND ELEVATIONS AND STRUCTURES. CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO ANY MODIFICATIONS.
4. ADEQUATE DRAINAGE SHALL BE MAINTAINED AT ALL TIMES DURING CONSTRUCTION AND ANY DRAINAGE DITCH OR STRUCTURE DISTURBED DURING CONSTRUCTION SHALL BE RESTORED TO EXISTING CONDITIONS OR BETTER.
5. THE APPROVAL OF THE PLANS IS NOT AN AUTHORIZATION TO GRADE ADJACENT PROPERTIES. WHEN FIELD CONDITIONS WARRANT OFF-SITE GRADING, PERMISSION MUST BE OBTAINED FROM AFFECTED PROPERTY OWNER(S). ANY ADJACENT PROPERTY OR RIGHT-OF-WAY DISTURBED DURING CONSTRUCTION SHALL BE RETURNED TO EXISTING CONDITIONS OR BETTER.
6. REFERENCE GEOTECHNICAL REPORT: GEOTECHNICAL ENGINEERING STUDY, CITY OF BRENHAM FIRE STATION NO. 2 BY GESSNER ENGINEERING, DATED MARCH, 25, 2024.
7. FILL MATERIAL FOR NON-STRUCTURAL AREAS (5 FOOT OUTSIDE OF EDGE OF PAVEMENT, BACK OF CURB, OR IMPROVED AREAS) SHALL BE PLACED IN 8" MAXIMUM LOOSE LIFTS AND COMPACTED TO A UNIFORM DENSITY OF AT LEAST 982% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR (ASTM D698) WITH A MOISTURE CONTENT OF +/- 2% OF OPTIMUM.
8. COMPACTION AND MOISTURE CONTROL SHALL BE VERIFIED BY IN-PLACE DENSITY TEST FOR EACH LIFT, 1 TEST PER 4,000 SF OF FILL PLACED, WITH A MINIMUM OF 1 TEST PER LIFT.
9. PRIOR TO REVEGETATION OPERATIONS. CONTRACTOR TO SPREAD/REPLACE AND CONSOLIDATE TOPSOIL TO A DEPTH OF 6" MINIMUM.
10. ALL DISRUPTED AREAS ARE TO HAVE ESTABLISHMENT OF GRASS AS OUTLINED PER THE LANDSCAPE PLAN.
11. CONTRACTOR IS RESPONSIBLE FOR WATERING (INCLUDING TEMPORARY IRRIGATION IN AREAS NOT RECEIVING PERMANENT IRRIGATION), MAINTENANCE, AND ESTABLISHMENT OF VEGETATION FOR A PERIOD OF 90 DAYS. CONTRACTOR TO GUARANTEE ALL PLANTED MATERIAL GROWTH AND COVERAGE FOR A PERIOD OF 6 MONTHS. GROWTH AND COVERAGE SHALL BE DEFINED AS 95% OF THE PLANTED AREA WITH UNIFORM COVERAGE OF GRASS GREATER THAN 1" IN HEIGHT WITH NO BARE SPOTS GREATER THAN 2 SQUARE FEET. SECOND APPLICATION OF SEED OR HYDROMULCH IS REQUIRED FOR BARE SPOTS NOT MEETING COVERAGE REQUIREMENT WITHIN 30 DAYS OF INITIAL APPLICATION.
12. ALL DISTURBED AREAS NOT TO BE PAVED OR NOT INCLUDED IN THE LANDSCAPE SCOPE ARE TO BE PREPARED AND HYDROMULCH OR SEEDED FOR PERMANENT ESTABLISHMENT OF VEGETATION. PRIOR TO OPERATIONS, CONTRACTOR IS TO REPLACE AND CONSOLIDATE TOPSOIL TO A DEPTH OF 6" MINIMUM. TOPSOIL TO BE HARLEYRAKE/TILLED TO A DEPTH OF 4" PRIOR TO SEEDING OR INSTALLATION OF SOD. FINAL GRADES WITH ESTABLISHED VEGETATION SHALL PROVIDE POSITIVE DRAINAGE.
13. CONTRACTOR SHALL MAINTAIN EROSION CONTROL UNTIL ALL LANDSCAPE AREAS ARE ESTABLISHED. CONTRACTOR IS RESPONSIBLE FOR CLEANUP FROM LANDSCAPING MATERIALS. MULCH OR LANDSCAPE SEDIMENT TRANSPORT THAT MAY OCCUR AFTER LANDSCAPE INSTALLATION INCLUDING MAINTENANCE OF GRATES AND TRENCH DRAINS.
14. CONTRACTOR IS RESPONSIBLE FOR OBTAINING T.C.E.Q CONSTRUCTION SITE PERMITTING AS NECESSARY
15. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PROTECT ALL MANHOLES, CLEANOUTS, VALVE BOXES, FIRE HYDRANTS, ETC. WITHIN THE AREA OF CONSTRUCTION. THEY MUST BE ADJUSTED TO PROPER GRADE BY THE CONTRACTOR PRIOR TO AND AFTER THE PLACING OF PAVEMENT AND GRADING.
16. SIDEWALKS SHALL HAVE A SLOPE NO GREATER THAN 5% AND A CROSS SLOPE NOT GREATER THAN 2%, UNLESS OTHERWISE NOTED.
17. HANDICAP ACCESSIBLE PARKING SPACES AND ACCESS AISLES SHALL HAVE A MAXIMUM OF 2% SLOPE IN ALL DIRECTIONS PER TAS REQUIRMENTS.
18. CONTRACTOR SHALL CONTACT GESSNER ENGINEERING IF DISCREPANCIES EXIST AT EXISTING GRADE TIE-INS.
19. CONTRACTOR TO VERIFY WITH ADJACENT PROPERTY OWNER WHEN GRADING ON ADJACENT PROPERTY.

PAVEMENT NOTES:

1. SUBGRADE:
1.A. EXISTING VEGETATION, TREES, STUMPS, AND ROOTS SHALL BE GRUBBED AND REMOVED. THE TOP 6" OF TOPSOIL AND SUBGRADE STRIPPED FROM THE AREAS TO BE COVERED BY PAVEMENT.
1.B. PAVING AREAS SHALL BE PROOF-ROLLED WITH A 20 TON COMPACTOR AND, IF REQUIRED AT THE TIME OF CONSTRUCTION , THE CONTRACTOR SHALL STABILIZE WEAK AREAS BY OVER EXCAVATING AND BACKFILLING WITH SPECIFIED MATERIALS.
1.C. FILL MATERIAL FOR AREAS UNDER PAVEMENT AND EXTENDING 5 FOOT BEYOND EDGE OF PAVEMENT OR BACK OF CURB, SHALL MEET THE MATERIALS AS OUTLINED IN THE GEOTECHNICAL REPORT: GEOTECHNICAL ENGINEERING STUDY, CITY OF BRENHAM FIRE STATION NO. 2 BY GESSNER ENGINEERING, DATED MARCH, 25, 2024.
1.D. FILL MATERIAL FOR AREAS UNDER PAVEMENT AND EXTENDING 5 FOOT BEYOND EDGE OF PAVEMENT OR BACK OF CURB, SHALL MEET THE SPECIFIED MATERIALS, BE PLACED IN 8" MAXIMUM LOOSE LIFTS, AND COMPACTED TO A UNIFORM DENSITY OF AT LEAST 98% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR (ASTM D698) WITH A MOISTURE CONTENT OF +/- 2% OF OPTIMUM.
1.E. COMPACTION AND MOISTURE CONTROL SHALL BE VERIFIED BY IN-PLACE DENSITY TEST FOR EACH LIFT FOR EVERY 200 LINEAR FEET OF PAVEMENT OR EVERY 4,000 SF OF FILL PLACED, WHICH EVER WOULD PRODUCE THE GREATER TESTING FREQUENCY, WITH A MINIMUM OF ONE TEST PER LIFT.
1.F. SOILS SHALL BE STABILIZED WITH LIME TREATMENT IF PAVEMENT SUBGRADE SOILS CONSIST OF CLAYS OR CLAYEY SANDS OF HIGH PLASTICITY (PI>20).
1.G. SOILS SHALL BE STABILIZED WITH CEMENT TREATMENT IF PAVEMENT SUBGRADE SOILS CONSIST OF SANDS OR SILTS WITH LOW PLASTICITY (PI <= 15).
1.H. STABILIZATION SHALL BE ACCOMPLISHED SUCH THAT A UNIFORM SUBGRADE MIX IS OBTAINED AND SHALL EXTEND TO 2 FOOT BEYOND THE BACK OF CURB OR EDGE OF PAVEMENT. PRIOR TO THE APPLICATION OF LIME OR CEMENT TO THE SUBGRADE, THE OPTIMUM PERCENTAGE TO BE ADDED SHALL BE DETERMINED BASED ON TEX-121-E LABORATORY TESTS (LIME) AND TEX-120-E LABORATORY TESTS (CEMENT) CONDUCTED ON MIXTURES OF THE SUBGRADE SOILS WITH VARYING PERCENTAGES. SUBGRADE SOIL SAMPLES SHOULD BE OBTAINED FROM THE PAVEMENT AREA AT THE PROPOSED FINAL SUBGRADE ELEVATION. THE LIME OR CEMENT SHOULD INITIALLY BE BLENDED WITH A MIXING DEVICE SUCH AS PULVERIZER OR MIXER AND SUFFICIENT WATER ADDED.
1.I. THE AMOUNT OF LIME REQUIRED FOR STABILIZATION SHOULD BE THE PERCENT REQUIRED BY WEIGHT TO PRODUCE A PH NOT LESS THAN 12.4 AND TO PROVIDE A PI VALUE OF LESS THAN OR EQUAL TO 18.
1.J. THE AMOUNT OF CEMENT REQUIRED FOR STABILIZATION SHOULD BE THE PERCENT REQUIRED BY WEIGHT TO PRODUCE A MINIMUM COMPRESSION STRENGTH OF 50 PSI PRIOR TO BEING OPEN TO LOCAL OR CONSTRUCTION TRAFFIC.
1.K. A STABILIZATION DEPTH CHECK SHALL BE PERFORMED WITH EACH DENSITY TEST FOR THE STABILIZED LIFT.

2. CONCRETE PAVEMENT:
2.A. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
2.B. ALL CONCRETE SHALL BE VIBRATED WHEN PLACED.
2.C. PAVEMENT CONTRACTION JOINTS SHALL BE INSTALLED PER PLAN AND DETAIL SHEET, WITH A MAXIMUM SPACING OF 24 TIMES THE THICKNESS OF THE PAVEMENT (12' FOR 6" PAVEMENT). CONTRACTION JOINTS SHALL BE INSTALLED AS SOON AS CONCRETE CURING ALLOWS AND SHALL BE CUT 1/4 OF THE THICKNESS OF THE PAVEMENT. AN EARLY ENTRY SAW IS PREFERRED. TOOLED OR FORMED JOINTS ARE NOT ALLOWED.
2.D. PAVEMENT EXPANSION JOINTS SHALL BE SPACED AS SHOWN ON THE PLANS AND INSTALLED PER DETAIL SHEET. CONSTRUCTION SHALL BE STOPPED AT EXPANSION JOINTS. IF CONDITIONS REQUIRE, CONSTRUCTION TO BE STOPPED AT OTHER LOCATIONS, A COLD JOINT SHALL BE CONSTRUCTED.
2.E. ISOLATION JOINTS SHALL BE PLACED AT ALL IN-PAVEMENT OBJECTS INCLUDING INLETS, LIGHT POLE FOOTINGS, CLEANOUTS, ETC.
2.F. ALL JOINTS SHALL BE SEALED. PROVIDE EXPANSION JOINT WATER STOP CAPS AT NEW CONCRETE. PROVIDE EXPANSION JOINT SEALANT AT NEW TO EXISTING PAVEMENT.
2.G. REFERENCE DETAIL SHEET FOR PAVEMENT AND SIDEWALK CONSTRUCTION DETAILS.
2.H. TRANSPORTATION AND PLACEMENT OF THE CONCRETE SHALL BE IN ACCORDANCE WITH ACI 301. A TEST SET CONSISTING OF 4 CYLINDERS SHALL BE TAKEN FOR EVERY 75 CUBIC YARDS OF CONCRETE.

3. REINFORCING STEEL:
3.A. ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60. THE PAVEMENT REINFORCEMENT SHALL BE PER DETAILS.
3.B. LAPS AND SPLICES IN REINFORCING BARS SHALL BE A MINIMUM OF 30 BAR DIAMETERS IN LENGTH. BARS SHALL BE SECURED AT EVERY OTHER INTERSECTION.

4. CURB AND GUTTER SECTION:
4.A. EXPANSION JOINTS SHALL BE SPACED AT A MAXIMUM DISTANCE OF 40' AND AT ALL RADIUS POINTS, PT'S AND PC'S AND SHALL BE SEALED.
4.B. CONTRACTION JOINTS SHALL BE SPACED AT A MAXIMUM OF 10' AND SHALL BE SEALED. TOOLED OR FORMED JOINTS ARE NOT ALLOWED.

5. PAINTING AND STRIPING:
5.A. CONTRACTOR SHALL PAINT STRIPING FOR THE PARKING AREA AS INDICATED ON THE PLAN. THE SOLID LINE REPRESENTS A 4" WIDE SOLID WHITE LINE TO BE PAINTED. CONTRACTOR IS RESPONSIBLE TO PAINT HANDICAP MARKINGS AND LOADING ZONES IN CONFORMANCE WITH CURRENT ADA/TAS STANDARDS AND ALL FIRE LANE MARKINGS IN ACCORDANCE WITH AUTHORITY HAVING JURISDICTION REQUIREMENTS.
5.B. MATERIAL AND METHODS FOR PAVEMENT MARKINGS SHALL CONFORM TO ITEM 666 AND DMS-8200 OF THE TXDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION OF HIGHWAYS, STREETS, AND BRIDGES.

GENERAL UTILITY NOTES:

1. THE CONTRACTOR SHALL NOTIFY TEXAS 811 AND THE APPROPRIATE UTILITY COMPANY 48 HOURS PRIOR TO EXCAVATION, AND SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS.
2. THE CONTRACTOR IS RESPONSIBLE FOR COMPLYING WITH ALL STATE AND FEDERAL REGULATIONS REGARDING CONSTRUCTION ACTIVITIES NEAR ENERGIZED OVERHEAD ELECTRIC LINES.
3. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR COORDINATING INSTALLATION OF ALL FRANCHISE & PRIVATE UTILITIES WITH EARTHWORK & PAVEMENT CONSTRUCTION.
4. GENERAL CONTRACTOR IS RESPONSIBLE FOR FURNISHING & INSTALLING ANY NECESSARY UTILITY CONDUIT PRIOR TO SUBGRADE PREPARATION & PAVING OPERATION.
5. GENERAL CONTRACTOR IS RESPONSIBLE FOR DETERMINATION OF UTILITY INSTALLATION ORDER.
6. ALL PIPES AND APPURTENANCES SHALL BE KEPT FREE OF DIRT AND OTHER DEBRIS. STORE ALL MATERIALS PER MANUFACTURERS RECOMMENDATIONS. ANY DAMAGED MATERIALS SHALL BE REMOVED FROM THE SITE AND REPLACED.
7. TRENCH BACKFILL FOR ALL UTILITIES SHALL MEET THE DETAILS, SPECIFIED MATERIALS, AND BE FREE OF DEBRIS, TRASH, VEGETATION, AND ROCKS LARGER THAN 2" IN DIAMETER OR MATERIAL AS OUTLINED IN THE GEOTECHNICAL REPORT. UNDER AREAS TO BE PAVED & WITHIN 5' OF EDGE OF PAVING, THE BACKFILL SHALL BE PLACED IN 8" MAXIMUM LOOSE LIFTS AND COMPACTED TO A UNIFORM DENSITY OF AT LEAST 98% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR(D698) OR BE CEMENT STABILIZED SAND COMPACTED TO A UNIFORM DENSITY OF AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D558 WITH A MOISTURE CONTENT OF +/- 2% OF OPTIMUM. ALL OTHER AREAS SHALL BE COMPACTED TO A UNIFORM DENSITY OF AT LEAST 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY THE STANDARD PROCTOR(D698).
8. COMPACTION AND MOISTURE CONTROL SHALL BE VERIFIED BY IN-PLACE DENSITY TEST FOR EACH LIFT FOR EVERY 100 LINEAR FEET OF TRENCH PLACED, WITH A MINIMUM OF ONE TEST PER LIFT.
9. ALL CONDUIT TO BE INSTALLED WITH PULL STRING AND END CAPS, WITH ENDS EXTENDING 2' BEYOND PAVEMENT EDGE. CONTRACTOR TO MAKE ENDS OF CONDUIT WITH PVC EXTENDING 3' ABOVE GROUND AS FOLLOWS: ELECTRIC- 4" PAINTED RED; COMMUNICATIONS- 3" PAINTED ORANGE; IRRIGATION- 3" PAINTED BROWN; WATER- 4" PAINTED BLUE.

STORM NOTES:

1. ALL STORM SEWER IS PROPOSED, UNLESS OTHERWISE NOTED.
2. TRENCH BACKFILL SHALL BE PER DETAILS.
3. STORM SEWER MATERIAL SHALL BE AS FOLLOWS FOR THE FOLLOWING INSTALLATIONS:
3.A. POLYVINYL CHLORIDE (PVC), ASTM D3034, SDR 26, TYPE PSM SEWER PIPE WITH BELL AND SPIGOT END FOR RUBBER GASKETED JOINTS MEETING ASTM F477
3.B. HIGH DENSITY POLYETHYLENE CORRUGATED PIPE (HDPE), AASHTO M252 (4"-10"), AASHTO M294 (12"-60"), AND ASTN F2306 (12"-60"), TYPE S, WITH A WATER TIGHT REINFORCED INTEGRAL BELL AND SPIGOT FOR RUBBER GASKETED JOINTS MEETING ASTM D3212 (ADS N-12, WT WATER TIGHT)
3.B. REINFORCED CONCRETE PIPE (RCP), ASTM C76, WALL B, CLASS III AND/OR CLASS IV, RUBBER GASKETED JOINT MEETING ASTM C443
4. CONCRETE FOR STRUCTURES (INLETS, CATCH BASINS, JUNCTIONS, ETC.)
4.A. MIN 4000 PSI-28 DAY STRENGTH FOR ITEMS UP TO 10' DIMENSION
4.B. MIN 5000 PSI-28 DAY STRENGTH FOR ITEMS WITH GREATER THAN 10' DIMENSION
5. CONTRACTOR IS TO USE SILT FENCING AROUND INLET AND JUNCTION BOXES AND GRAVEL FILLED PERMEABLE BAGS AROUND INLET BOXES (AS NECESSARY) TO PREVENT SEDIMENT FROM ENTERING STORM SEWER SYSTEM. PRIOR TO ACCEPTANCE OF PROJECT FOR SUBSTANTIAL COMPLETION, CONTRACTOR IS TO CLEAN ALL STORM SEWER FACILITIES OF SEDIMENT. CONTRACTOR TO USE EROSION CONTROL LOGS AROUND CULVERT INLETS AND OUTLETS TO PREVENT SEDIMENT FROM ENTERING THE CULVERTS. PRIOR TO ACCEPTANCE OF PROJECT FOR SUBSTANTIAL COMPLETION, CONTRACTOR IS TO CLEAN ALL CULVERTS AND STORM FACILITIES OF SEDIMENT.
6. CONTRACTOR SHALL PROVIDE A MINIMUM OF 12 INCH CLEARANCE AT STORM SEWER AND WATER LINE CROSSINGS AND A MINIMUM OF 6 INCH CLEARANCE AT STORM AND SANITARY SEWER CROSSINGS.
7. ALL PERMANENT ROCK RIP-RAP TO BE LIMESTONE USING GENERALLY 200LB - 250LB PIECES WITH SMALLER ROCK FILLING VOIDS. ROCK TO BE INSTALLED TO 1.5 TIMES AVERAGE ROCK DIAMETER MIN. THICKNESS. INSTALL SOIL RETENTION FILTER FABRIC BENEATH ROCK PER TXDOT MATERIAL SPEC. DMS-6200, TYPE 2 (SUCH AS 205NW NON-WOVEN FILTER FABRIC AS MFD. BY US FABRICS). RIP-RAP TO BE HAND PLACED PROVIDING A NEAT, UNIFORM, TIGHT SURFACE IN ACCORDANCE WITH TXDOT SPECIFICATIONS ITEM #432, STONE RIP-RAP (TYPE R). BROKEN CONCRETE MAY NOT BE USED FOR PERMANENT INSTALLATIONS. NO SOIL SHOULD BE VISIBLE THROUGH RIP-RAP.-)

SANITARY SEWER NOTES:

1. ALL SANITARY SEWER LINES TO BE POLYVINYL CHLORIDE (PVC), ASTM D3034, SDR 26, TYPE PSM SEWER PIPE WITH BELL AND SPIGOT END FOR RUBBER GASKETED JOINTS MEETING ASTM F477SDR-26 PVC UNLESS OTHERWISE NOTED ON THE PLANS .
2. SANITARY SEWER LINES SHALL BE CONSTRUCTED IN ACCORDANCE WITH CURRENT TCEQ REGULATIONS, CHAPTER 217, LOCAL JURISDICTIONAL REGULATIONS, AND IN ACCORDANCE WITH THE 2018 INTERNATIONAL PLUMBING CODE.
3. ALL SECTIONS OF THE SANITARY COLLECTION SYSTEM SHALL BE INSTALLED NO CLOSER THAN NINE FEET IN ALL DIRECTIONS TO THE POTABLE WATER DISTRIBUTION FACILITIES. ALL SEPARATION DISTANCES SHALL BE MEASURED FROM THE OUTSIDE SURFACE OF EACH OF THE RESPECTIVE PIECES. IF NINE FEET OF SEPARATION CANNOT BE MET, FOLLOW CURRENT TCEQ CHAPTER 217.53 (D) AND 290.44(E) REGULATIONS. IF CONFLICTS OCCUR, CONTACT ENGINEER.
4. ALL SANITARY SEWER LINES SHALL BE THOROUGHLY CLEANED, TESTED, AND APPROVED PRIOR TO ANY CONNECTIONS BEING MADE TO THE EXISTING SANITARY SEWER SYSTEM.
5. ALL SANITARY SEWER LINE AND MANHOLE TESTING SHALL BE IN ACCORDANCE WITH CURRENT TCEQ REGULATIONS AND SPECIFICATIONS. A LOW PRESSURE AIR TEST OR AN INFILTRATION/EXFILTRATION TEST SHALL BE COMPLETED IN ACCORDANCE WITH 217.57 (A). DEFLECTION TESTING BY MANDREL SHALL BE COMPLETED ON ALL FLEXIBLE PIPES. MANDREL SIZING AND TESTING PROCEDURES SHALL BE IN ACCORDANCE WITH 217.57 (B). A VACUUM TEST SHALL BE PERFORMED ON ALL MANHOLES IN ACCORDANCE WITH 217.58 (B)(2).
6. ALL ASPECTS OF THE SEWER LINE, INCLUDING PIPE JOINTS AND MANHOLES, SHALL HAVE A DESIGN LIFE CYCLE OF NO LESS THAN FIFTY YEARS. IF A PIPE OR AN INTEGRAL STRUCTURAL COMPONENT OF A PIPE WILL DETERIORATE WHEN SUBJECTED TO CORROSIVE INTERNAL CONDITIONS OR IF A PIPE OR COMPONENT DOES NOT HAVE A CORROSIVE RESISTANT LINER INSTALLED BY THE MANUFACTURER, THE CONTRACTOR MUST DEMONSTRATE THE STRUCTURAL INTEGRITY OF THE PIPE DURING THE MINIMUM 50-YEAR DESIGN LIFE CYCLE.
7. CLEAN-OUT INSTALLATIONS MUST PASS ALL APPLICABLE TESTING REQUIREMENTS OUTLINED FOR GRAVITY COLLECTION PIPES IN 217.57 (RELATING TO TESTING REQUIREMENTS FOR INSTALLATION OF GRAVITY COLLECTION SYSTEM PIPES).
8. A MANHOLE MUST BE MADE OF MONOLITHIC, CAST IN-PLACE CONCRETE, FIBERGLASS, PRE-CAST CONCRETE MEETING ASTM C478, HIGH-DENSITY POLYETHYLENE, OR EQUIVALENT MATERIAL THAT PROVIDES ADEQUATE STRUCTURAL INTEGRITY. THE USE OF BRICKS TO ADJUST A MANHOLE COVER TO GRADE OR CONSTRUCT A MANHOLE IS PROHIBITED.
9. THE INSIDE DIAMETER OF A MANHOLE MUST BE NO LESS THAN 48 INCHES.
10. THE BOTTOM OF A MANHOLE MUST CONTAIN A U-SHAPED CHANNEL THAT IS A SMOOTH CONTINUATION OF THE INLET AND OUTLET PIPES.
11. A MANHOLE CONNECTION MUST USE WATERTIGHT, SIZE-ON-SIZE RESILIENT CONNECTORS THAT ALLOW FOR DIFFERENTIAL SETTLEMENT AND MUST CONFORM TO ASTM C923.

WATER NOTES:

1. ALL WATER MAIN LINES SHALL BE PVC PRESSURE PIPE, 2-INCH THROUGH 12-INCH, SHALL CONFORM TO THE REQUIREMENTS OF ANSI/AWWA C900, CURRENT REVISION, CLASS 150 DR 18. PIPE SHALL BE DESIGNED AND CONSTRUCTED IN CONFORMANCE WITH THE MINIMUM REQUIREMENTS OF THE "MANUAL OF WATER SUPPLY PRACTICES", AWWA MANUAL NO. M23. PVC PIPE WITH THE USE OF DUCTILE IRON FITTINGS IS THE PREFERRED MATERIAL FOR WATER LINE CONSTRUCTION. THE USE OF DIP IS ALLOWED, AS NECESSARY.
2. THE WATER LINE DOMESTIC SERVICE SHALL BE SDR 9 POLYETYLENE PIPE.
3. ALL WATER LINES MAINS AND SERVICE LINES TO HAVE 12" GAUGE COPPER TRACER WIRE PER CITY DETAILS.
4. POTABLE WATER LINES SHALL BE CONSTRUCTED IN ACCORDANCE WITH CURRENT TCEQ REGULATIONS, CHAPTER 290, LOCAL JURISDICTIONAL REGULATIONS, AND IN ACCORDANCE WITH THE 2012 INTERNATIONAL PLUMBING CODE.
5. SEPARATION OF PUBLIC WATER AND WASTEWATER MAINS SHALL BE CONSISTENT WITH THE CURRENT RULES & REGULATIONS FOR PUBLIC WATER SYSTEMS OF THE TCEQ.
6. WATER SERVICE LINES SHALL MAINTAIN A MINIMUM COVER OF FOUR (4) FEET AND A MAXIMUM COVER OF FIVE (5) FEET UNLESS OTHERWISE SPECIFIED ON PLANS AND/ OR REQUIRED FOR UTILITY CROSSINGS.
7. ALL NEWLY INSTALLED PIPES AND RELATED PRODUCTS MUST CONFORM TO AMERICAN NATIONAL STANDARDS INSTITUTE/NATIONAL SANITATION FOUNDATION (ANSI/NSF) STANDARD 61 AND MUST BE CERTIFIED BY AN ORGANIZATION ACCREDITED BY ANSI.
8. ALL PLASTIC PIPE FOR USE IN PUBLIC WATER SYSTEMS MUST ALSO BEAR THE NATIONAL SANITATION FOUNDATION SEAL OF APPROVAL (NSF-PW) AND HAVE AN ASTM DESIGN PRESSURE RATING OF AT LEAST 150 PSI OR A STANDARD DIMENSION RATION OF 26 OR LESS.
9. NO PIPE WHICH HAS BEEN USED FOR ANY PURPOSE OTHER THAN THE CONVEYANCE OF DRINKING WATER SHALL BE ACCEPTED OR RELOCATED FOR USE IN ANY PUBLIC DRINKING WATER SUPPLY.
10. LEAD BAN SHALL BE FOLLOWED PER CURRENT TCEQ 290.44 (B) REGULATIONS.
11. POTABLE WATER DISTRIBUTION LINES AND WASTEWATER MAINS OR LATERALS THAT FORM PARALLEL UTILITY LINES SHALL BE INSTALLED IN SEPARATE TRENCHES.
12. NO PHYSICAL CONNECTION SHALL BE MADE BETWEEN A DRINKING WATER SUPPLY AND A SEWER LINE. ANY APPURTENANCES SHALL BE DESIGNED AND CONSTRUCTED SO AS TO PREVENT ANY POSSIBILITY OF SEWAGE ENTERING THE DRINKING WATER SYSTEM.
13. ALL SECTIONS OF THE POTABLE WATER DISTRIBUTION SYSTEM SHALL BE INSTALLED NO CLOSER THAN NINE FEET ON ALL DIRECTIONS TO THE SANITARY SEWER COLLECTION FACILITIES. ALL SEPARATION DISTANCES SHALL BE MEASURED FROM THE OUTSIDE SURFACE OF EACH OF THE RESPECTIVE PIECES. IF THE NINE FOOT SEPARATION CAN NOT BE MET, FOLLOW CURRENT TCEQ CHAPTER 217.53 (D) AND 290.44 (E) REGULATIONS. IF CONFLICTS OCCUR, CONTACT ENGINEER.
14. WATERLINES SHALL NOT BE INSTALLED CLOSER THAN TEN FEET TO A SEPTIC TANK OR DRAIN FIELD.
15. FIRE HYDRANTS SHALL NOT BE INSTALLED WITHIN NINE FEET VERTICALLY OR HORIZONTALLY OF ANY WASTEWATER MAIN, LATERAL, OR SERVICE.
16. SANITARY PRECAUTIONS, FLUSHING, DISINFECTION PROCEDURES, AND MICROBIAL SAMPLING SHALL BE AS PRESCRIBED IN AWWA STANDARDS OR LOCAL JURISDICTIONAL REQUIREMENTS. ALL TEST AND FLUSHING WATER SHALL BE POTABLE AND OF A KNOWN SOURCE.
17. AFTER THE PIPE HAS BEEN LAID AND BACKFILLED, BUT PRIOR TO THE REPLACEMENT OF PAVEMENT, EACH VALVED SECTION OF NEWLY LAID PIPE SHALL BE SUBJECTED TO A HYDROSTATIC PRESSURE TEST. TESTING PROCEDURES SHALL BE PER SPECIFICATION OR LOCAL JURISDICTION WITH A MINIMUM PRESSURE OF 150 PSI, WHICHEVER IS MORE STRINGENT. ADJUSTMENT SHALL BE MADE FOR DIFFERENTIAL IN ELEVATION BETWEEN THE LOW POINT OF THE SECTION BEING TESTED AND THE CENTERLINE OF THE PRESSURE TEST GAUGE.
18. EACH VALVED SECTION OF PIPE SHALL BE SLOWLY FILLED WITH WATER TO THE SPECIFIED TEST PRESSURE, MEASURED TO THE POINT OF LOWEST ELEVATION. WATER SHALL BE SUPPLIED BY MEANS OF A PUMP CONNECTED TO THE PIPE IN A SATISFACTORY AND SANITARY MANNER. PRESSURE SHALL BE HELD FOR A MINIMUM OF 2 HOURS WITHOUT PRESSURE LOSS OR PER LOCAL JURISDICTION. THE PUMP, PIPE CONNECTION, AND ALL NECESSARY APPARATUS, INCLUDING GAUGES AND METERS SHALL BE FURNISHED BY THE CONTRACTOR.
19. NO PIPE INSTALLATION WILL BE ACCEPTED UNTIL THE LEAKAGE OR PRESSURE LOSS IS LESS THAN REQUIRED.
20. THE WATER LINES SHALL BE FLUSHED AND THOROUGHLY STERILIZED. STERILIZATION SHALL FOLLOW THE PROCEDURES AS OUTLINED IN CURRENT AWWA C651, OR PER LOCAL JURISDICTION, WHICHEVER IS MORE STRINGENT. A MINIMUM OF ONE SAMPLE FOR MICROBIAL TESTING SHALL BE COMPLETED PER 1,000 FEET OF COMPLETE WATERLINE.

DRAINAGE AREA MAP NOTES:

1. THIS SHEET IS FOR SITE PLANNING PURPOSES ONLY. IT IS NOT TO BE USED AS A DOCUMENT FOR CONSTRUCTION. DRAINAGE CALCULATIONS WERE PERFORMED UTILIZING NRCS METHODOLOGIES.

C0.0 NOTES

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979-694-1791
WWW.BRWARCH.COM

STATE OF TEXAS
PEDRO RICO, JR.
133608
LICENSED PROFESSIONAL ENGINEER
10/24/24

CORPORATE OFFICE
401 W 26TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

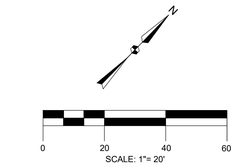
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C0.0
CIVIL
NOTES

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

VICINITY MAP



BENCHMARK 1 ⌖BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

BENCHMARK 2 ⌖BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

NOTE 1:
ALL NATURAL GAS LINES LOCATED UNDER PAVEMENT MUST BE SLEEVED IN SCHEDULE 40 PIPE. SLEEVE MUST HAVE MINIMUM LONG-SWEEP 90 DEGREE TURNS AT DIRECTION CHANGES. SLEEVES MUST BE TWO PIPE SIZES LARGER THAN THE GAS LINE

NOTE 2:
ALL UNDERGROUND GAS LINES AND GROUND WATER LINES MUST HAVE A MINIMUM 12 GAUGE COPPER TRACER WIRE INSTALLED PARALLEL TO THE BURIED GAS LINE OR BURIED WATER LINE.

PARKING TABULATION	
STANDARD PARKING PROVIDED:	27
ADA PARKING PROVIDED:	2
TOTAL PARKING PROVIDED:	29

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- 340 EXISTING CONTOURS
- 340 PROPOSED CONTOURS
- ST EX. | PROP. STORM LINE
- W EX. | PROP. WATER LINE
- SA EX. | PROP. SANITARY SEWER LINE
- CWR HWR CWS HWS EXISTING THERMALS
- CWR HWR CWS HWS PROPOSED THERMALS
- G EX. | PROP. GAS LINE
- T EX. | PROP. DATA/TELECOM
- UE EX. | PROP. UNDERGROUND ELECTRIC
- FO EX. | PROP. FIBER OPTIC
- OE EX. | PROP. OVERHEAD ELECTRIC
- EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- PROP. POST INDICATOR VALVE
- HOSE LAY PROP. HOSE LAY
- EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- PROP. STORM SEWER CURB INLET
- EX. | PROP. LIGHT POLE
- PAE PROPOSED PUBLIC ACCESS EASEMENT
- PUE PROPOSED UTILITY EASEMENT

C1.0 SITE PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-1675
WWW.BRWARCH.COM

PEDRO RIOS, JR. 133608 REGISTERED ARCHITECT STATE OF TEXAS
10/24/24

CORPORATE OFFICE
4004 BEMIS STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

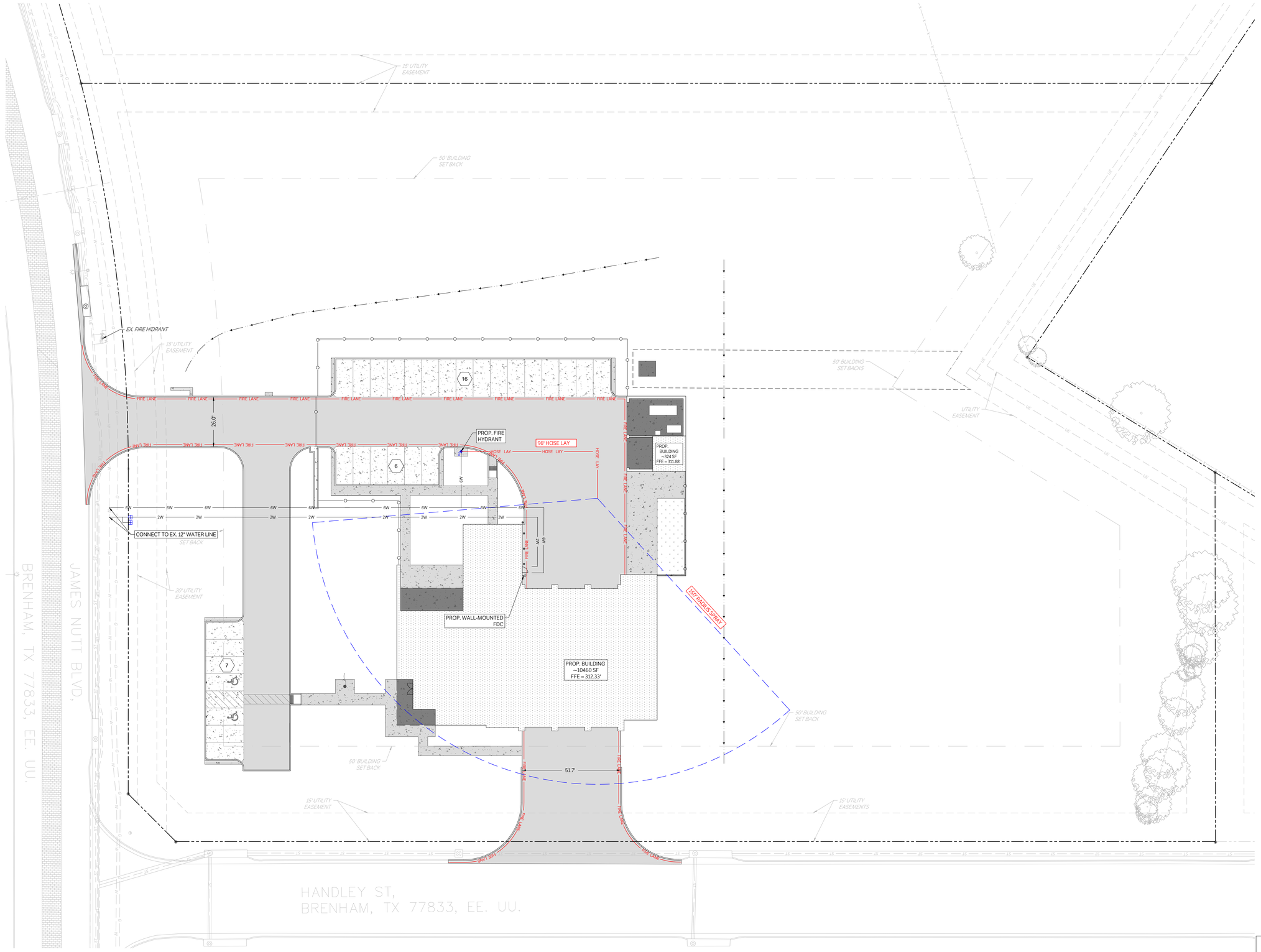
GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C1.0
CIVIL
SITE PLAN



CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

N

0 20 40 60
SCALE: 1"= 20'

BENCHMARK 1 ✤BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ✤BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

LEGEND

- FIRE LANE — FIRE LANE WITH RED STRIPES CONTAINING THE WORDING "FIRE LANE - NO PARKING -TOW AWAY", PAINTED IN 4" WHITE LETTERS
- PROPOSED BUILDING
- HOSE LAY — HOSE LAY PATH
- 150' SPRAY RADIUS

C1.1 FIRE SITE PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1717
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4001 WHITE STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

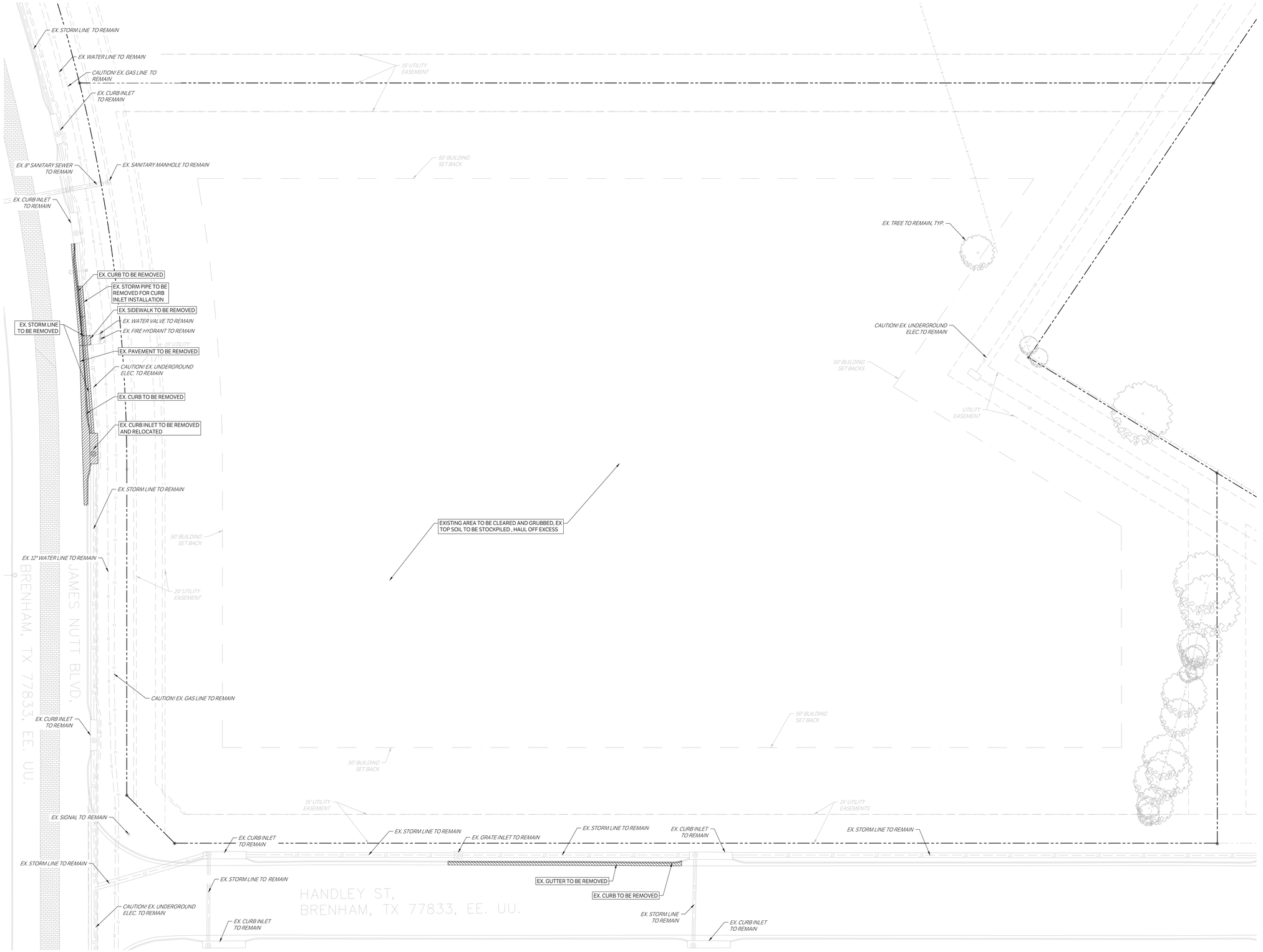
GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C1.1
CIVIL
FIRE SITE PLAN



CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

N

0 20 40 60
SCALE: 1"= 20'

BENCHMARK 1 ✤BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ✤BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

C2.0 DEMOLITION PLAN

SCALE: 1"=20'

LEGEND
DEMOLITION AREA

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7171
WWW.BRWARCH.COM

BRW

STATE OF TEXAS
PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4041 N. MAIN STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

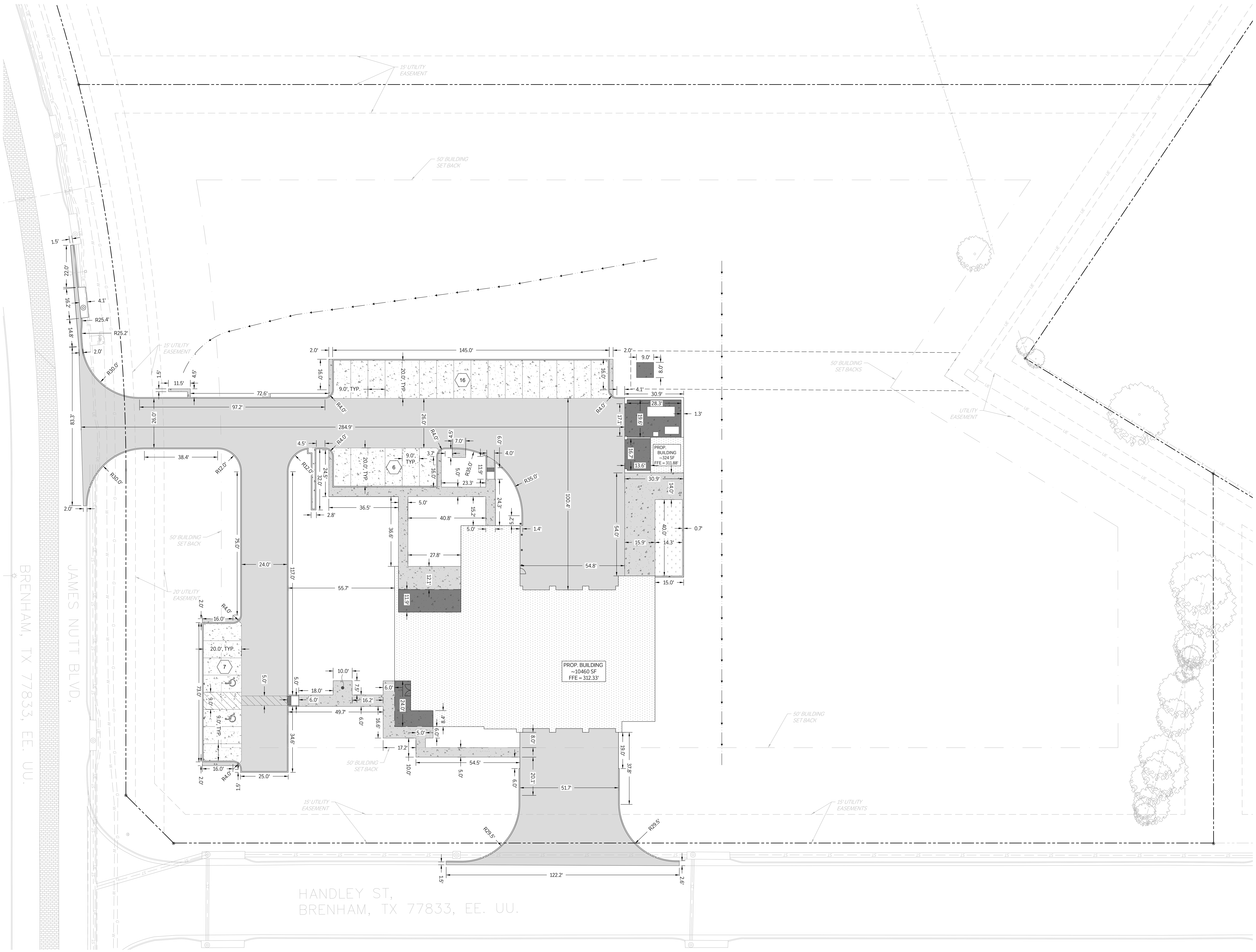
DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C2.0
CIVIL
DEMOLITION PLAN

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.



SCALE: 1"= 20'

BENCHMARK 1 BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. | PROP. STORM LINE
- EX. | PROP. WATER LINE
- EX. | PROP. SANITARY SEWER LINE
- EXISTING THERMALS
- PROPOSED THERMALS
- EX. | PROP. GAS LINE
- EX. | PROP. DATA/TELECOM
- EX. | PROP. UNDERGROUND ELECTRIC
- EX. | PROP. FIBER OPTIC
- EX. | PROP. OVERHEAD ELECTRIC
- EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- PROP. POST INDICATOR VALVE
- PROP. HOSE LAY
- EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- PROP. STORM SEWER CURB INLET
- EX. | PROP. LIGHT POLE
- PAE PROPOSED PUBLIC ACCESS EASEMENT
- PUE PROPOSED UTILITY EASEMENT

C3.0 DIMENSION PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979-694-1791
WWW.BRWARCH.COM

STATE OF TEXAS
PEDRO RICO, JR.
133608
LICENSED PROFESSIONAL ENGINEER
10/24/24

GESSNER ENGINEERING
CORPORATE OFFICE
401 W 26TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

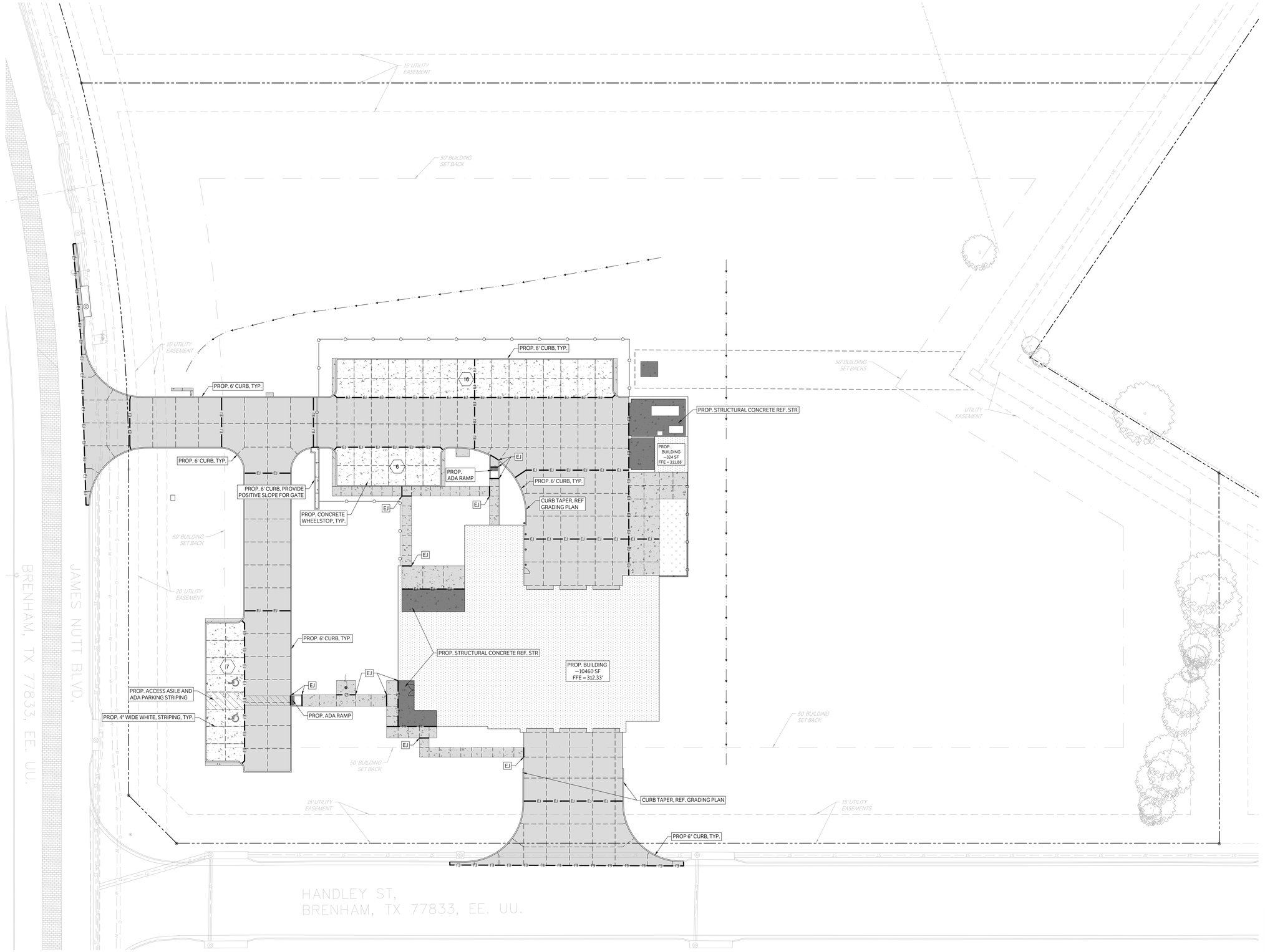
DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

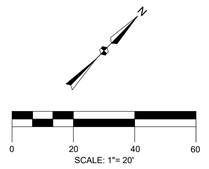
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C3.0
CIVIL
DIMENSION PLAN

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.





BENCHMARK 1 ✤BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ✤BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

LEGEND

- EXISTING PAVEMENT EDGE
- CONTROL JOINT
- EXPANSION JOINT
- FIRE LANE WITH RED STRIPES CONTAINING THE WORDING "FIRE LANE - NO PARKING -TOW AWAY", PAINTED IN 4" WHITE LETTERS
- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE

C4.0 PAVING PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1770
WWW.BRWARCH.COM

REGISTERED PROFESSIONAL ENGINEER
PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4041 TEXAS STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C4.0
CIVIL
PAVING PLAN

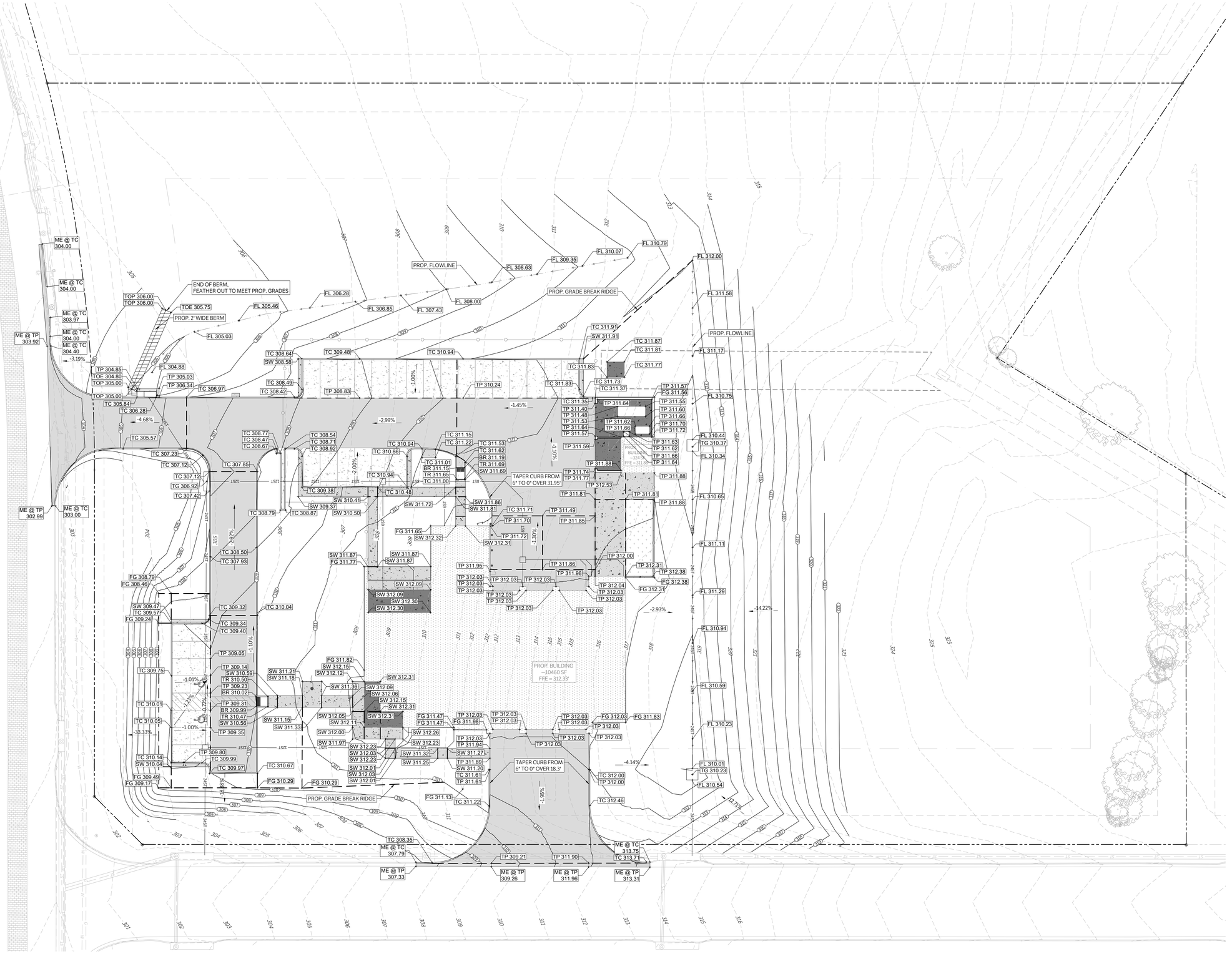
CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

N

0 20 40 60
SCALE: 1"= 20'

BENCHMARK 1 ⌖BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ⌖BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE



LEGEND

340	EXISTING CONTOURS
340	PROPOSED CONTOURS
	PROPERTY LINE
	PROPOSED SWALE WITH DIRECTION OF FLOW ARROWS
	PROPOSED GRADE BREAK
BR	PROPOSED FINISHED GRADE AT BOTTOM OF RAMP
BS	PROPOSED FINISHED GRADE AT BOTTOM OF STAIR
BW	PROPOSED FINISHED GRADE AT BASE OF WALL
FG	PROPOSED FINISHED GRADE ELEVATION
FL	PROPOSED FLOWLINE ELEVATION
GUT	PROPOSED GUTTER FLOWLINE ELEVATION
GB	PROPOSED GRADE BREAK
JB	PROPOSED TOP OF JUNCTION BOX ELEVATION
ME @ SW	MATCH EXISTING SIDEWALK ELEVATION***
ME @ TC	MATCH EXISTING TOP OF CURB ELEVATION***
ME @ TP	MATCH EXISTING AT TOP OF PAVEMENT ELEVATION***
SW	PROPOSED TOP OF PAVEMENT AT SIDEWALK ELEVATION
TC	PROPOSED TOP OF CURB ELEVATION
TG	PROPOSED TOP OF GRATE ELEVATION
TP	PROPOSED TOP OF PAVEMENT ELEVATION
TR	PROPOSED TOP OF RAMP ELEVATION
TW	PROPOSED TOP OF WALL ELEVATION
TMS	PROPOSED TOP OF MUD SLAB

***CONTACT GESSNER ENGINEERING WITH ANY DISCREPANCIES BETWEEN THE ME ELEVATION CALLED OUT ON THE PLANS AND FIELD CONDITIONS

C5.0 GRADING PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7477
WWW.BRWARCH.COM

PEDRO RIOS, JR.
LICENSED
No. 133608
ARCHITECT
10/24/24

CORPORATE OFFICE
4001 E. 29TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

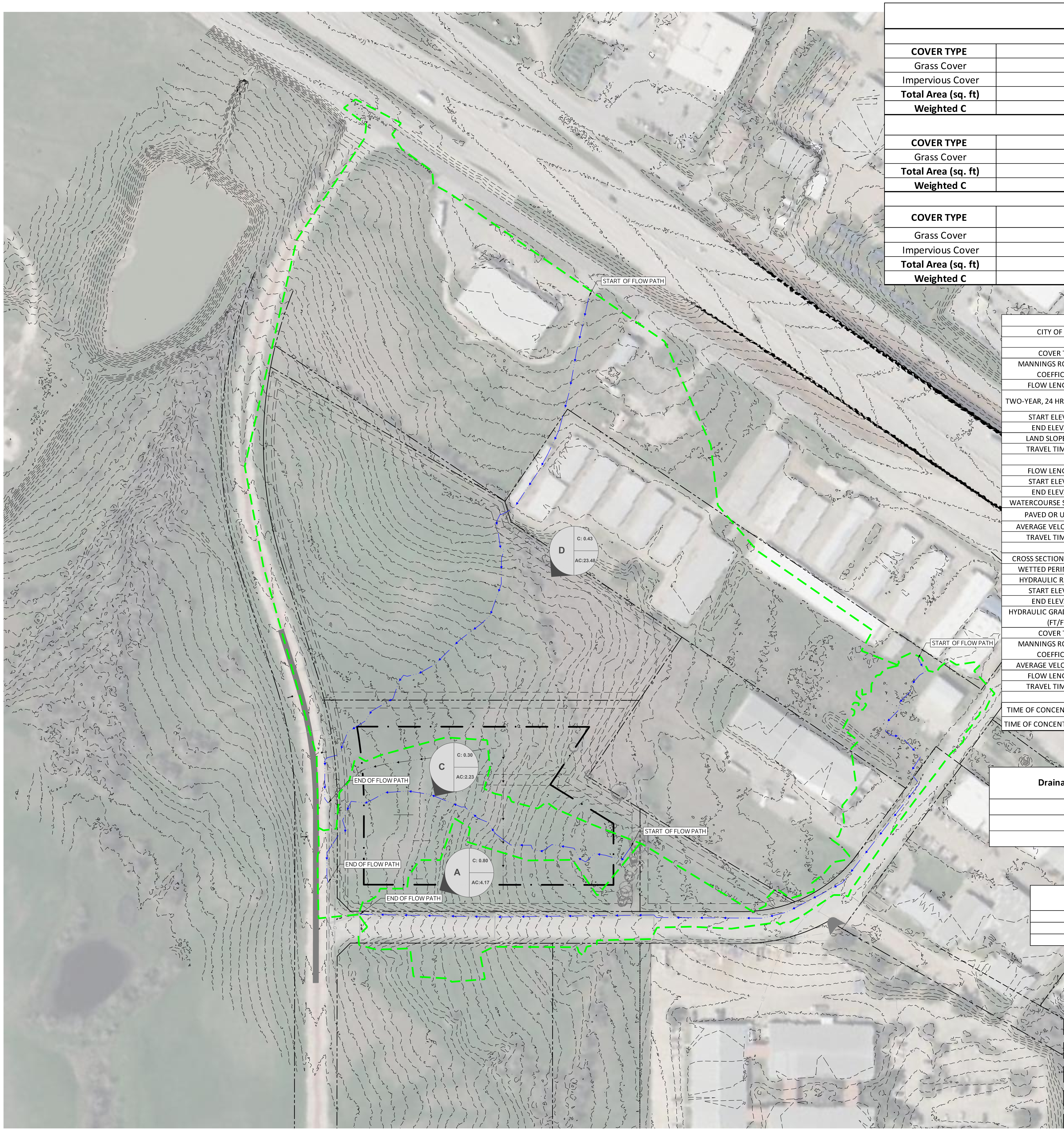
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C5.0

CIVIL

GRADING PLAN



Pre

A			
COVER TYPE	**Surface Description**	**C**	**Area (SF)**
Grass Cover	Grass Cover	0.30	37937.11
Impervious Cover	Building, Pavment	0.95	143499.74
Total Area (sq. ft)	**181436.85**	**Total Area (ac.)**	**4.17**
Weighted C	**0.80**		

C			
COVER TYPE	**Surface Description**	**C**	**Area (SF)**
Grass Cover	Grass Cover	0.30	97187.16
Total Area (sq. ft)	**97187.16**	**Total Area (ac.)**	**2.23**
Weighted C	**0.30**		

D			
COVER TYPE	**Surface Description**	**C**	**Area (SF)**
Grass Cover	Grass Cover	0.30	815752.17
Impervious Cover	Building, Pavment	0.95	207253.79
Total Area (sq. ft)	**1023005.96**	**Total Area (ac.)**	**23.48**
Weighted C	**0.43**		

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION. CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

0 80 160 240
SCALE: 1"= 80'

BENCHMARK 1 BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

PRE DEVELOPED TIME OF CONCENTRATION							
CITY OF BRENHAM		A	C		D		
SHEET FLOW							
COVER TYPE		GRASS (BERMUDA)	GRASS (BERMUDA)		GRASS (BERMUDA)		ASPHALT
MANNINGS ROUGHNESS COEFFICIENT	n	0.41	0.41		0.41		0.011
FLOW LENGTH (FT)	L	300.00	300.00		255.98		44.02
TWO-YEAR, 24 HR RAINFALL (IN)	P2	4.39	4.39		4.39		4.39
START ELEVATION	ft	332.39	326.47		338.28		331.06
END ELEVATION	ft	331.04	317.74		331.06		330.30
LAND SLOPE (FT/FT)	s	0.005	0.029		0.028		0.017
TRAVEL TIME (MIN)	Tt	81.73	38.76		34.57		0.57
SHALLOW CONCENTRATED FLOW							
FLOW LENGTH (FT)	L	608.02	409.76	74.36	149.03	630.17	136.57
START ELEVATION	ft	331.04	317.74	303.00	330.30	326.63	326.63
END ELEVATION	ft	326.22	303.00	301.56	326.63	304.17	303.31
WATERCOURSE SLOPE (FT/FT)	s	0.0079	0.0360	0.0193	0.0247	0.0356	0.1707
PAVED OR UNPAVED		PAVED	UNPAVED	PAVED	PAVED	UNPAVED	PAVED
AVERAGE VELOCITY (FT/S)	V	1.81	3.06	2.83	3.19	3.05	8.40
TRAVEL TIME (MIN)	Tt	5.60	2.23	0.44	0.78	3.45	0.27
CHANNEL FLOW							
CROSS SECTIONAL AREA (SF)	a	4.91					
WETTED PERIMETER (FT)	pw	7.85					
HYDRAULIC RADIUS (FT)	r	0.63					
START ELEVATION	ft	316.49					
END ELEVATION	ft	295.97					
HYDRAULIC GRADELINE SLOPE (FT/FT)	s	0.0387					
COVER TYPE		RCP					
MANNINGS ROUGHNESS COEFFICIENT	n	0.0130					
AVERAGE VELOCITY (FT/S)	V	16.49					
FLOW LENGTH (FT)	L	530.00					
TRAVEL TIME (MIN)	Tt	0.54					
RESULTS							
TIME OF CONCENTRATION (HR)	Tc	1.464	0.683		0.603		
TIME OF CONCENTRATION (MIN)	Tc	87.87	41.00		36.19		

Drainage Area	Tc (min)	Rainfall Intensity-Duration-Frequency (inches/hr)				
		2 Year	10 Year	25 Year	50 Year	100 Year
A	87.87	1.54	2.24	2.69	3.03	3.40
C	41.00	2.56	3.64	4.30	4.80	5.32
D	36.19	2.79	3.91	4.62	5.14	5.69

Drainage Area	C	A (ac.)	Q-10 Year (cfs)	Q-25 Year (cfs)	Q-100 Year (cfs)
A	0.80	4.17	7.47	8.97	11.34
C	0.30	2.23	2.44	2.88	3.56
D	0.43	23.48	39.48	46.65	57.45

LEGEND
DRAINAGE AREA BOUNDARY
DRAINAGE AREA LABEL AND FLOW DIRECTION
PROPERTY LINE
EXISTING CONTOURS
PROPOSED CONTOURS
FLOW PATH

C6.0 PRE DRAINAGE MAP

SCALE: 1"=80'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979-694-1791
WWW.BRWARCH.COM

STATE OF TEXAS
PEDRO RICO, JR.
133608
LICENSED PROFESSIONAL ENGINEER
10/24/24

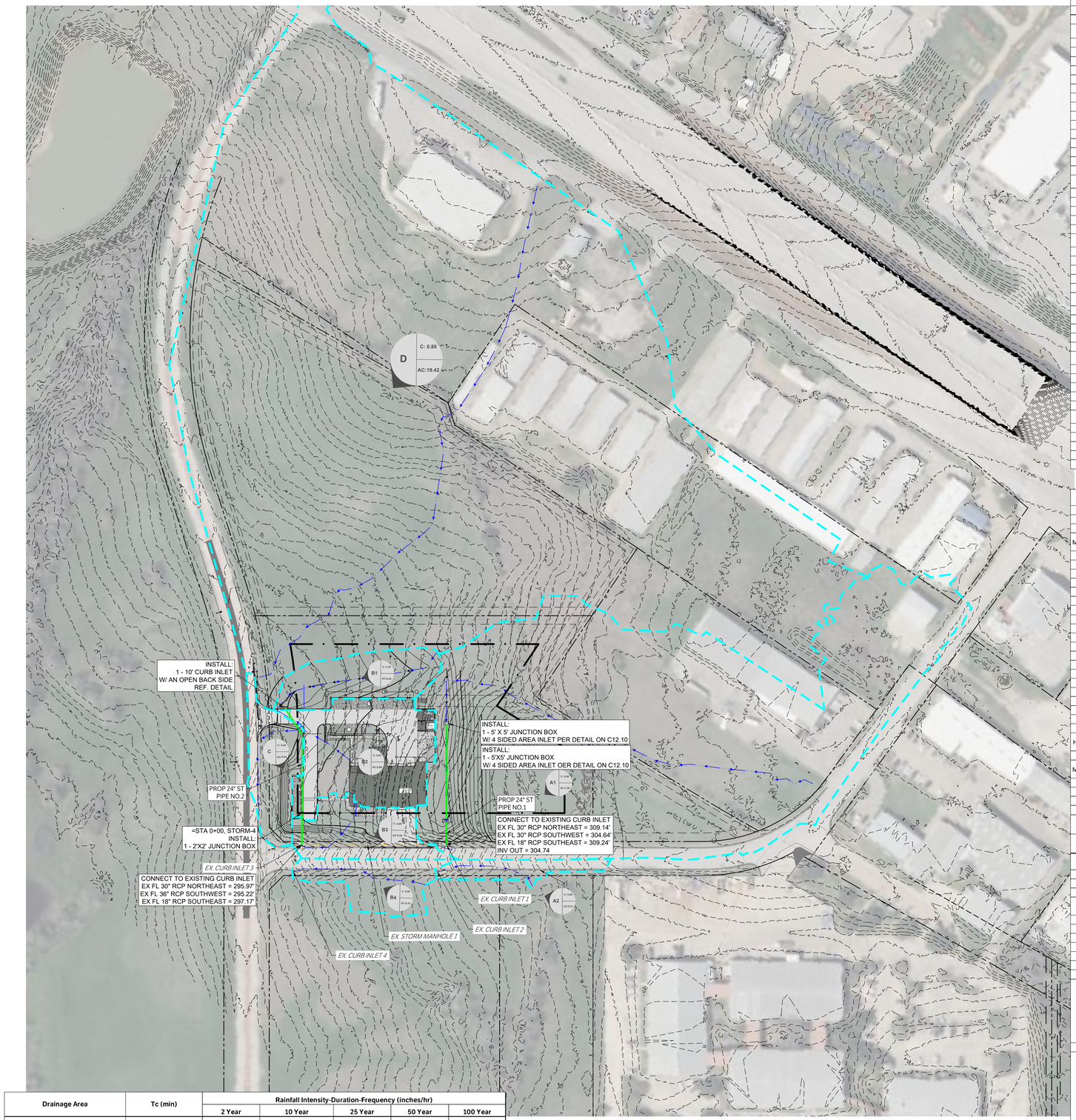
CORPORATE OFFICE
401 W 26TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910
GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C6.0
CIVIL
PRE DRAINAGE MAP



Drainage Area	Tc (min)	Rainfall Intensity-Duration-Frequency (inches/hr)				
		2 Year	10 Year	25 Year	50 Year	100 Year
A1	26.49	3.30	4.64	5.46	6.07	6.69
A2	10.00	5.13	7.14	8.35	9.24	10.13
B1	39.56	2.61	3.71	4.39	4.89	5.43
B2	10.36	5.13	7.14	8.35	9.24	10.13
B3	10.00	5.13	7.14	8.35	9.24	10.13
B4	10.00	5.13	7.14	8.35	9.24	10.13
C	12.59	4.70	6.55	7.67	8.49	9.31
D	39.51	2.61	3.72	4.39	4.90	5.43

Drainage Area	C	A (ac.)	Q-10 Year (cfs)	Q-25 Year (cfs)	Q-100 Year (cfs)
A1	0.80	7.36	27.32	32.15	39.39
A2	0.80	0.21	1.20	1.40	1.70
B1	0.30	0.50	0.56	0.66	0.81
B2	0.83	0.99	5.87	6.86	8.32
B3	0.60	0.55	2.36	2.76	3.34
B4	0.80	0.41	2.34	2.74	3.32
C	0.48	0.44	1.38	1.62	1.97
D	0.80	19.42	57.79	68.20	84.36

C6.1 POST DRAINAGE MAP

SCALE: 1"=80'

Post

Brenham Community Development Corporation Business Center Drainage Study has C of 0.80 for Future Development

A1

COVER TYPE	Surface Description		
Grass Cover	Grass Cover		
Impervious Cover	Building, Pavment		
Total Area (sq. ft)	**320658.94**	**Total Area (ac.)**	**7.36**
Weighted C	**0.8 (AFTER FUTURE DEVELOPMENT)**		

A2

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	3610.77
Impervious Cover	Building, Pavment	0.95	5403.64
Total Area (sq. ft)	**9014.41**	**Total Area (ac.)**	**0.21**
Weighted C	**0.8 (AFTER FUTURE DEVELOPMENT)**		

B1

COVER TYPE	Surface Description	C	
Grass Cover	Grass Cover	0.30	
Total Area (sq. ft)	**21782.79**	**Total Area (ac.)**	**0.50**
Weighted C	**0.30**		

B2

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	8184.05
Impervious Cover	Building, Pavment	0.95	34745.92
Total Area (sq. ft)	**42929.97**	**Total Area (ac.)**	**0.99**
Weighted C	**0.83**		

B3

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	12949.76
Impervious Cover	Pavment	0.95	11109.71
Total Area (sq. ft)	**24059.47**	**Total Area (ac.)**	**0.55**
Weighted C	**0.60**		

B4

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	12784.41
Impervious Cover	Pavment	0.95	4984.98
Total Area (sq. ft)	**17769.39**	**Total Area (ac.)**	**0.41**
Weighted C	**0.8 (AFTER FUTURE DEVELOPMENT)**		

C

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	13892.44
Impervious Cover	Pavment	0.95	5454.00
Total Area (sq. ft)	**19346.44**	**Total Area (ac.)**	**0.44**
Weighted C	**0.48**		

D

COVER TYPE	Surface Description	C	AREA (SF)
Grass Cover	Grass Cover	0.30	840383.92
Impervious Cover	Building, Pavment	0.95	5403.64
Total Area (sq. ft)	**845787.56**	**Total Area (ac.)**	**19.42**
Weighted C	**0.8 (AFTER FUTURE DEVELOPMENT)**		

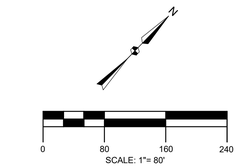
POST DEVELOPED TIME OF CONCENTRATION

Brenham FS No.2 (**After Future Development**)		A1		A2		B1	B2	
SHEET FLOW								
COVER TYPE		GRASS (BERMUDA)	ASPHALT	GRASS (BERMUDA)	ASPHALT	GRASS (BERMUDA)	GRASS (BERMUDA)	ASPHALT
MANNINGS ROUGHNESS COEFFICIENT	n	0.41	0.011	0.41	0.011	0.41	0.41	0.011
FLOW LENGTH (FT)	L	50.00	250.00	49.15	132.84	300.00	68.54	116.39
TWO-YEAR, 24 HR RAINFALL (IN)	P2	4.39	4.39	4.39	4.39	4.39	4.39	4.39
START ELEVATION	ft	331.52	331.30	322.45	320.69	313.72	312.33	308.68
END ELEVATION	ft	331.30	328.86	320.69	314.24	305.42	308.68	305.38
LAND SLOPE (FT/FT)	s	0.0045	0.0098	0.0358	0.0485	0.0277	0.0532	0.0284
TRAVEL TIME (MIN)	Tt	19.50	2.87	8.39	0.91	39.56	9.35	1.02
SHALLOW CONCENTRATED FLOW								
FLOW LENGTH (FT)	L	658.23						
START ELEVATION	ft	328.86						
END ELEVATION	ft	310.23						
WATERCOURSE SLOPE (FT/FT)	s	0.0283						
PAVED OR UNPAVED		UNPAVED						
AVERAGE VELOCITY (FT/S)	V	2.71						
TRAVEL TIME (MIN)	Tt	4.04						
CHANNEL FLOW								
CROSS SECTIONAL AREA (SF)	a	3.14						
WETTED PERIMETER (FT)	pw	6.28						
HYDRAULIC RADIUS (FT)	r	0.50						
START ELEVATION	ft	304.50						
END ELEVATION	ft	303.86						
HYDRAULIC GRADELINE SLOPE (FT/FT)	s	0.0150						
COVER TYPE		HDPE						
MANNINGS ROUGHNESS COEFFICIENT	n	0.0120						
AVERAGE VELOCITY (FT/S)	V	9.58						
FLOW LENGTH (FT)	L	42.65						
TRAVEL TIME (MIN)	Tt	0.07						
RESULTS								
TIME OF CONCENTRATION (HR)	Tc	0.441		0.155		0.659	0.173	
TIME OF CONCENTRATION (MIN)	Tc	26.49		10.00 (MIN TOC)		39.56	10.36	

POST DEVELOPED TIME OF CONCENTRATION

B3			B4	C		D	
SHEET FLOW							
CONCRETE	GRASS (BERMUDA)	ASPHALT	CONCRETE	GRASS (BERMUDA)	ASPHALT	GRASS (BERMUDA)	ASPHALT
0.011	0.41	0.011	0.011	0.41	0.011	0.41	0.011
22.27	74.51	46.85	240.29	84.69	123.08	255.98	44.02
4.39	4.39	4.39	4.39	4.39	4.39	4.39	4.39
312.30	312.01	304.03	314.74	307.50	303.00	338.28	331.06
312.01	304.03	302.12	302.12	303.00	301.56	331.06	330.30
0.0128	0.1072	0.0407	0.0525	0.0531	0.0117	0.0282	0.0173
0.37	7.55	0.42	1.42	11.08	1.51	34.57	0.57
SHALLOW CONCENTRATED FLOW							
						915.77	
						330.30	
						303.31	
						0.0295	
						PAVED	
						3.49	
						4.37	
CHANNEL FLOW							
RESULTS							
0.139			0.024	0.210		0.659	
10.00 (MIN TOC)			10.00 (MIN TOC)	12.59		39.51	

Storm Inlet	Pipe Diameter (in.)	Pipe Area (sq. ft)	Flow Description	Q-10 Year (cfs)	Q-25 Year (cfs)	Q-100 Year (cfs)
Ex. Curb Inlet 1	30.00	4.91	A1+A2	28.52	33.55	41.09
Ex. Curb Inlet 2	18.00	1.77	A2	1.20	1.40	1.70
Ex. Curb Inlet 3	36.00	7.07	A1+A2+B1+B2+B3+B4	98.82	116.39	143.22
Ex. Curb Inlet 4	18.00	1.77	B4	57.79	68.20	84.36



BENCHMARK 1 ⌖BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

BENCHMARK 2 ⌖BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

LEGEND

- DRAINAGE AREA BOUNDARY
- A1 C Tc — DRAINAGE AREA LABEL AND FLOW DIRECTION
- PROPERTY LINE
- 340 — EXISTING CONTOURS
- 340 — PROPOSED CONTOURS
- FLOW PATH

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-1777
WWW.BRWARCH.COM

CORPORATE OFFICE
4603 WILEY POST
BRYAN, TEXAS 77803
(979) 680-3840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C6.1
CIVIL
POST DRAINAGE MAP

Inlet Design for 5'x5' Junction Box			
Target Drainage Area			A1
Drainage Area NOTFlowing to Inlet (sq.ft)			110551.33
Drainage Area A1 (sq.ft)			320658.94
Area to Storm Inlet (sq.ft)			210107.61
Area to Storm Inlet(ac)			4.82
Weighted C (after future development)			0.80
Tc (min)			26.49
100Yr Intensity (in/hr)			6.69
Q (100 Year) for Inlet (cfs)			25.81
Inlet Design			Inlet Selection
5'x5' Junction Box No.1			
Allowable Top of Water Elevation	311.30	Selection	5'x5' Junction Box w/ 4 Sided Area Inlet
Inlet Top Elev.	310.386	Area Inlet (no clogging)	3'x0.5' Each Way
Allowable HW	0.914	Opening Area Each Inlet	1.5
Allowable HW Adjust	0.914	Opening Area Total	6
Cd	0.62	HW	0.75
Q100	25.81	WSE@100YR	311.13
Theoritical Inlet Area (NO CLOGGING)	5.43	Allowable Top of Water Elevation	311.30
Theoritical Inlet Area (W/ CLOGGING)	10.85		
5'x5' Junction Box No.2			
Allowable Top of Water Elevation	311.50	Selection	5'x5' Junction Box w/ 4 Sided Area Inlet
Inlet Top Elev.	310.22	Area Inlet (no clogging)	3'x0.5' Each Way
Allowable HW	1.28	Opening Area Each Inlet	1.5
Allowable HW Adjust	1.28	Opening Area Total	6
Cd	0.62	HW	0.75
Q100	25.81	WSE@100YR	310.97
Theoritical Inlet Area (NO CLOGGING)	4.59	Allowable Top of Water Elevation	311.50
Theoritical Inlet Area (W/ CLOGGING)	9.17		

Inlet Design for 10' Curb Inlet w/ An Open Back Side			
Target Drainage Area	B1	Target Drainage Area	B2
Drainage Area B1 (sq.ft)	21782.79	Drainage Area B2 (sq.ft)	42929.97
Area to Storm Inlet (sq.ft)	21782.79	Area to Storm Inlet (sq.ft)	42929.97
Area to Storm Inlet(ac)	0.50	Area to Storm Inlet(ac)	0.99
Weighted C	0.30	Weighted C	0.83
Tc (min)	39.56	Tc (min)	10.36
100Yr Intensity (in/hr)	5.43	100Yr Intensity (in/hr)	10.13
Q (100 Year) for Inlet Acceptance (cfs)	0.81	Q (100 Year) for Inlet Acceptance (cfs)	8.32
Total Q(100 Year) for Inlet Acceptance (B1+B2) (cfs)		9.13	
Inlet Design		Inlet Selection	
Curb Inlet Side for Drainage Area B1			
Allowable Top of Water Elevation	305.50	Selection	10' Curb Inlet
Flow Line Elevation	305.24	Area Inlet (no clogging)	10'x0.5' Each Way
Allowable HW	0.26	Opening Area Each Inlet	5
Allowable HW Adjust	0.26	Opening Area for B2	5
Cd	0.62	HW	0.001
Q100	0.81	WSE@100YR	305.24
Theoritical Inlet Area (NO CLOGGING)	0.32	Allowable Top of Water Elevation	305.50
Theoritical Inlet Area (W/ CLOGGING)	0.64		
Curb Inlet Side for Drainage Area B2			
Allowable Top of Water Elevation/Curb Elevation	305.84	Selection	10' Curb Inlet
Flow Line Elevation	305.34	Area Inlet (no clogging)	10'x0.5' Each Way
Allowable HW	0.5	Opening Area Each Inlet	5
Allowable HW Adjust	0.5	Opening Area for B2	5
Cd	0.62	HW	0.11
Q100	8.32	WSE@100YR	305.45
Theoritical Inlet Area (NO CLOGGING)	2.36	Allowable Top of Water Elevation	305.84
Theoritical Inlet Area (W/ CLOGGING)	4.73		

Pipe Design for 10 Yr Storm	
Pipe ID	PROP. No. 1
Target Drainage Area	A1
Drainage Area A1 (sq.ft)	320658.94
Area Not Carried by Pipe (sq. ft)	110551.33
Area Carried by Pipe (sq.ft)	210107.61
Area Carried by Pipe (ac)	4.82
Weighted C	0.80
Tc (min)	26.49
10Yr Intensity (in/hr)	4.64
Q(10 Year) for Pipe (cfs)	17.90
Pipe Diamter (in)	24.00
Pipe Area (sq. ft)	3.14
Pipe Slope (ft/ft)	0.01
Manning's Coefficient	0.011
24" Pipe Capacity (cfs)	26.81
Pipe Velocity (fps)	8.53

Pipe Design for 10 Yr Storm	
Pipe ID	PROP. No. 2
Target Drainage Area	B1+B2
Q(B1+B2) 10 Year (cfs)	6.42
Pipe Diamter (in)	24.00
Pipe Area (sq. ft)	3.14
Pipe Slope (ft/ft)	0.015
Manning's Coefficient	0.011
24" Pipe Capacity (cfs)	32.39
Pipe Velocity (fps)	2.04

	Rim Elevation (ft.)
Ex. Curb Inlet 1	314.09
Ex. Curb Inlet 2	314.24
Ex. Storm Manhole 1	307.78
Ex. Curb Inlet 3	302.12
Ex. Curb Inlet 4	302.12

Storm Inlet	Pipe Diameter (in.)	Pipe Area (sq. ft)	Flow Description	Q-10 Year (cfs)	Q-25 Year (cfs)	Q-100 Year (cfs)
Ex. Curb Inlet 1	30.00	4.91	A1+A2	28.52	33.55	41.09
Ex. Curb Inlet 2	18.00	1.77	A2	1.20	1.40	1.70
Ex. Curb Inlet 3	36.00	7.07	A1+A2+B1+B2+B3+B4	98.82	116.39	143.22
Ex. Curb Inlet 4	18.00	1.77	B4	57.79	68.20	84.36

HGL Calculation for 100 Year Storm													
From	To	Inlet/Manhole	HGL (ft.)	Pipe Flow Description	Pipe Flow-100 year (cfs)	Pipe Diameter (in.)	Cross Section Area (sq.ft)	Manning's Coefficenct (n)	Velocity (fps)	Velocity Head (ft)	Friction Loss (ft)	Pipe Length (ft)	Minor Loss Coefficient	Minor Loss (ft)
		Ex. Curb Inlet 2	305.05											
Ex. Curb Inlet 2	Ex. Curb Inlet 1			A2	1.70	18	1.77	0.013	0.96	0.01	0.01	42.53	0.5	0.01
		Ex. Curb Inlet 1	305.05											
Ex. Curb Inlet 1	Ex. Storm Manhole 1			A1+A2	41.09	30	4.91	0.013	8.37	1.09	1.19	118.78	0.5	0.54
		Ex. Storm Manhole 1	304.41											
Ex. Storm Manhole 1	Ex. Curb Inlet 3			A1+A2+B1+B2+B3	53.56	30	4.91	0.013	10.91	1.85	2.21	130.46	0.5	0.92
		Ex. Curb Inlet 3	303.12											

HGL Calculation for 100 Year Storm													
From	To	Inlet/Manhole	HGL (ft.)	Pipe Flow Description	Pipe Flow-100 year (cfs)	Pipe Diameter (in.)	Cross Section Area (sq.ft)	Manning's Coefficenct (n)	Velocity (fps)	Velocity Head (ft)	Friction Loss (ft)	Pipe Length (ft)	Minor Loss Coefficient	Minor Loss (ft)
		Ex. Curb Inlet 4	303.14											
Ex. Curb Inlet 4	Ex. Curb Inlet 3			B4	3.32	18	1.77	0.013	1.88	0.05	0.04	42.94	0.5	0.03
		Ex. Curb Inlet 3	303.12											

HGL Calculation for 100 Year Storm													
From	To	Inlet/Manhole	HGL (ft.)	Pipe Flow Descirption	Pipe Flow-100 year (cfs)	Pipe Diameter (in.)	Cross Section Area (sq.ft)	Manning's Coefficenct (n)	Velocity (fps)	Velocity Head (ft)	Firction Loss (ft)	Pipe Length (ft)	Minor Loss Coefficient	Minor Loss (ft)
		Prop. 5'x5' Junction Box - 1	305.99											
Prop. 5'x5' Junction Box - 1	Prop. 5'x5' Junction Box - 2			A1 after Exclusion	25.81	24	3.14	0.011	8.22	1.05	1.59	171.7	0.5	0.52
		Prop. 5'x5' Junction Box - 2	304.92											
Prop. 5'x5' Junction Box - 2	Ex. Cubr Inlet 1			A1 after Exclusion	25.81	24	3.14	0.011	8.22	1.05	0.39	42.6	0.5	0.52
		Ex. Curb Inlet 1	305.05											

HGL Calculation for 100 Year Storm													
From	To	Inlet/Manhole	HGL (ft.)	Pipe Flow Descirption	Pipe Flow-100 year (cfs)	Pipe Diameter (in.)	Cross Section Area (sq.ft)	Manning's Coefficenct (n)	Velocity (fps)	Velocity Head (ft)	Firction Loss (ft)	Pipe Length (ft)	Minor Loss Coefficient	Minor Loss (ft)
		Prop. 10' Curb Inlet w/ Open Back Side	303.22											
Prop. 10' Curb Inlet w/ Open Back Side	Prop. 5' Curb Inlet w/ 5' Extension			B1	0.81	24	3.14	0.011	0.26	0.001	0.001	57.3	0.5	0.001
		Prop. 5' Curb Inlet w/ 5' Extension	303.22											
Prop. 5' Curb Inlet w/ 5' Extension	Prop. 2'x2' Junction Box			B1+B2	9.13	24	3.14	0.011	2.91	0.13	0.16	139	0.5	0.07
		Prop. 2'x2' Junction Box	303.12											
Prop. 2'x2' Junction Box	Ex. Curb Inlet 3			B1+B2	9.13	24	3.14	0.011	2.91	0.13	0.07	56.2	0.5	0.07
		Ex. Curb Inlet 3	303.12											

C6.2 DRAINAGE CALCULATIONS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7477
WWW.BRWARCH.COM

CORPORATE OFFICE
4041 WHITE STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

PEDRO RIOS, JR. 133608 — 10/24/24

GESSNER ENGINEERING

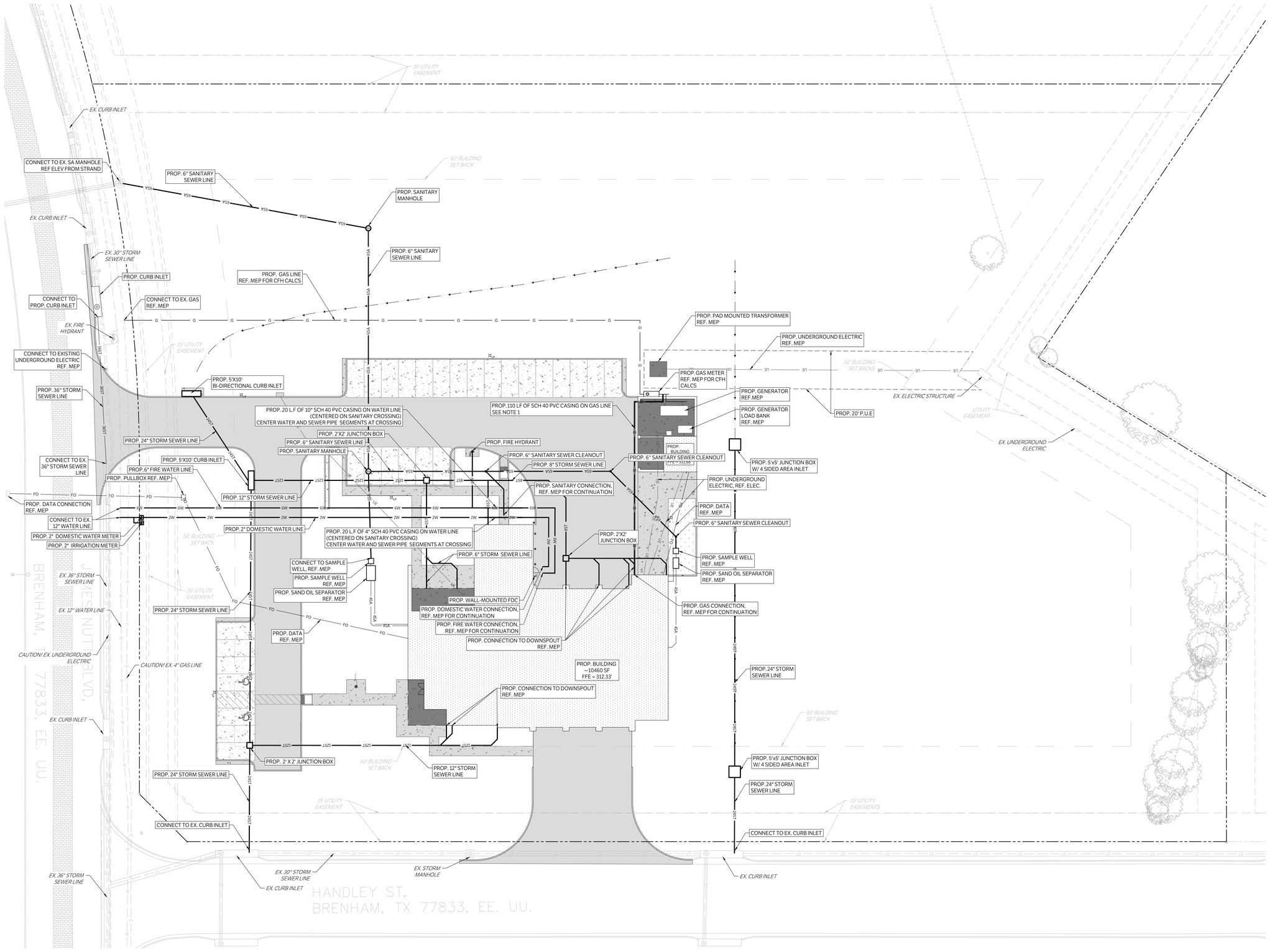
DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

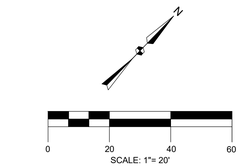
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C6.2
CIVIL
DRAINAGE CALCULATIONS

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.





BENCHMARK 1 ⌖BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ⌖BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

NOTE 1:
ALL NATURAL GAS LINES LOCATED UNDER PAVEMENT MUST BE SLEEVED IN SCHEDULE 40 PIPE. SLEEVE MUST HAVE MINIMUM LONG-SWEEP 90 DEGREE TURNS AT DIRECTIONCHANGES. SLEEVES MUST BE TWO PIPE SIZES LARGER THAN THE GAS LINE

NOTE 2:
ALL UNDERGROUND GAS LINES AND GROUND WATER LINES MUST HAVE A MINIMUM 12 GAUGE COPPER TRACER WIRE INSTALLED PARALLEL TO THE BURIED GAS LINE OR BURIED WATER LINE

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- 340 EXISTING CONTOURS
- 340 PROPOSED CONTOURS
- ST EX. | PROP. STORM LINE
- W EX. | PROP. WATER LINE
- SA EX. | PROP. SANITARY SEWER LINE
- CWR, CWS, HWS, HWS EXISTING THERMALS
- CWR, CWS, HWS, HWS PROPOSED THERMALS
- G EX. | PROP. GAS LINE
- T EX. | PROP. DATA/TELECOM
- UE EX. | PROP. UNDERGROUND ELECTRIC
- FO EX. | PROP. FIBER OPTIC
- OE EX. | PROP. OVERHEAD ELECTRIC
- FIH EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- INV PROP. POST INDICATOR VALVE
- HOSE LAY PROP. HOSE LAY
- SA EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- ST PROP. STORM SEWER CURB INLET
- LP EX. | PROP. LIGHT POLE
- PAE PROPOSED PUBLIC ACCESS EASEMENT
- PUE PROPOSED UTILITY EASEMENT

C7.0 OVERALL UTILITY

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1770
WWW.BRWARCH.COM

CORPORATE OFFICE
401 E. 18TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

REGISTERED PROFESSIONAL ENGINEER
PEDRO RIOS, JR.
133608
10/24/24

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

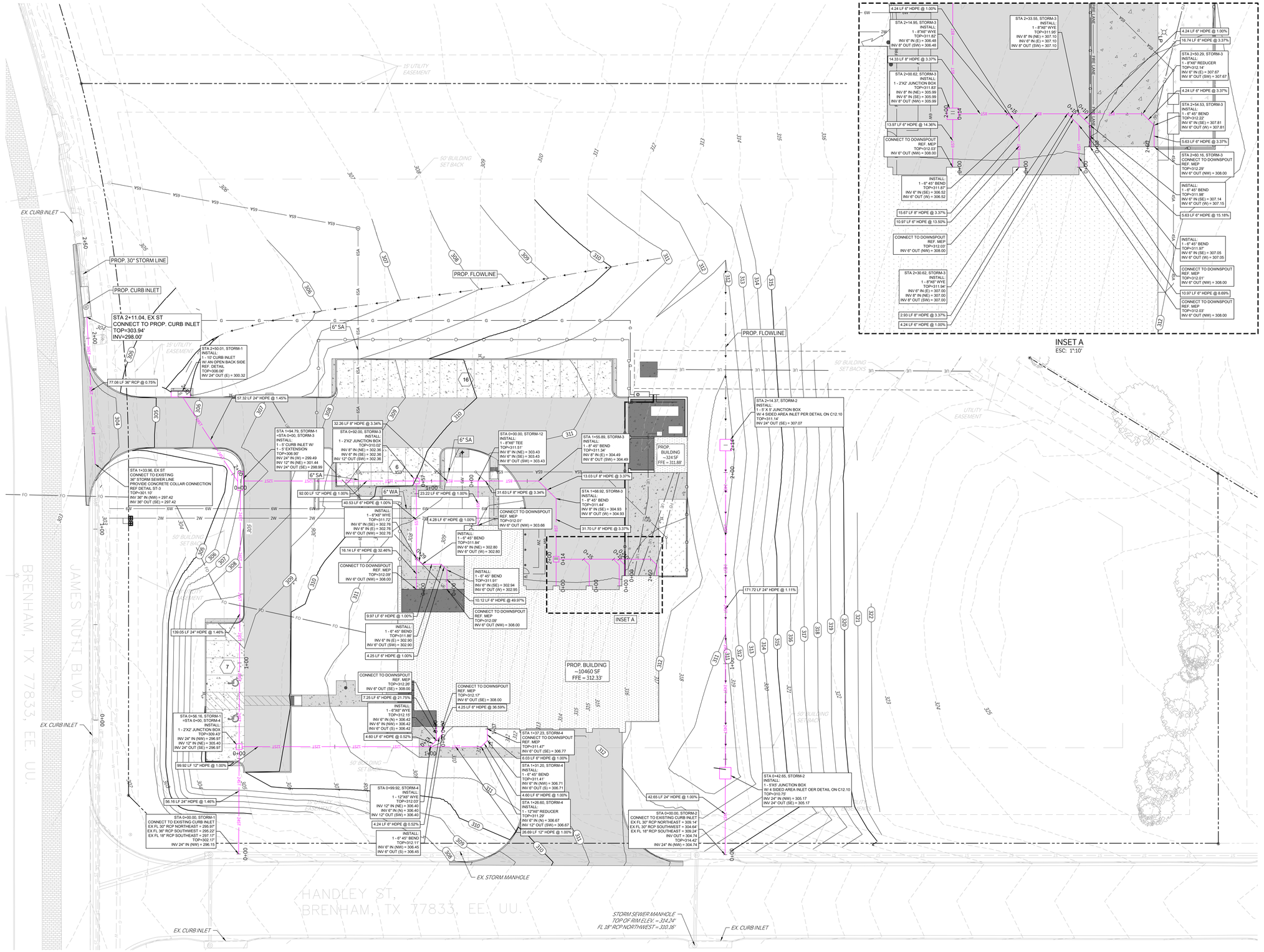
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

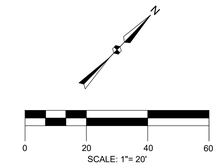
NO.	REVISION	DATE

C7.0
CIVIL
OVERALL UTILITY

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

INSET A
ESC: 1":10'





BENCHMARK 1 ✪BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

BENCHMARK 2 ✪BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. | PROP. STORM LINE
- EX. | PROP. WATER LINE
- EX. | PROP. SANITARY SEWER LINE
- EXISTING THERMALS
- PROPOSED THERMALS
- EX. | PROP. GAS LINE
- EX. | PROP. DATA/TELECOM
- EX. | PROP. UNDERGROUND ELECTRIC
- EX. | PROP. FIBER OPTIC
- EX. | PROP. OVERHEAD ELECTRIC
- EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- PROP. POST INDICATOR VALVE
- PROP. HOSE LAY
- EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- PROP. STORM SEWER CURB INLET
- EX. | PROP. LIGHT POLE
- PAE PROPOSED PUBLIC ACCESS EASEMENT
- PUE PROPOSED UTILITY EASEMENT

C8.0 **STORM PLAN**
SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-4747
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4041 MAYS STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

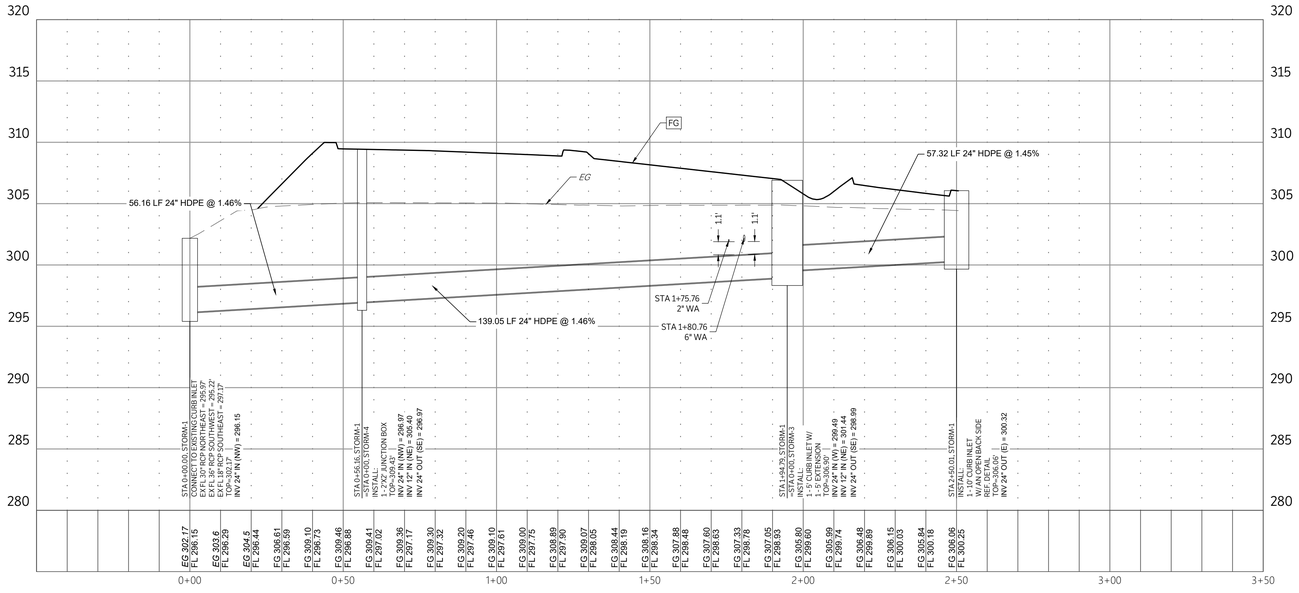
GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

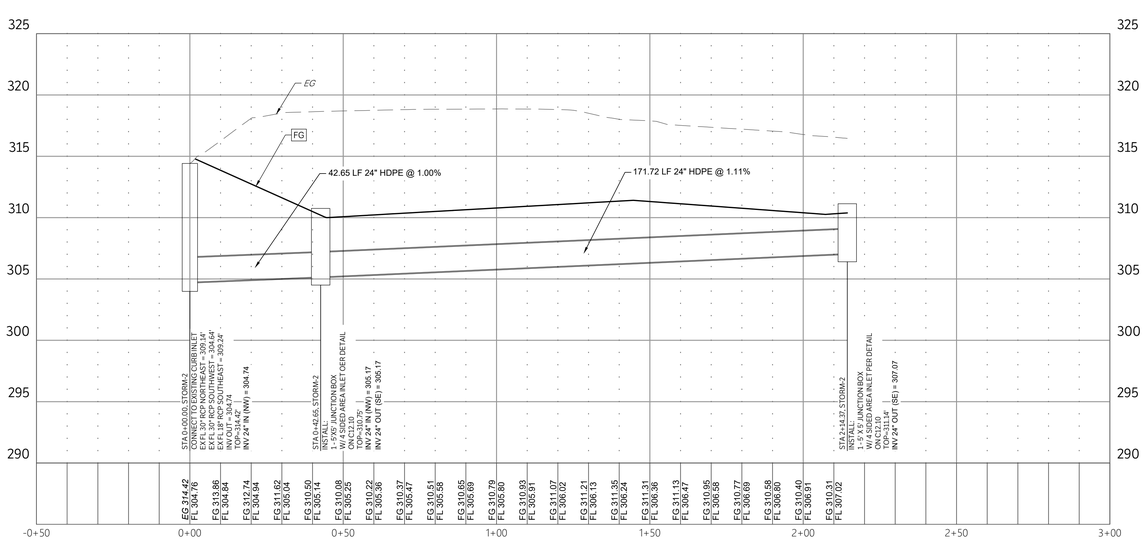
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C8.0
CIVIL
STORM PLAN



STORM-1
SCALE: 1"=20' H, 1"=5' V



STORM-2
SCALE: 1"=20' H, 1"=5' V

C8.1 STORM PROFILES

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1779
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
401 W. 15TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

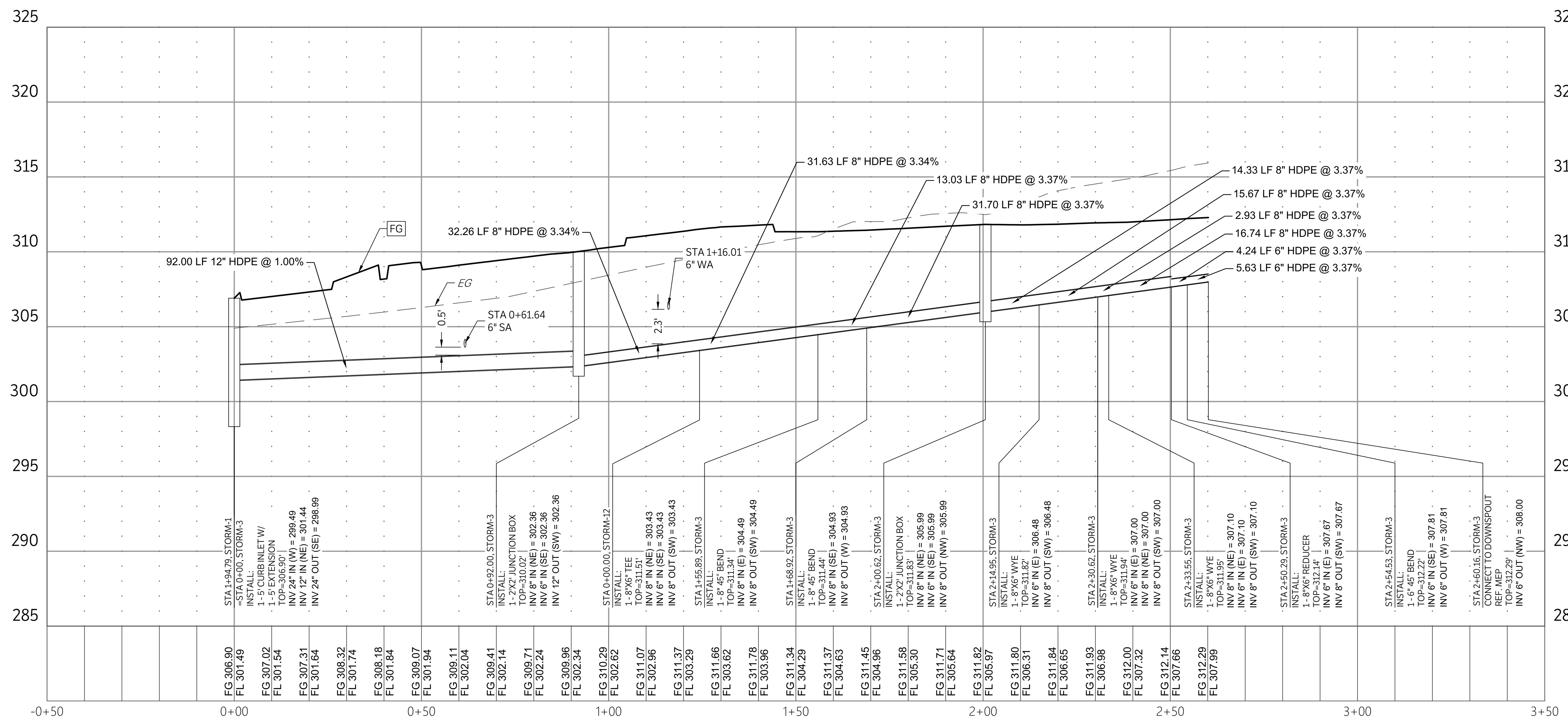
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

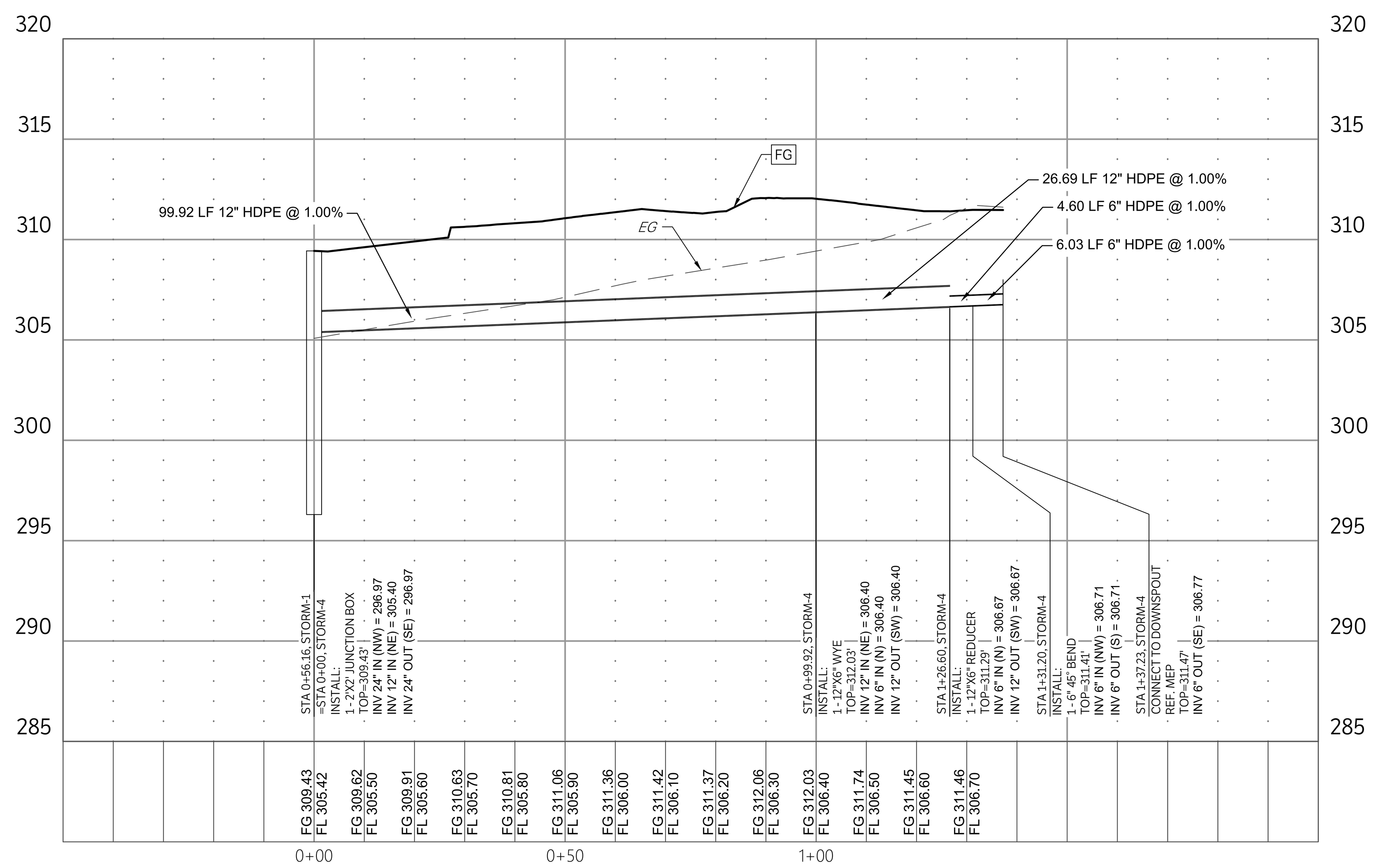
C8.1

CIVIL

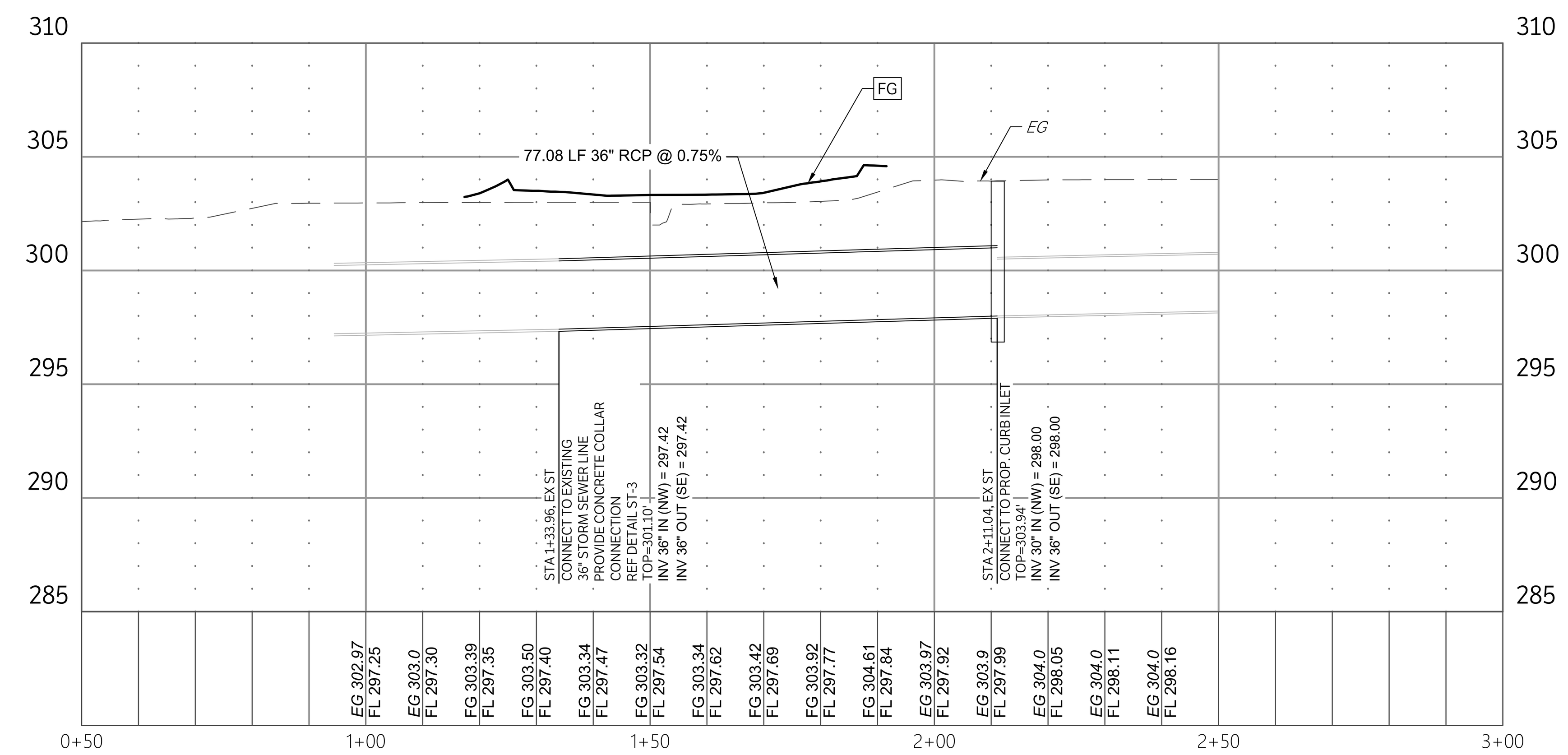
STORM PROFILES



STORM-3
SCALE: 1"=20' H, 1"=5' V



STORM-4
SCALE: 1"=20' H, 1"=5' V



EX ST
SCALE: 1"=20' H, 1"=5' V

C8.2 STORM PROFILES

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979-694-1791
WWW.BRWARCH.COM

BRW

PEDRO RICO, JR.
133608
10/24/24

CORPORATE OFFICE
401 W 26TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

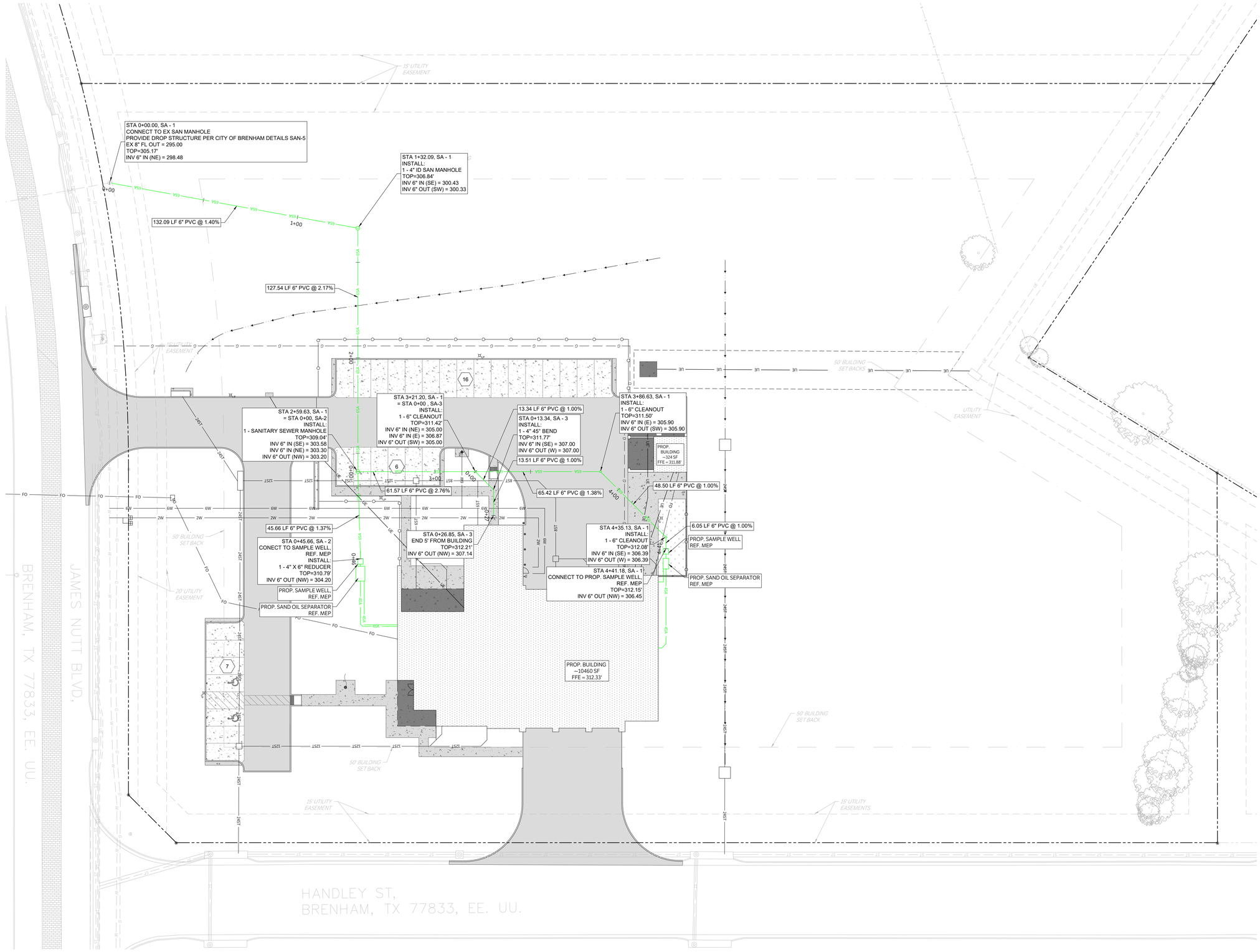
DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

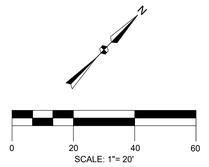
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C8.2
CIVIL
STORM PROFILES

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.





BENCHMARK 1 ✪BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ✪BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. | PROP. STORM LINE
- EX. | PROP. WATER LINE
- EX. | PROP. SANITARY SEWER LINE
- EXISTING THERMALS
- PROPOSED THERMALS
- EX. | PROP. GAS LINE
- EX. | PROP. DATA/TELECOM
- EX. | PROP. UNDERGROUND ELECTRIC
- EX. | PROP. FIBER OPTIC
- EX. | PROP. OVERHEAD ELECTRIC
- EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- PROP. POST INDICATOR VALVE
- PROP. HOSE LAY
- EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- PROP. STORM SEWER CURB INLET
- EX. | PROP. LIGHT POLE
- PAE — PROPOSED PUBLIC ACCESS EASEMENT
- PUE — PROPOSED UTILITY EASEMENT

C9.0 SANITARY SEWER PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-7575
WWW.BRWARCH.COM

BRW

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
401 WEST 15TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

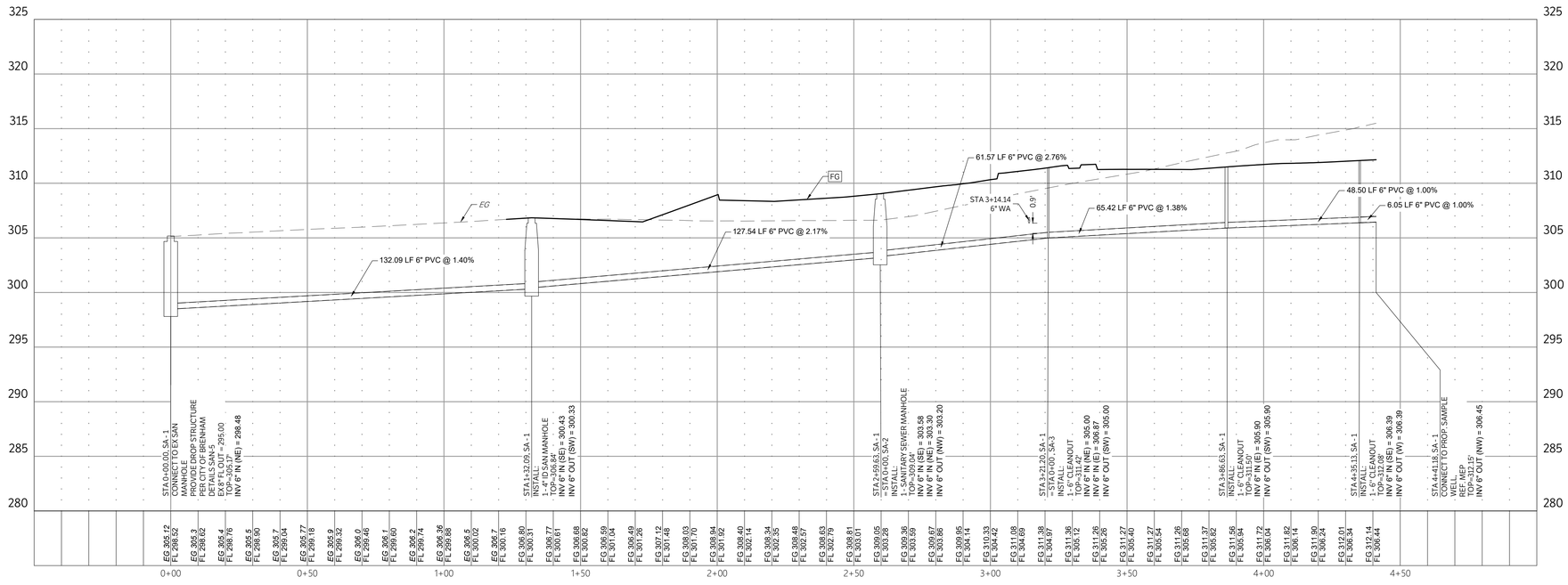
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

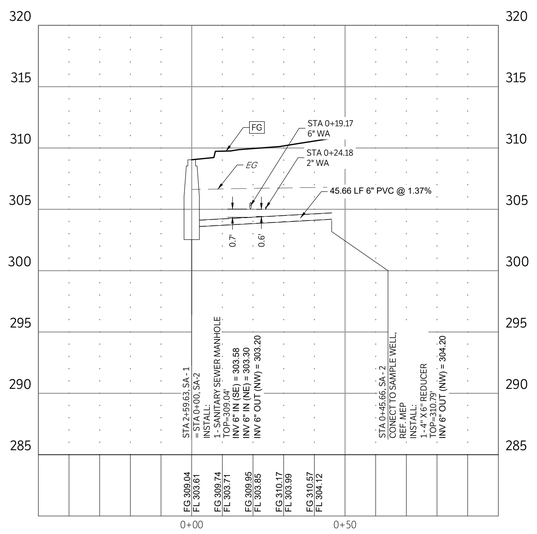
C9.0

CIVIL

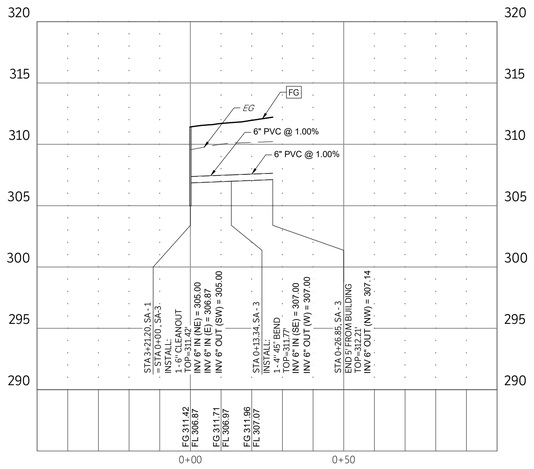
SANITARY SEWER PLAN



SA - 1
SCALE: 1"=20' H, 1"=5' V



SA - 2
SCALE: 1"=20' H, 1"=5' V



SA - 3
SCALE: 1"=20' H, 1"=5' V

C9.1 SANITARY SEWER PROFILES

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-7777
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
401 E. 15TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C9.1

CIVIL

SANITARY SEWER PROFILES

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.

0 20 40 60
SCALE: 1"= 20'

BENCHMARK 1 ✪BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

BENCHMARK 2 ✪BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON NORTH EDGE OF MANHOLE

STA 0+00.00, WA - 2
CONNECT TO EX. WATER LINE
INSTALL:
1 - 12" X 6" TAPPING SLEEVE & VALVE
7.06 LF 2" SDR9 POLYETHYLENE
20.11 LF 6" C900 DR18

STA 0+00.00, WA - 1
CONNECT TO EX. WATER LINE
INSTALL:
1 - 2" SERVICE SADDLE

STA 0+07.06, WA - 1
INSTALL:
1 - 2" TEE

STA 0+07.06, WA - 1
INSTALL:
2 - 2" 45° BENDS

STA 0+11.02, WA - 1
INSTALL:
1 - 2" WATER METER

STA 0+11.06, WA - 1
INSTALL:
1 - 2" IRRIGATION METER AND BACKFLOW PREVENTER REF IRRIGATION PLANS FOR CONTINUATION
4.00 LF 2" SDR9 POLYETHYLENE
2.82 LF 2" SDR9 POLYETHYLENE

43.09 LF 6" C900 DR18

STA 0+63.20, WA - 2
INSTALL:
1 - 6" 45'' VERTICAL BEND

3.00 LF 6" C900 DR18

STA 0+66.21, WA - 2
INSTALL:
1 - 6" 45° VERTICAL BEND

STA 0+66.14, WA - 1
INSTALL:
1 - 2" 45'' VERTICAL BEND

3.00 LF 2" SDR 9

STA 0+63.14, WA - 1
INSTALL:
1 - 2" 45'' VERTICAL BEND

STA 1+23.58, WA - 2
INSTALL:
1 - 6" 45'' VERTICAL BEND

2.49 LF 6" C900 DR18

STA 1+26.06, WA - 2
INSTALL:
1 - 6" 45'' VERTICAL BEND

59.86 LF 6" C900 DR18

59.91 LF 2" SDR 9

STA 0+29.44, WA - 3
INSTALL:
1 - STD FH ASSEMBLY
1 - 6" GATE VALVE & BOX

29.44 LF 6" C900 DR18

98.60 LF 2" SDR 9

STA 1+84.59, WA - 2
INSTALL:
1 - 6"X6" TEE

43.37 LF 6" C900 DR18

STA 2+27.95, WA - 2
INSTALL:
2 - 6" 45° BENDS

34.22 LF 6" C900 DR18

STA 2+50.46, WA - 1
INSTALL:
2 - 2" 45° BENDS

STA 2+24.64, WA - 1
INSTALL:
2 -2" 45° BENDS

25.82 LF 2" SDR 9

STA 2+53.46, WA - 1
END 5' FROM BUILDING
REF. MEP FOR CONTINUATION

PROP. WALL MOUNTED FDC

3.00 LF 2" SDR 9

STA 2+68.44, WA - 2
END 5' FROM BUILDING
REF. MEP FOR CONTINUATION

STA 2+62.17, WA - 2
INSTALL:
2 - 4" 45° BENDS

6.27 LF 6" C900 DR18

PROP. 20 L.F OF 10" SCH 40 PVC CASING ON WATER LINE (CENTERED ON SANITARY CROSSING)
CENTER WATER AND SEWER PIPE SEGMENTS AT CROSSING

PROP. BUILDING
~324 SF
FFE = 311.88'

PROP. BUILDING
~10460 SF
FFE = 312.33'

EX. WATER VALVE
EX. FIRE HYDRANT
EX. 12" WATER LINE

15' UTILITY EASEMENT
50' BUILDING SET BACK
UTILITY EASEMENT

JAMES NUTT BLVD,
BRENHAM, TX 77833, EE. UU.

HANDLEY ST,
BRENHAM, TX 77833, EE. UU.

NOTE:
ALL UNDERGROUND GAS LINES AND GROUND WATER LINES MUST HAVEA MINIMUM 12 GAUGE COPPER TRACER WIRE INSTALLED PARALLEL TO THE BURIED GAS LINE OR BURIED WATER LINE

LEGEND

- PROPOSED 4" CONCRETE SIDEWALK
- PROPOSED 6" CONCRETE PARKING
- PROPOSED 7" CONCRETE PAVEMENT
- PROPOSED STRUCTURAL CONCRETE
- EXISTING PAVEMENT EDGE
- PROPERTY LINE
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EXISTING CONTOURS
- PROPOSED CONTOURS
- EX. | PROP. STORM LINE
- EX. | PROP. WATER LINE
- EX. | PROP. SANITARY SEWER LINE
- EXISTING THERMALS
- PROPOSED THERMALS
- EX. | PROP. GAS LINE
- EX. | PROP. DATA/TELECOM
- EX. | PROP. UNDERGROUND ELECTRIC
- EX. | PROP. FIBER OPTIC
- EX. | PROP. OVERHEAD ELECTRIC
- EX. | PROP. FIRE HYDRANT
- EX. | PROP. WATER METER
- EX. | PROP. GATE VALVE
- EX. IRRIGATION CONTROL VALVE
- PROP. FIRE DEPARTMENT CONNECTION
- PROP. POST INDICATOR VALVE
- PROP. HOSE LAY
- EX. | PROP. SANITARY SEWER MANHOLE
- EX. | PROP. SANITARY SEWER CLEANOUT
- EX. STORM SEWER MANHOLE
- PROP. STORM SEWER CURB INLET
- EX. | PROP. LIGHT POLE
- PAE PROPOSED PUBLIC ACCESS EASEMENT
- PUE PROPOSED UTILITY EASEMENT

C10.0 WATER PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1770
WWW.BRWARCH.COM

BRW

PEDRO RIOS, JR.
LICENSED
133608
10/24/24

CORPORATE OFFICE
4041 WHITE STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

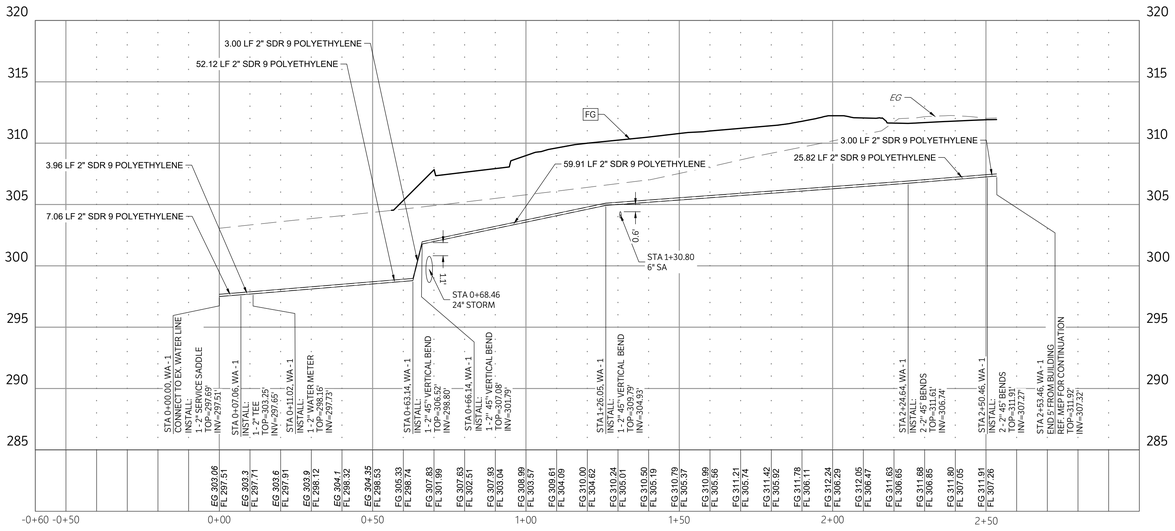
GESSNER ENGINEERING

10/24/2024
DATE
AW
DRAWN BY
PR
CHECKED BY
BRW PROJECT NUMBER
MATCH THE ARCH

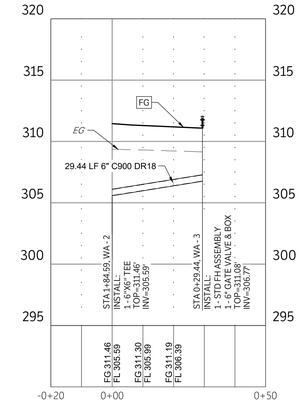
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

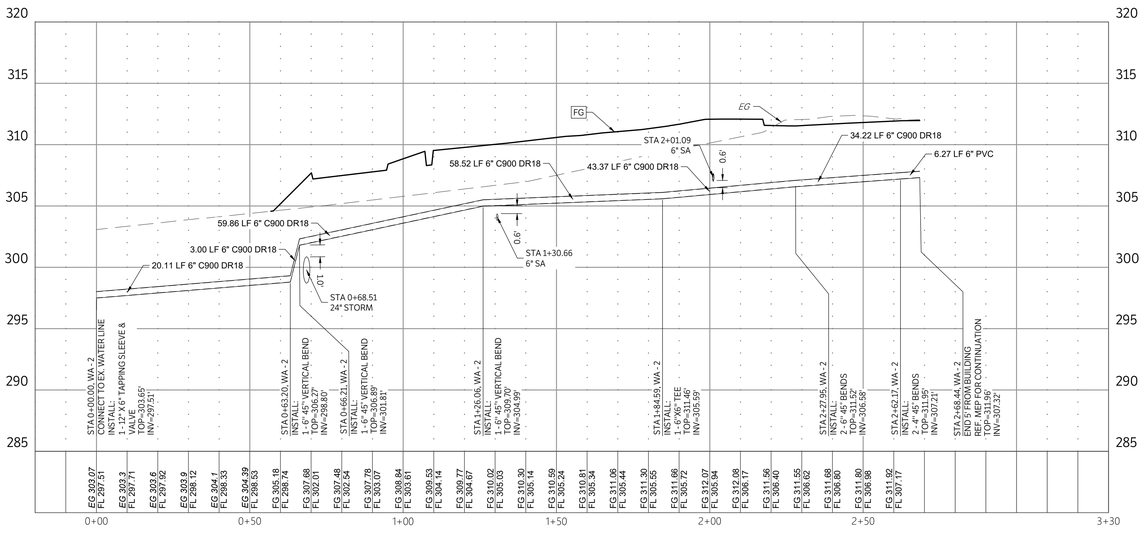
C10.0
CIVIL
WATER PLAN



WA - 1
SCALE: 1"=20' H, 1"=5' V



WA - 3
SCALE: 1"=20' H, 1"=5' V



WA - 2
SCALE: 1"=20' H, 1"=5' V

C10.1 WATER PROFILES

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7779
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4004 TEXAS AVENUE
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

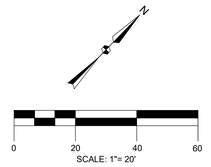
DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

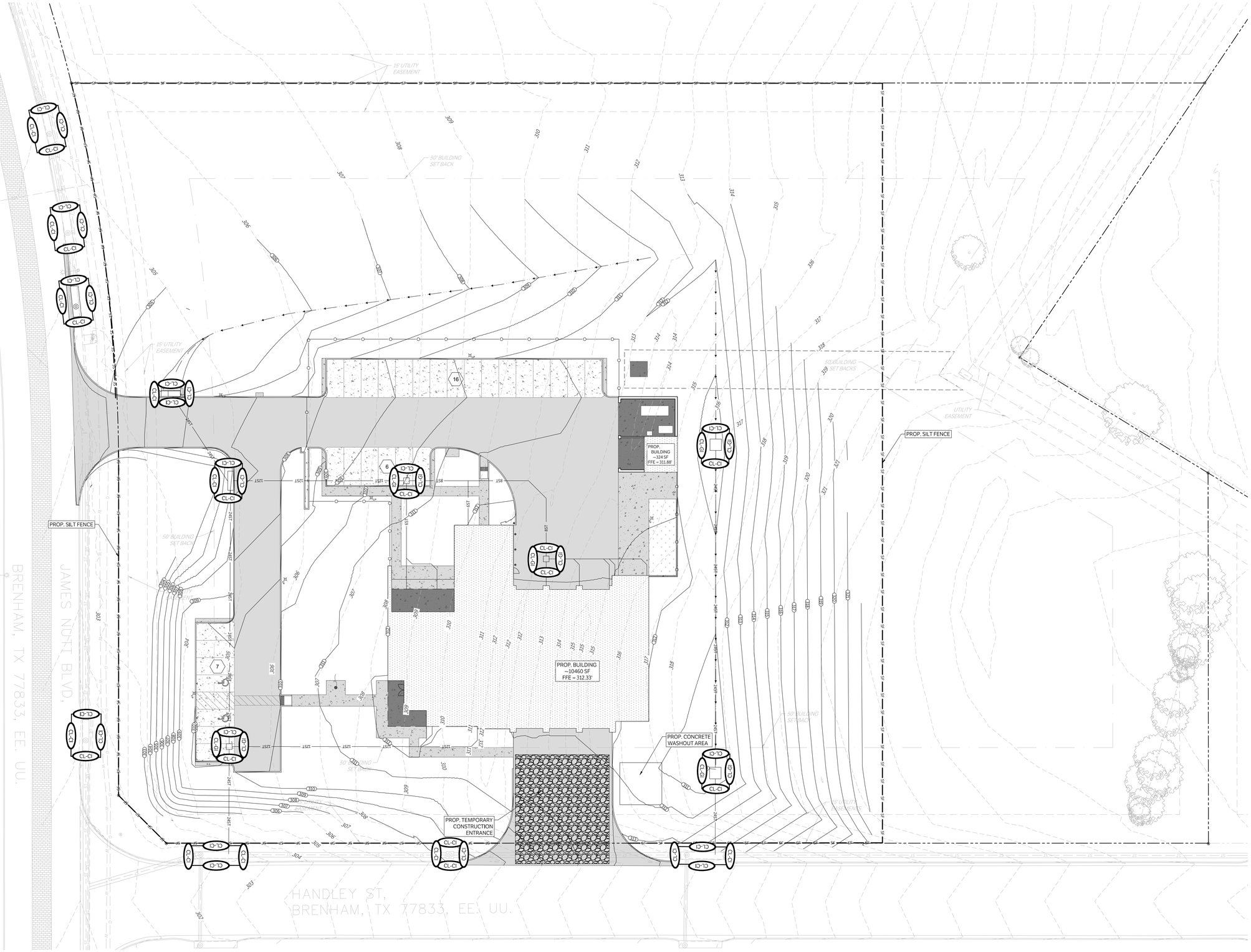
C10.1
CIVIL
WATER PROFILES

CAUTION: CONTACT TEXAS 811 AND LOCAL UTILITY PROVIDERS TO LOCATE EXISTING UTILITIES PRIOR TO CONSTRUCTION.
CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.



BENCHMARK 1 ✤BM1
ELEVATION = 305.28'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE

BENCHMARK 2 ✤BM2
ELEVATION = 307.78'
TOP OF MANHOLE RIM ON
NORTH EDGE OF MANHOLE



LEGEND

- CONSTRUCTION ENTRANCE, INSTALLED PER DETAIL
- PROPERTY LINE
- 340 EXISTING CONTOURS
- 340 PROPOSED CONTOURS
- EXISTING FLOW PATH
- PROPOSED FLOW PATH
- SF SF SF SILT FENCE, INSTALLED PER DETAIL
- CL-CI PROPOSED DAM EROSION CONTROL, LOG CURB INLET
- CL-GI PROPOSED DAM EROSION CONTROL, LOG GRATE INLET

C11.0 EROSION PLAN

SCALE: 1"=20'

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-1779
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4004 BELTWAY STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C11.0
CIVIL
EROSION PLAN

EROSION CONTROL NOTES:
OWNER INFORMATION: CITY OF BRENHAM
200 W VULCAN ST
BRENHAM, TX 77833

PROJECT NAME: BRENHAM FIRE STATION #2

PROJECT LOCATION: XXXX JAMES NUTT BLVD.
BRENHAM, TX. 77833

LATITUDE: 30° 08' 21" N
LONGITUDE: 96° 22' 15" W
TOTAL SITE AREA IS: 5 ACRES
TOTAL AREA OF SITE EXPECTED TO BE DISTURBED: APPROXIMATELY 2.72 ACRES

EXISTING SITE CONDITIONS
LAND USE: UNDEVELOPED
LAND COVER: GRASS
RECEIVING WATERS: WOODWARD CREEK

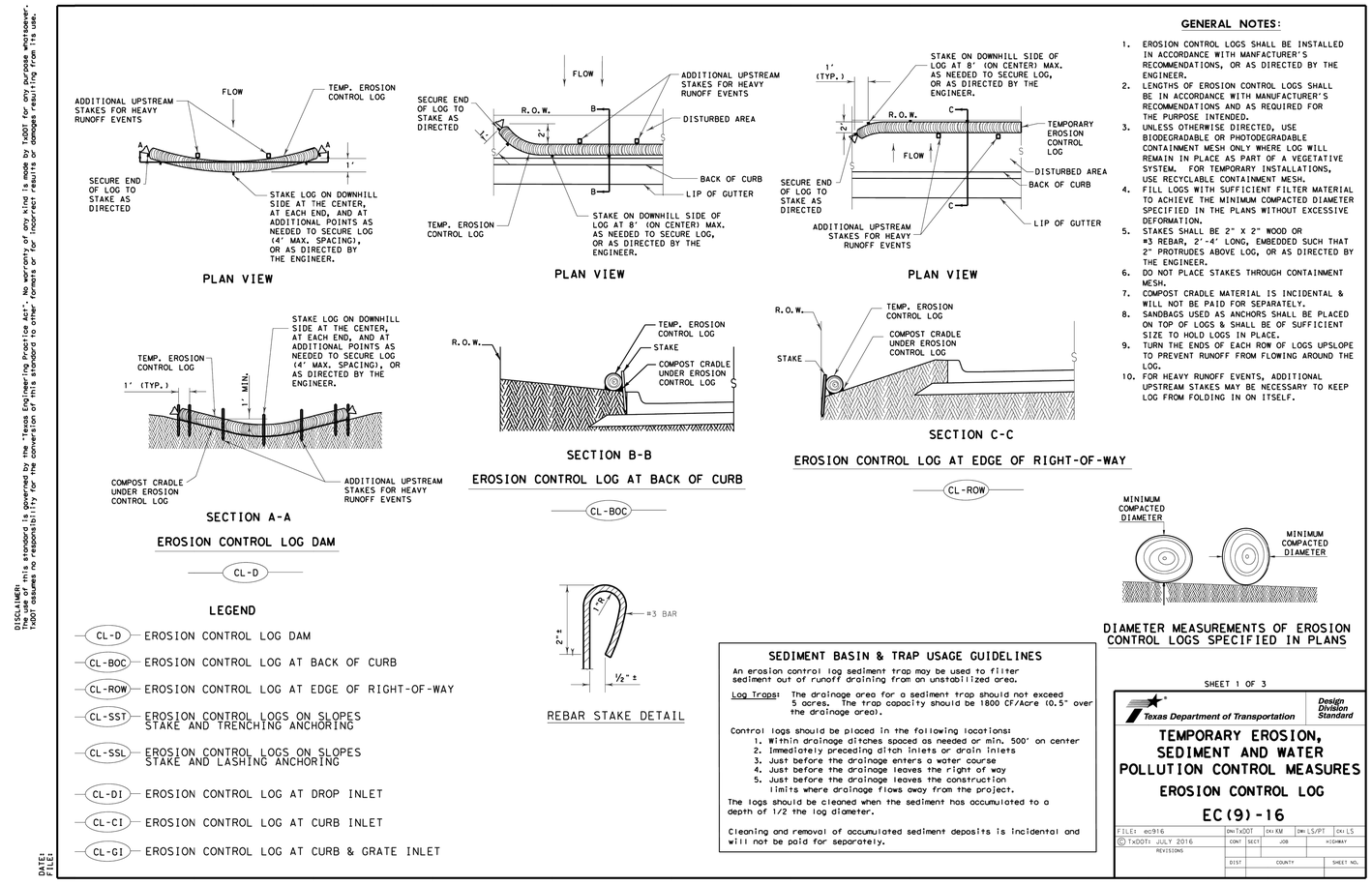
SOIL INFORMATION
PERCENT SLOPES 3 TO 5
HYDROLOGIC SOIL GROUP: D

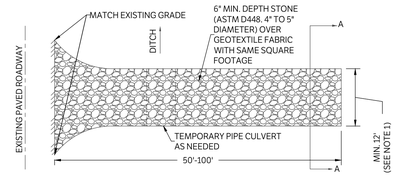
POST DEVELOPED SITE CONDITIONS
LAND USE: FIRE STATION

NATURE OF ACTIVITIES
CLEARING OF ANY EXISTING TREES & BRUSH; STRIPPING OF TOPSOIL; SITE CUT/FILL OPERATIONS, CONSTRUCTION OF 26,033.65 SF PAVED AREAS, 23,600.0 SF OF BUILDING, UTILITIES, REPLACEMENT OF TOPSOIL AND REVEGETATION.

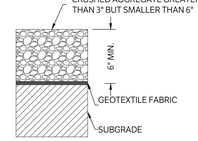
SEQUENCE OF MAJOR ACTIVITIES
1. INSTALL SILT FENCE AT LIMITS OF CONSTRUCTION & STOCK PILE AREAS
2. INSTALL ROCK CONSTRUCTION ENTRANCE
3. INSTALL GRAVEL FILTER BAGS AROUND EXISTING INLETS
4. CLEAR SITE
5. INSTALL SITE IMPROVEMENTS
6. AFTER ESTABLISHMENT OF GRASS, REMOVE ALL TEMPORARY EROSION CONTROL (SILT-FENCE);
7. SEED ALL AREAS NOT HAVING PERMANENT GRASS COVERAGE AS DEFINED.

GENERAL EROSION CONTROL NOTES
1. ALL UTILITIES AND SERVICE LINES SHOWN ARE TAKEN FROM RECORD INFORMATION SUPPLIED BY THE UTILITY OWNER OR HORIZONTALLY LOCATED BY INDEPENDENT LOCATORS. CONTRACTOR IS RESPONSIBLE TO REPORT ANY CONFLICTS BETWEEN PLAN AND ACTUAL CONDITIONS PRIOR TO CONSTRUCTION. OWNER AND ENGINEER SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF INFORMATION OR DATA RELIED ON TO DEPICT UNDERGROUND FACILITIES.
2. CONTRACTOR IS TO CONTACT TEXAS 811 AND OWNERS OF ALL UTILITIES AND SERVICE LINES WITHIN THE PROJECT AREA PRIOR TO CONSTRUCTION. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH FACILITY OWNERS. CONTRACTOR IS TO VERIFY THE EXACT LOCATION AND VERTICAL POSITIONING OF ALL PIPELINES, EXISTING UTILITIES, AND SERVICE LINES WITHIN THE PROJECT AREA WHETHER SHOWN ON THE PLANS OR NOT, AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.
3. CONTRACTOR IS TO MAINTAIN STRUCTURAL INTEGRITY OF ALL PIPELINES, ELECTRIC TRANSMISSION POLES AND LINES, PERMANENT AND TEMPORARY UTILITIES. CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE DONE TO EXISTING UTILITY FACILITIES, PAVEMENT, ETC. AS A RESULT OF CLEARING/DIRTWORK ACTIVITIES.
4. CONTACT GESSNER ENGINEERING IF CONFLICTS OCCUR.
5. ALL DISTURBED AREAS NOT TO BE PAVED ARE TO HAVE ESTABLISHMENT OF GRASS AS OUTLINED IN THE DESCRIPTION OF CONTROLS, STABILIZATION PRACTICES NOTES.
6. ALL SWALE AREAS (BOTTOM WIDTHS & SIDE SLOPES) ARE TO BE PREPARED AND HYDROMULCHED FOR PERMANENT ESTABLISHMENT OF VEGETATION. PRIOR TO HYDROMULCHING OPERATIONS, CONTRACTOR TO REPLACE TOPSOIL TO A DEPTH OF 6". TOPSOIL IS TO BE DISKED TO A DEPTH OF AT LEAST 4" AND LIGHTLY COMPACTED. FINAL GRADES WITH ESTABLISHED VEGETATION SHALL BE AS CALLED OUT ON THE GRADING PLAN.
7. CONTRACTOR IS TO MAINTAIN EROSION CONTROL AT ALL LOCATIONS OF CONSTRUCTION, THROUGHOUT DURATION OF THE PROJECT AND UNTIL VEGETATION IS ESTABLISHED. INSURE SEDIMENT IS NOT TRANSPORTED DOWNSTREAM FROM PROJECT VIA GRAVEL FILTER BAGS AND SILT FENCE INSTALLATIONS. IF EXCESSIVE EROSION IS OBSERVED IN THE FIELD, ADDITIONAL EROSION CONTROLS SHALL BE INSTALLED.
8. CONTRACTOR SHALL NOT ALLOW SEDIMENT TO ENTER THE DOWNSTREAM CHANNEL. CONTRACTOR SHALL BE RESPONSIBLE FOR CLEANING OF THE DOWNSTREAM CHANNEL AREAS AND RESTORING TO ORIGINAL CONDITION, INCLUDING ESTABLISHMENT OF REVEGETATION SHOULD CONSTRUCTION SEDIMENT BE FOUND OUTSIDE THE LIMITS OF CONSTRUCTION.
9. THE CONTRACTOR WILL REMOVE ALL EXCESS SOIL FROM CONSTRUCTION VEHICLES PRIOR TO EXITING THE SITE.
10. THE CONTRACTOR SHALL UNDERTAKE PROPER METHODS TO REDUCE DUST GENERATION FROM THE SITE.
11. THE CONTRACTOR MUST COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS REGARDING SEDIMENTS AND EROSION CONTROL.
12. A COPY OF THIS PLAN MUST BE KEPT AT THE CONSTRUCTION FACILITY DURING THE ENTIRE CONSTRUCTION PERIOD.
13. ALL FINISHED GRADES ARE TO BE HYDRO-MULCHED, SPOT SODDED OR SEEDED AND WATERED UNTIL GROWTH IS ESTABLISHED.

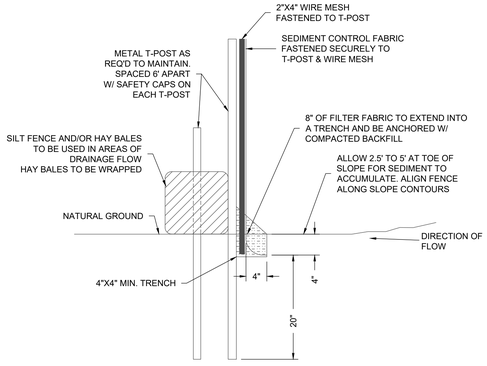




NOTES:
1. SHALL BE FULL WIDTH OF SITE ENTRANCE OR FOUR TIMES THE CIRCUMFERENCE OF THE LARGEST CONSTRUCTION VEHICLE TIRE, WHICHEVER IS GREATER.
2. CONSTRUCT SEDIMENT BARRIER AND CHANNELIZE RUNOFF TO SEDIMENT TRAPPING DEVICE.
3. DRESS WITH ADDITIONAL STONE AS NEEDED. STONE IS TO BE MAINTAINED SO AS TO PREVENT CONSTRUCTION TRAFFIC FROM TRACKING MUD ONTO ADJACENT PUBLIC STREETS.



CONSTRUCTION ENTRANCE/EXIT
NTS



SILT CONTROL FENCE
NTS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979.764.7777
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
LICENSED ARCHITECT
10/24/24

CORPORATE OFFICE
603 W 13TH STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

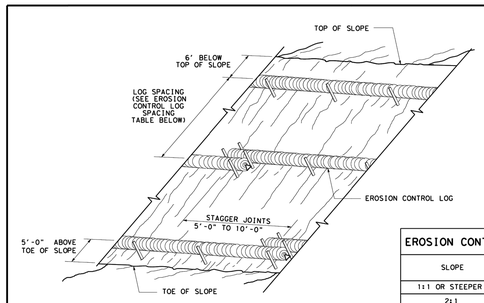
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C11.1
CIVIL
EROSION CONTROL NOTES

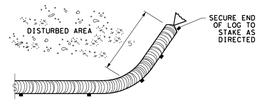
C11.1 EROSION CONTROL NOTES

DATE:
FILE:

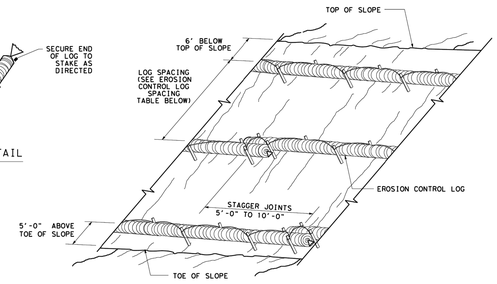


EROSION CONTROL LOGS ON SLOPES
STAKE AND TRENCHING ANCHORING

CL-SST



END SECTION RAP DETAIL

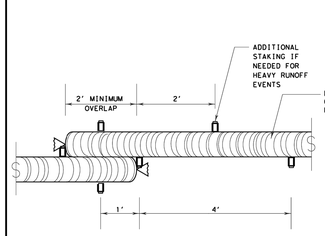


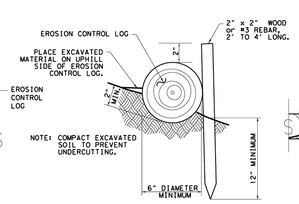
EROSION CONTROL LOGS ON SLOPES
STAKE AND LASHING ANCHORING

CL-SSL

EROSION CONTROL LOG SPACING TABLE				
SLOPE	LOG DIAMETER			
	6"	8"	12"	18"
1:1 OR STEEPER	5'	10'	15'	20'
2:1	10'	20'	30'	40'
3:1	15'	30'	45'	60'
4:1 OR FLATTER	20'	40'	60'	80'

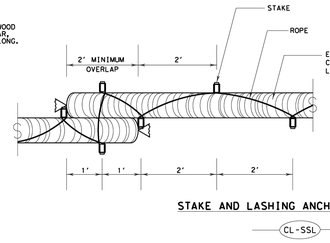
* ADJUSTMENTS CAN BE MADE FOR SOIL TYPE:
SOFT, LOAMY SOILS-ADJUST ROWS CLOSER TOGETHER;
HARD, ROCKY SOILS- ADJUST ROWS FARTHER APART

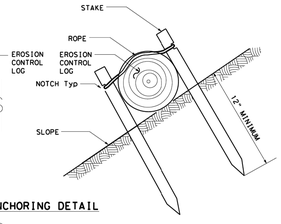




STAKE AND TRENCHING ANCHORING DETAIL

CL-SST

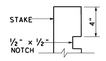




STAKE AND LASHING ANCHORING DETAIL

CL-SSL

TRENCH DEPTH TABLE	
LOG DIAMETER	DEPTH
6"	2"
8"	3"
12"	4"
18"	5"



STAKE NOTCH DETAIL

SHEET 2 OF 3

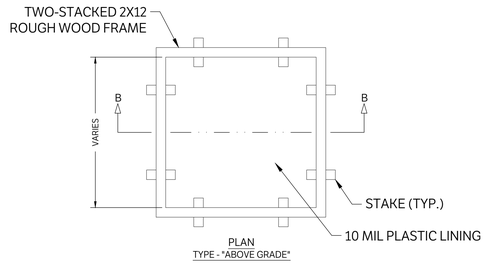
Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

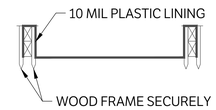
EROSION CONTROL LOG

EC(9)-16

FILE: ec116	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.



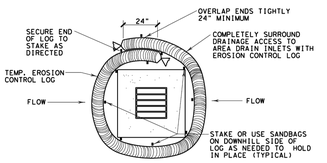
PLAN
TYPE - "ABOVE GRADE"



SECTION B-B

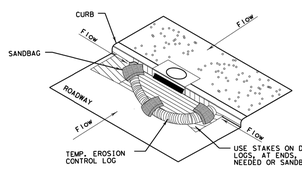
CONCRETE WASHOUT DETAIL
NTS

DATE:
FILE:



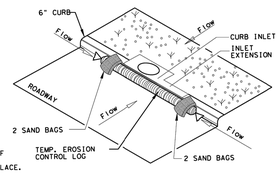
EROSION CONTROL LOG AT DROP INLET

CL-DI



EROSION CONTROL LOG AT CURB INLET

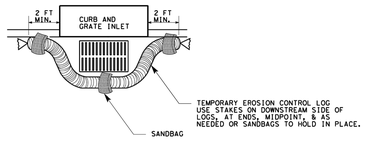
CL-CI



EROSION CONTROL LOG AT CURB INLET

CL-CI

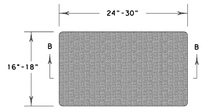
NOTE:
EROSION CONTROL LOGS USED AT CURB INLETS SHOULD ONLY BE USED IF THEY WILL NOT IMPEDE TRAFFIC OR FLOOD THE ROADWAY OR WHEN THE STORM SEWER SYSTEM IS NOT FULLY FUNCTIONAL.



EROSION CONTROL LOG AT CURB & GRADE INLET

CL-GI

SECTION B-B



SANDBAG DETAIL

SHEET 3 OF 3

Texas Department of Transportation — Design Division Standard

TEMPORARY EROSION, SEDIMENT AND WATER POLLUTION CONTROL MEASURES

EROSION CONTROL LOG

EC(9)-16

FILE: ec916	DN: TxDOT	CK: KM	DW: LS/PT	CK: LS
© TxDOT: JULY 2016	CONT	SECT	JOB	HIGHWAY
REVISIONS	DIST	COUNTY		SHEET NO.

C11.2 EROSION CONTROL DETAILS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 764-7777
WWW.BRWARCH.COM

BRW

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4001 WHITE STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

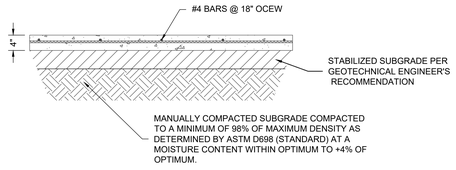
GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

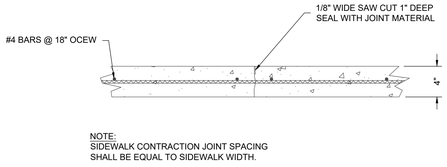
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C11.2
CIVIL
EROSION CONTROL DETAILS

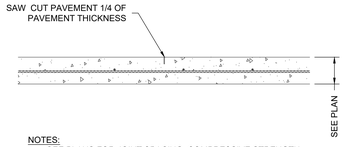


SIDEWALK SECTION
NTS



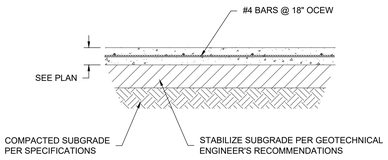
NOTE:
SIDEWALK CONTRACTION JOINT SPACING SHALL BE EQUAL TO SIDEWALK WIDTH.

SIDEWALK CONTRACTION JOINT
NTS



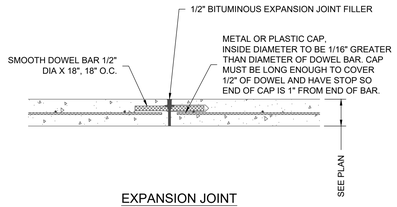
NOTES:
1. SEE PLANS FOR JOINT SPACING, COMPRESSIVE STRENGTH, PAVEMENT THICKNESS, AND REINFORCING.
2. SAW CUT OPERATIONS SHALL BEGIN AS SOON AS POSSIBLE AFTER CONCRETE PLACEMENT.
3. SEAL ALL JOINTS WITH SELF LEVELING JOINT SEALANT MATERIAL PER SPECIFICATIONS.

CONTROL JOINT
NTS

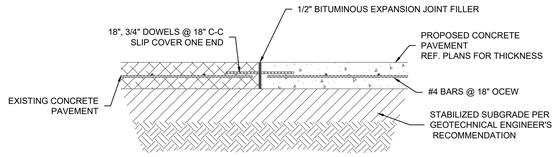


NOTES:
1. SEE PLAN FOR JOINT SPACING, PAVEMENT THICKNESS, AND REINFORCING. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI
2. DEPTH OF STABILIZATION SHALL BE A MINIMUM OF 6 INCHES OR BASED ON GEOTECHNICAL RECOMMENDATIONS SUBGRADE CONDITIONS.
3. SUBGRADE STABILIZATION SHALL BE PER GEOTECHNICAL RECOMMENDATIONS AND LIME/CEMENT SERIES BASED ON ACTUAL SUBGRADE CONDITIONS.

CONCRETE PAVEMENT
NTS

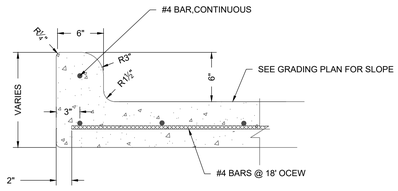


EXPANSION JOINT
NTS

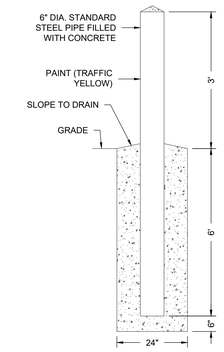


NOTE:
1. SEE PLANS FOR THICKNESS OF EXISTING AND PROPOSED CONCRETE PAVEMENT
2. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI

EXISTING CONCRETE TIE-IN
NTS

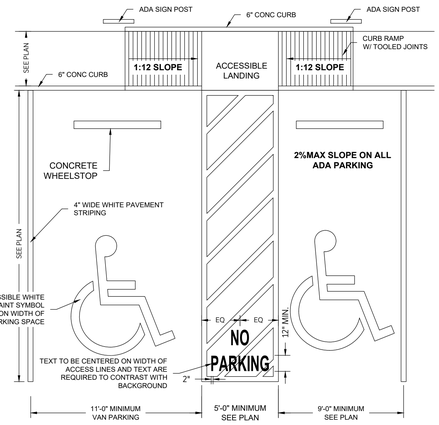


INTEGRAL CURB & GUTTER
NTS

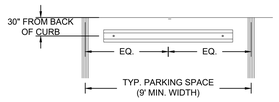


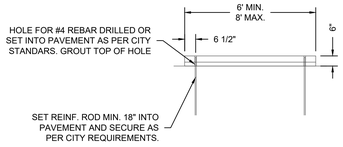
6" EMBEDDED BOLLARD DETAIL
NTS

NOTE:
1. CONCRETE SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH OF 4,000 PSI.
2. ALL CONCRETE SHALL BE VIBRATED WHEN PLACED.
3. PAVEMENT CONTRACTION JOINTS SHALL BE INSTALLED PER PLAN, WITH A MAXIMUM SPACING OF 24 TIMES THE THICKNESS OF THE PAVEMENT (12' FOR 6" PAVEMENT). CONTRACTION JOINTS SHALL BE INSTALLED AS SOON AS CONCRETE CURING ALLOWS AND SHALL BE CUT 1/4 OF THE THICKNESS OF THE PAVEMENT.
4. PAVEMENT EXPANSION JOINTS SHALL BE SPACED AS SHOWN ON THE PLANS. CONSTRUCTION SHALL BE STOPPED AT EXPANSION JOINTS.
5. ALL JOINTS SHALL BE SEALED. PROVIDE EXPANSION JOINT WATER STOP CAPS AT NEW CONCRETE. PROVIDE EXPANSION JOINT SEALANT AT NEW TO EXISTING PAVEMENT.

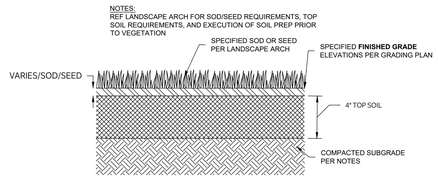


PROP ADA PARKING SPACES
NTS





TYP. WHEEL STOP
NTS



LANDSCAPED AREAS (SOD/SEED)
NTS

C12.0 DETAILS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7171
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4041 N. MAIN STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

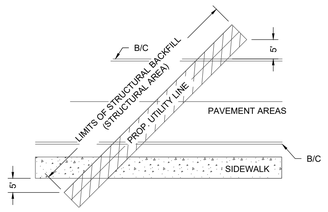
GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRW PROJECT NUMBER MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C12.0
CIVIL
DETAILS



NOTE:
STRUCTURAL BACKFILL AREA INCLUDES ALL PAVED AREAS (SIDEWALKS, STREETS, ALLEYS, DRIVEWAYS,AND PARKING AREAS) AND SHALL EXTEND 5' BEYOND THE CURB LINE.
STRUCTURAL BACKFILL SHALL BE CEMENT STABILIZED (OPTION NO. 2 IN W4-03) OR EXCAVATED SOIL COMPACTED TO 98% MAXIMUM DRY DENSITY AS PER ASTM D698 WITHIN OPTIMUM TO +4% WET OF OPTIMUM (OPTION NO. 1 IN W4-02)

STRUCTURAL BACKFILL AREA
NTS

SANITARY SEWER CLEANOUT
NTS

ALL CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 4500 psi.

REINFORCING STEEL SHALL COMPLY WITH ASTM A615 GRADE 60, A706 GRADE 60 OR A497 GRADE 70. BAR BENDING AND PLACEMENT SHALL COMPLY WITH THE LATEST ACI STANDARDS

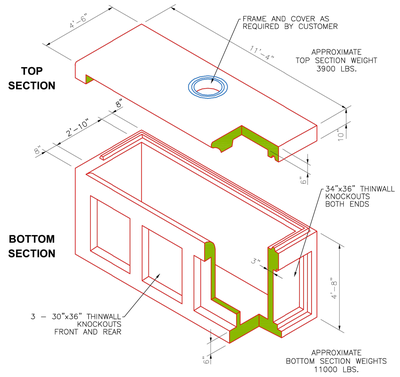
STANDARD STRUCTURAL DESIGN IS BASED ON AASHTO H 20 SIDEWALK LOADING.

WATER TABLE IS AT 3'-0" BELOW GRADE FOR STANDARD STRUCTURAL DESIGN

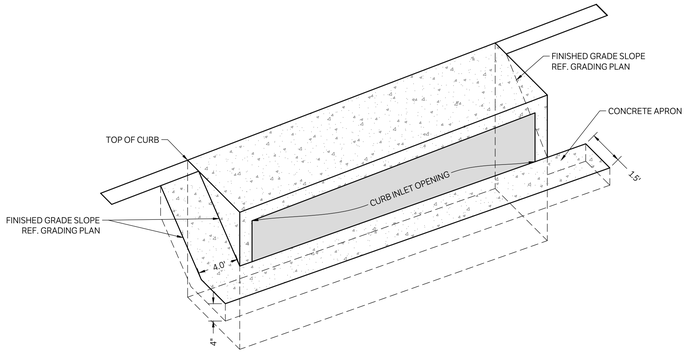
THE STANDARD DESIGN IS BASED ON THE TOP AT GRADE AND THE BASE AT 5'-0" MAX. BELOW GRADE.

THE STRUCTURE SHALL BE PLACED ON A COMPACTED GRANULAR BASE TO INSURE UNIFORM DISTRIBUTION OF SOIL PRESSURES.

SPECIAL DESIGNS BASED ON OTHER LOADINGS OR DEEPER INSTALLATION DEPTHS ARE AVAILABLE ON REQUEST.

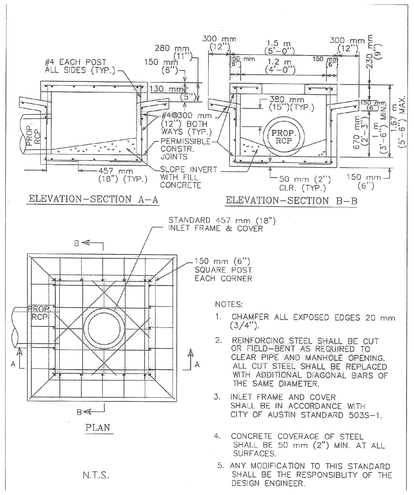


10' CURB INLET
NTS



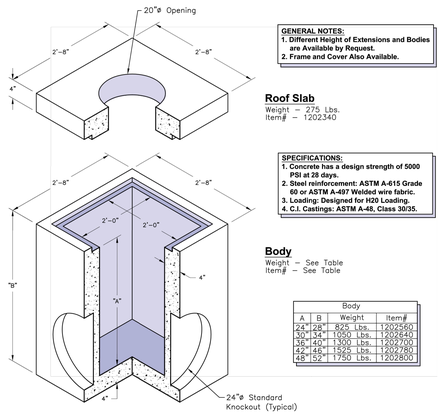
BI-DIRECTIONAL CURB INLET REAR OPENING
NTS

Oldcastle Precast | ***Water*** | ***2'-0"x2'-0" I.D. Junction Box*** Model: **JB-220**



NOTES:
1. CHAMFER ALL EXPOSED EDGES 20 mm (3/4").
2. REINFORCING STEEL SHALL BE CUT OR FIELD-BENT AS REQUIRED TO CLEAR PIPE AND MANHOLE OPENING. ALL CUT STEEL SHALL BE REPLACED WITH ADDITIONAL DIAGONAL BARS OF THE SAME DIAMETER.
3. INLET FRAME AND COVER SHALL BE IN ACCORDANCE WITH CITY OF AUSTIN STANDARD 503S-1.
4. CONCRETE COVERAGE OF STEEL SHALL BE 50 mm (2") MIN. AT ALL SURFACES.
5. ANY MODIFICATION TO THIS STANDARD SHALL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER.

4- SIDED AREA INLET
NTS



GENERAL NOTES:
1. Different Height of Extensions and Bodies are Available by Request.
2. Frame and Cover Also Available.

Roof Slab
Weight – 275 Lbs.
Item# – 1202340

SPECIFICATIONS:
1. Concrete has a design strength of 5000 PSI at 28 days.
2. Steel reinforcement: ASTM A-615 Grade 60 or ASTM A-497 Welded wire fabric.
3. Loading: Designed for H20 Loading.
4. C.I. Castings: ASTM A-48, Class 30/35.

Body
Weight – See Table
Item# – See Table

Body			
A	B	Weight	Item#
24"	28"	825 Lbs.	1202560
30"	32"	1050 Lbs.	1202640
36"	40"	1300 Lbs.	1202700
42"	42"	1595 Lbs.	1202780
48"	52"	1750 Lbs.	1202800

Texas Region | *For more information about our products please visit us on the web at:* oldcastleprecast.com | © 2013 Oldcastle Precast, Inc. JB-3 | 888-9 Oldcastle (888-965-3227)

C12.1 DETAILS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7477
WWW.BRWARCH.COM

CORPORATE OFFICE
4004 WHITE STREET
BRYAN, TEXAS 77803
(979) 680-8840
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

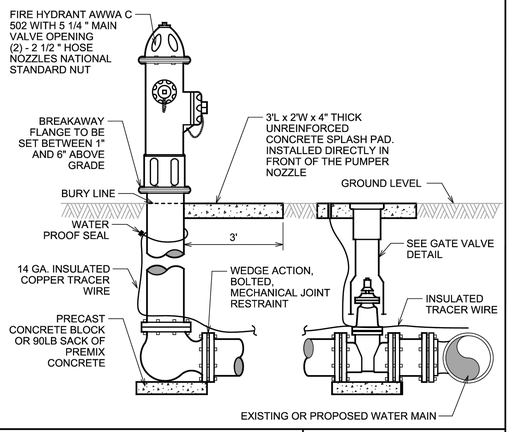
NO.	REVISION	DATE

C12.1

CIVIL
DETAILS

GENERAL NOTES

1. FIRE HYDRANT SHALL BE MANUFACTURED BY MUELLER, OR AMERICAN DARLING.
2. FIRE HYDRANTS SHALL HAVE A THREE-WAY NOZZLE ARRANGEMENT, A 5-1/4 INCH COMPRESSION TYPE MAIN VALVE, A MECHANICAL JOINT (MJ) BOOT, AND CONFORM TO THE REQUIREMENTS OF AMERICAN WATER WORKS ASSOCIATION (AWWA) C502.
3. FIRE HYDRANT COLOR SHALL BE RED WITH YELLOW PUMPER CAPS AND SILVER STEAMER CAPS.
4. THE BONNET OF THE FIRE HYDRANT SHALL BE FACTORY PAINTED WHITE.
5. INSTALL WEDGE ACTION, BOLTED MECHANICAL JOINT RESTRAINT ON ALL PIPE JOINTS BETWEEN MAIN & HYDRANT.
6. CONTRACTOR SHALL INSTALL A BLUE REFLECTIVE PAVEMENT MARKER AT THE CENTERLINE OF EACH STREET IN LINE WITH THE HYDRANT.
7. HYDRANT WEEP HOLES SHALL BE WRAPPED WITH CONSTRUCTION GRADE PLASTIC.



City of BRENHAM

FIRE HYDRANT

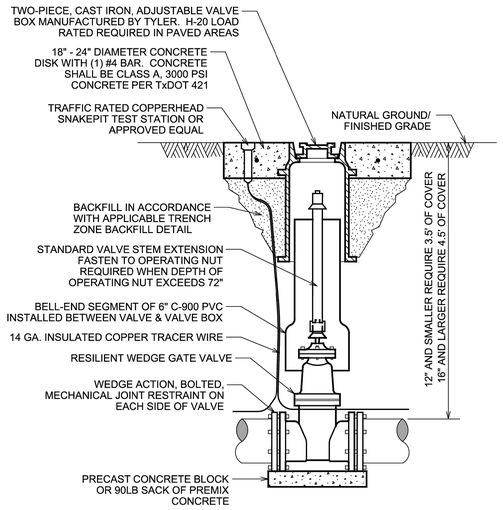
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21	REVISED DATE: 07/20/21

WTR - 6

GENERAL NOTES

1. ALL MAIN LINE VALVE 18" IN DIAMETER & SMALLER SHALL BE RESILIENT WEDGE GATE VALVES.
2. MAIN LINE VALVE WITH DIAMETERS GREATER THAN 18" MAY BE EITHER RESILIENT WEDGE GATE VALVES OR BUTTERFLY VALVES.
3. RESILIENT WEDGE GATE VALVES SHALL BE AMERICAN FLOW CONTROL.
4. TRACER WIRE SHALL BE CONNECTED TO ALL WATER METER ANGLE STOPS, FIRE HYDRANTS, AND VALVE BOX RISERS.



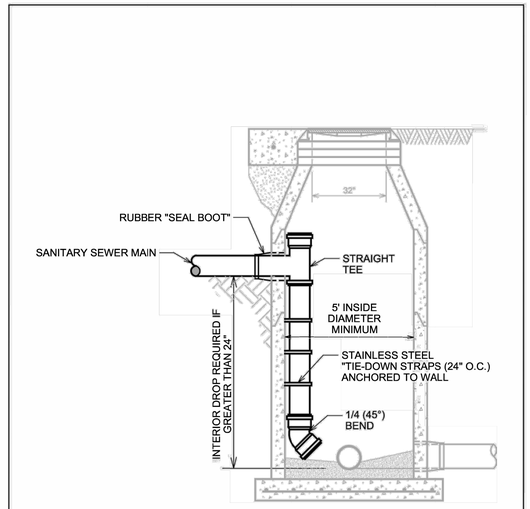
City of BRENHAM

GATE VALVE

STANDARD CONSTRUCTION DETAILS

DATE: 07/12/21	REVISED DATE: 07/12/21

WTR - 7



City of BRENHAM

DROP STRUCTURE FOR MANHOLE DETAIL

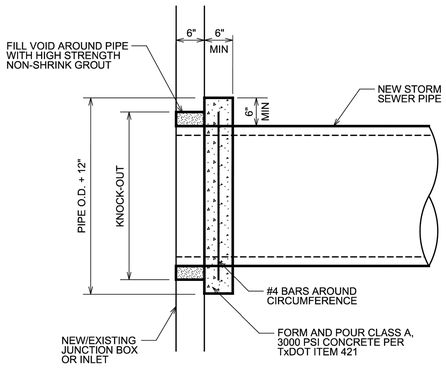
STANDARD CONSTRUCTION DETAILS

DATE: 11/22/19	REVISED DATE: 11/22/19

SAN -5

GENERAL NOTES

1. NEW PIPE TO BE SET FLUSH WITH INSIDE WALL OF STRUCTURE.



City of BRENHAM

GROUTED STORM SEWER CONNECTION DETAIL

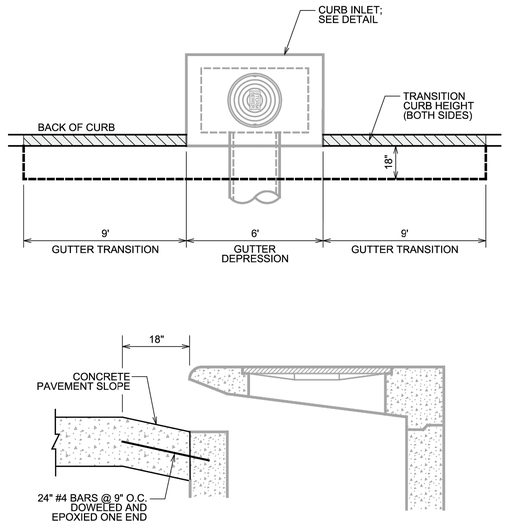
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21	REVISED DATE: 07/20/21

STM - 3

GENERAL NOTES

1. GUTTER DEPRESSION SHALL NOT BE LOCATED WITHIN THE AREA OF A CURB RAMP/LANDING OR DRIVEWAY.



City of BRENHAM

GUTTER DEPRESSION AT CURB INLET

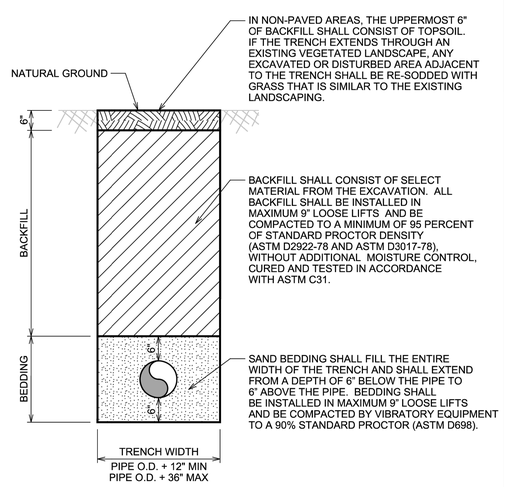
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21	REVISED DATE: 07/20/21

STM - 4

GENERAL NOTES

1. BANK SAND SHALL BE SP, SW OR SM PER USC (ASTM D2487 AND SHALL HAVE THE FOLLOWING PROPERTIES: LESS THAN 15% PASSING #200 SIEVE; LESS THAN 2% CLAY LUMPS; PLASTICITY INDEX LESS THAN 7; LIQUID LIMIT LESS THAN 25.



City of BRENHAM

WATER & SANITARY SEWER BEDDING & BACKFILL (NON-PAVED AREAS)

STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21	REVISED DATE: 07/20/21

BBF - 1

C12.2 DETAILS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-7477
WWW.BRWARCH.COM

CORPORATE OFFICE
4041 N. MAIN STREET
BRYAN, TEXAS 77803
(979) 680-3840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

DATE	10/24/2024
DRAWN BY	AW
CHECKED BY	PR
BRW PROJECT NUMBER	MATCH THE ARCH

BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

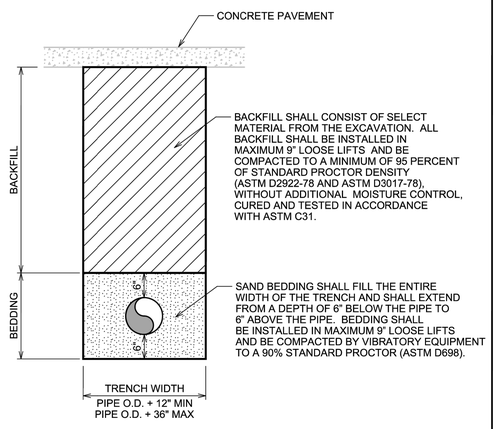
C12.2

CIVIL

DETAILS

GENERAL NOTES

1. BANK SAND SHALL BE SP, SW OR SM PER USC (ASTM D2487 AND SHALL HAVE THE FOLLOWING PROPERTIES: LESS THAN 15% PASSING #200 SIEVE; LESS THAN 2% CLAY LUMPS; PLASTICITY INDEX LESS THAN 7; LIQUID LIMIT LESS THAN 25.



City of BRENHAM — WATER & SANITARY SEWER BEDDING & BACKFILL (CONCRETE PAVED AREAS)

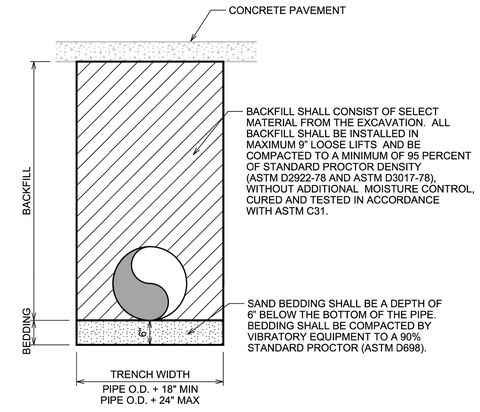
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

BBF - 2

GENERAL NOTES

1. BANK SAND SHALL BE SP, SW OR SM PER USC (ASTM D2487 AND SHALL HAVE THE FOLLOWING PROPERTIES: LESS THAN 15% PASSING #200 SIEVE; LESS THAN 2% CLAY LUMPS; PLASTICITY INDEX LESS THAN 7; LIQUID LIMIT LESS THAN 25.



City of BRENHAM — STORM SEWER BEDDING & BACKFILL FOR RCP PIPE (CONCRETE PAVED AREAS)

STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

BBF - 5

GENERAL NOTES

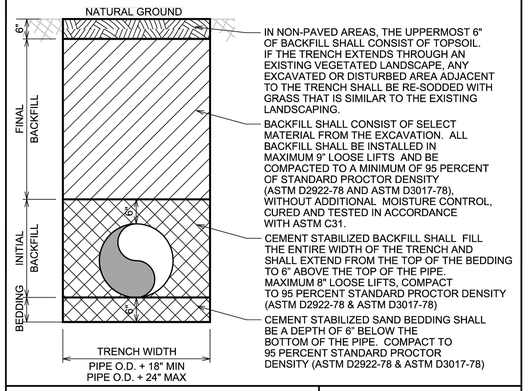
1. BEDDING AND INITIAL BACKFILL SHALL BE CEMENT STABILIZED SAND AND SHALL EXTEND FROM 6 INCHES BELOW THE PIPE TO 6 INCHES ABOVE THE PIPE. THE CEMENT STABILIZED SAND BACKFILL SHALL MEET THE FOLLOWING REQUIREMENTS:

A. THE CEMENT SHALL BE PORTLAND CEMENT, TYPE I, ASTM C150.

B. THE SAND SHALL BE CLEAN, DURABLE SAND; LESS THAN 0.5% CLAY CLUMPS, ASTM C142; LESS THAN 0.5% LIGHTWEIGHT PIECES, ASTM C123; ORGANIC IMPURITIES, ASTM C40; NOT SHOWING A COLOR DARKER THAN STANDARD COLOR; AND PLASTICITY INDEX OF LESS THAN 6, ASTM D423 & ASTM D424.

C. CEMENT-SAND MIXTURE SHALL CONSIST OF AT LEAST 1.5 SACKS OF CEMENT PER TON OF SAND. MINIMUM UNCONFINED COMPRESSIVE STRENGTH OF 100 PSI IN 48 HOURS, WHEN COMPACTED TO A MINIMUM OF 95% OF STANDARD PROCTOR DENSITY (ASTM D2922-78 & ASTM D3017-78),WITHOUT ADDITIONAL MOISTURE CONTROL, CURED & TESTED IN ACCORDANCE WITH ASTM C31.

D. CEMENT STABILIZED SAND SHALL BE PLACED & COMPACTED WITHIN 3 HOURS OF BATCHING.



City of BRENHAM — STORM SEWER BEDDING & BACKFILL FOR HDPE PIPE (NON-PAVED AREAS)

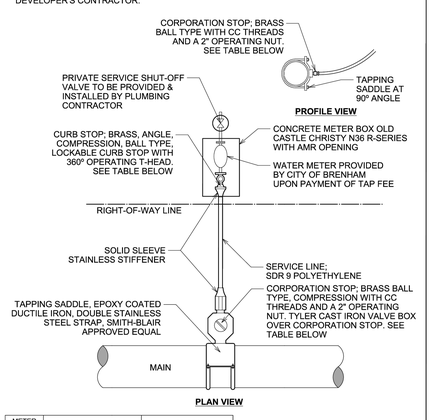
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

BBF - 7

GENERAL NOTES

1. WATER SERVICES 2" AND SMALLER MUST BE SINGLE LOT CONNECTIONS.
2. WATER SERVICE SHALL BE LOCATED WITHIN THE RIGHT-OF-WAY AS CLOSE TO THE LOT LINE AS POSSIBLE.
3. CITY OF BRENHAM TO SUPPLY WATER METER UPON PAYMENT OF TAP FEE BY DEVELOPER OR DEVELOPER'S CONTRACTOR.



METER SIZE	CORPORATION STOP	CURB STOP
1-1/2"	FORD FB1000-6-TA-QT67-NL	FORD BFA43-666-WR-G-NL
2"	FORD FB1000-7-TA-QT67-NL	FORD BFA43-777-WR-G-NL

City of BRENHAM — 1 1/2" AND 2" WATER SERVICE DETAIL (SINGLE SERVICE)

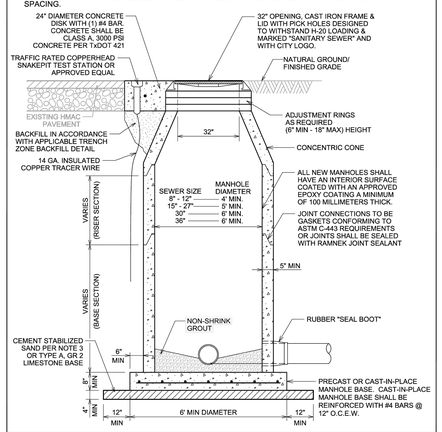
STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

WTR - 12

GENERAL NOTES

1. INSTALLATION OF PRECAST STRUCTURES SHALL BE PER MANUFACTURERS INSTRUCTIONS. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF PRE-CAST STRUCTURES TO ENGINEER PRIOR TO ORDERING MATERIALS.
2. PRECAST STRUCTURE, RING, AND COVER SHALL BE DESIGNED FOR H-20 WHEEL LOADING.
3. CEMENT STABILIZED SAND SHALL CONTAIN A MINIMUM OF 1.5 SACKS OF CEMENT PER CUBIC YARD. SAND SHALL BE SP, SW OR SM PER USC (ASTM D2487) AND SHALL HAVE THE FOLLOWING PROPERTIES: LESS THAN 15% PASSING #200 SIEVE; LESS THAN 2% CLAY LUMPS; PI <7; LL <25.
4. TRACER STATION TO BE INCLUDED AT ALL MANHOLES AT THE INTERSECTIONS AND AT 500' MAXIMUM SPACING.



City of BRENHAM — SANITARY SEWER MANHOLE (PRE-CAST CONCRETE MANHOLE)

STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

SAN - 1

GENERAL NOTES

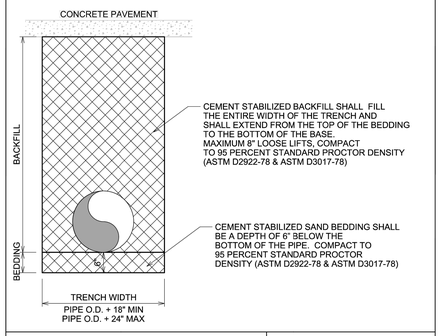
1. UNDER CONCRETE PAVING, BEDDING AND BACKFILL SHALL BE CEMENT STABILIZED SAND AND SHALL EXTEND FROM 6 INCHES BELOW THE PIPE TO THE BOTTOM OF THE BASE SECTION. THE CEMENT STABILIZED SAND BACKFILL SHALL MEET THE FOLLOWING REQUIREMENTS:

A. THE CEMENT SHALL BE PORTLAND CEMENT, TYPE I, ASTM C150.

B. THE SAND SHALL BE CLEAN, DURABLE SAND; LESS THAN 0.5% CLAY CLUMPS, ASTM C142; LESS THAN 0.5% LIGHTWEIGHT PIECES, ASTM C123; ORGANIC IMPURITIES, ASTM C40; NOT SHOWING A COLOR DARKER THAN STANDARD COLOR; AND PLASTICITY INDEX OF LESS THAN 6, ASTM D423 & ASTM D424.

C. CEMENT-SAND MIXTURE SHALL CONSIST OF AT LEAST 1.5 SACKS OF CEMENT PER TON OF SAND. MINIMUM UNCONFINED COMPRESSIVE STRENGTH OF 100 PSI IN 48 HOURS, WHEN COMPACTED TO A MINIMUM OF 95% OF STANDARD PROCTOR DENSITY (ASTM D2922-78 & ASTM D3017-78),WITHOUT ADDITIONAL MOISTURE CONTROL, CURED & TESTED IN ACCORDANCE WITH ASTM C31.

D. CEMENT STABILIZED SAND SHALL BE PLACED & COMPACTED WITHIN 3 HOURS OF BATCHING.



City of BRENHAM — STORM SEWER BEDDING & BACKFILL FOR HDPE PIPE (CONCRETE PAVED AREAS)

STANDARD CONSTRUCTION DETAILS

DATE: 07/20/21 | REVISED DATE: 07/20/21

BBF - 8

C12.3 DETAILS

BROWN REYNOLDS WATFORD ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 846-8778
WWW.BRWARCH.COM

PEDRO RIOS, JR.
133608
10/24/24

CORPORATE OFFICE
4041 VILLAGE STREET
BRYAN, TEXAS 77803
(979) 680-3840
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10/24/2024
DRAWN BY AW
CHECKED BY PR
BRVV PROJECT NUMBER MATCH THE ARCH

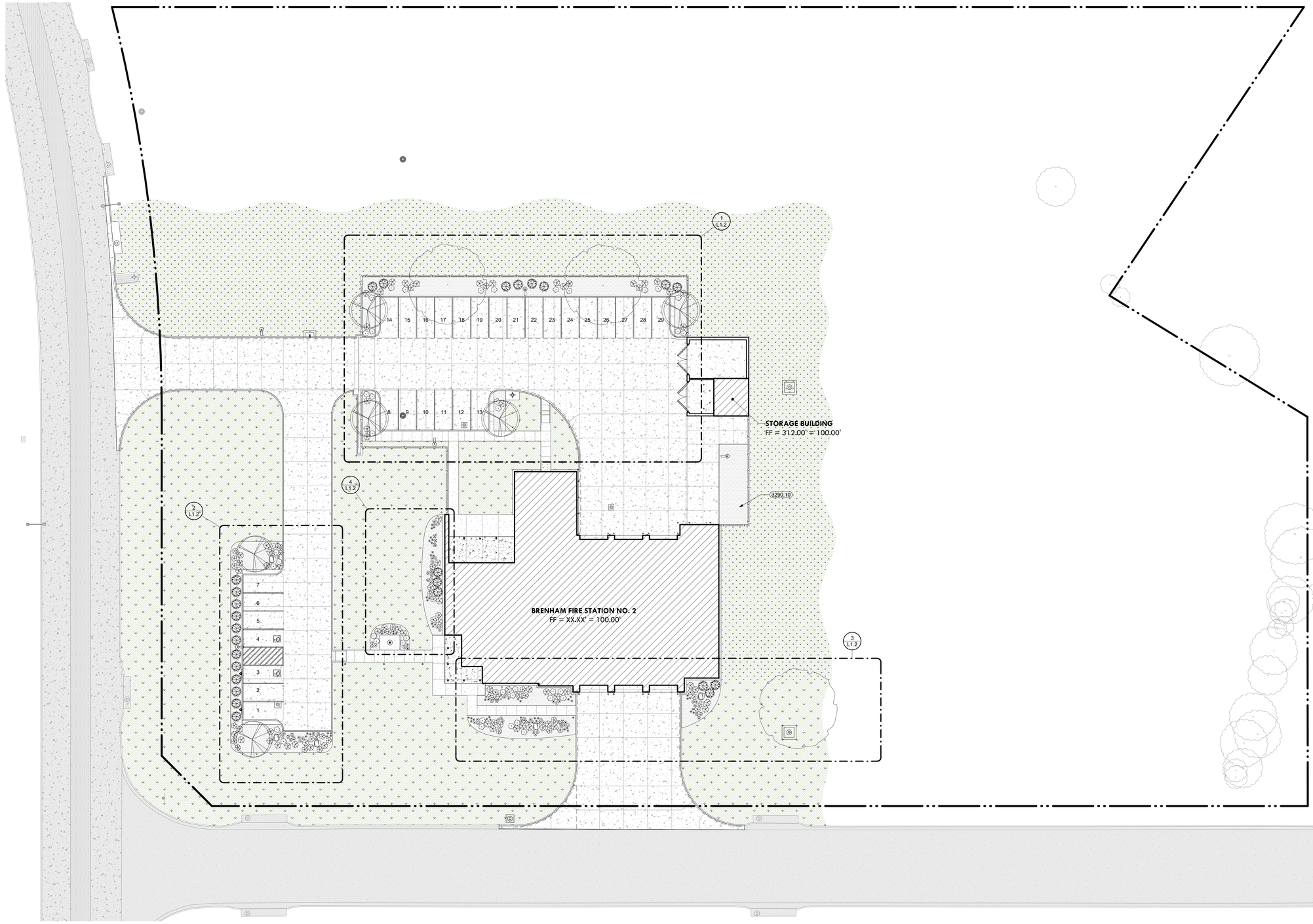
BRENHAM FIRE STATION #2
FIRE TRAINING COMPLEX
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

C12.3

CIVIL

DETAILS



TRUE NORTH PLAN NORTH

1 LANDSCAPE PLAN

1" = 20'-0"

LANDSCAPE LEGEND

SYMBOL	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
	---	CYNODON DACTYLON	BERMUDA GRASS SOD	---	SEE SPECIFICATIONS
	---	CYNODON DACTYLON	BERMUDA GRASS HYDROMULCH	---	SEE SPECIFICATIONS
	---	---	RIVER ROCK	1774 SF	SEE SPECIFICATIONS
	54	TULBAGHIA VIOLACEA	SOCIETY GARLIC	1 GAL	24" TRIANGULAR SPACING
	28	HEMEROCALLIS 'STELLA DE ORO'	DAYLILY	1 GAL	24" TRIANGULAR SPACING
	59	RUELLIA BRITTONIANA 'KATIE'	KATIE'S DWARF RUELLIA	1 GAL	24" TRIANGULAR SPACING
	32	HESPERALOE PARVIFLORA 'YELLOW'	YELLOW YUCCA	3 GAL	36" SPACING
	41	HESPERALOE PARVIFLORA	RED YUCCA	3 GAL	36" SPACING
	70	MUHLENBERGIA DUBIA	PINE MUHLY GRASS	3 GAL	36" - 48" SPACING
	26	LEUCOPHYLLUM FRUTESCENS 'SILVERADO	'SILVERADO' TEXAS SAGE	3 GAL	36" - 48" SPACING
	5	---	BOULDER	2' DIA	---

LANDSCAPE LEGEND CONTINUED

SYMBOL	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
	20	---	EXISTING TREE	---	--
	6	VITEX AGNUS-CASTUS	VITEX	30 GALLON	MULTI-TRUNK TREE
	3	QUERCUS VIRGINIANA	LIVE OAK	2-1/2" CALIPER MIN.	SINGLE STRAIGHT TRUNK

DEVELOPED AREA

TOTAL SITE AREA:	217,797 SF
BCDC LANDSCAPE REQUIREMENT: (20% OF SITE AREA PLANTED/MAINTAINED WITH APPROVED VEGETATION)	**43,560 SF**
BUILDING FOOTPRINT:	10,337 SF
SITE PAVING + SIDEWALK:	75,336 SF
TOTAL DEVELOPED AREA:	85,673 SF
CITY OF BRENHAM LANDSCAPE REQUIREMENT: (15% OF DEVELOPED AREA)	**6,126 SF**
LANDSCAPE BED AREA:	3,954 SF
SCREENING BED AREA:	533 SF
RIVER ROCK BED AREA:	1,658 SF
TOTAL LANDSCAPED AREA:	**6,145 SF**
BERMUDA SOD AREA:	34,123 SF
BERMUDA HYDROMULCH AREA:	25,798 SF
TOTAL VEGETATION:	**59,921 SF**

RALPH HOLLIDAY 6837 REGISTERED LANDSCAPE ARCHITECT STATE OF TEXAS
10/24/2024

BRWARCHITECTS
175 CENTURY SQUARE DRIVE SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY EW, SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

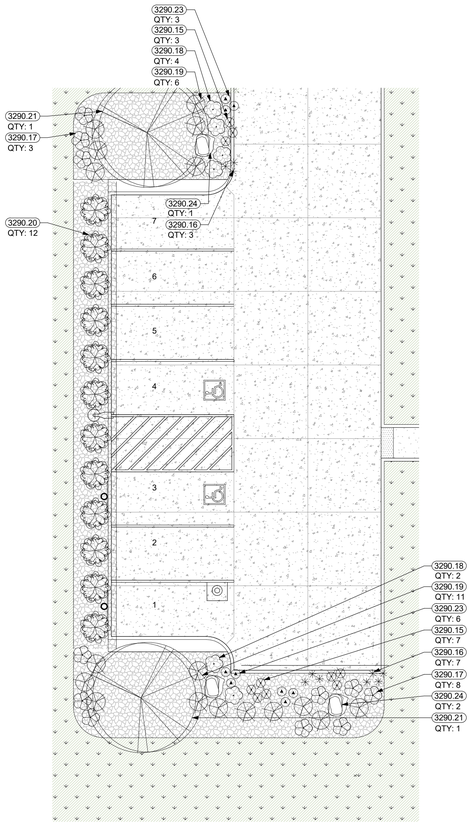
NO.	REVISION	DATE

L1.1

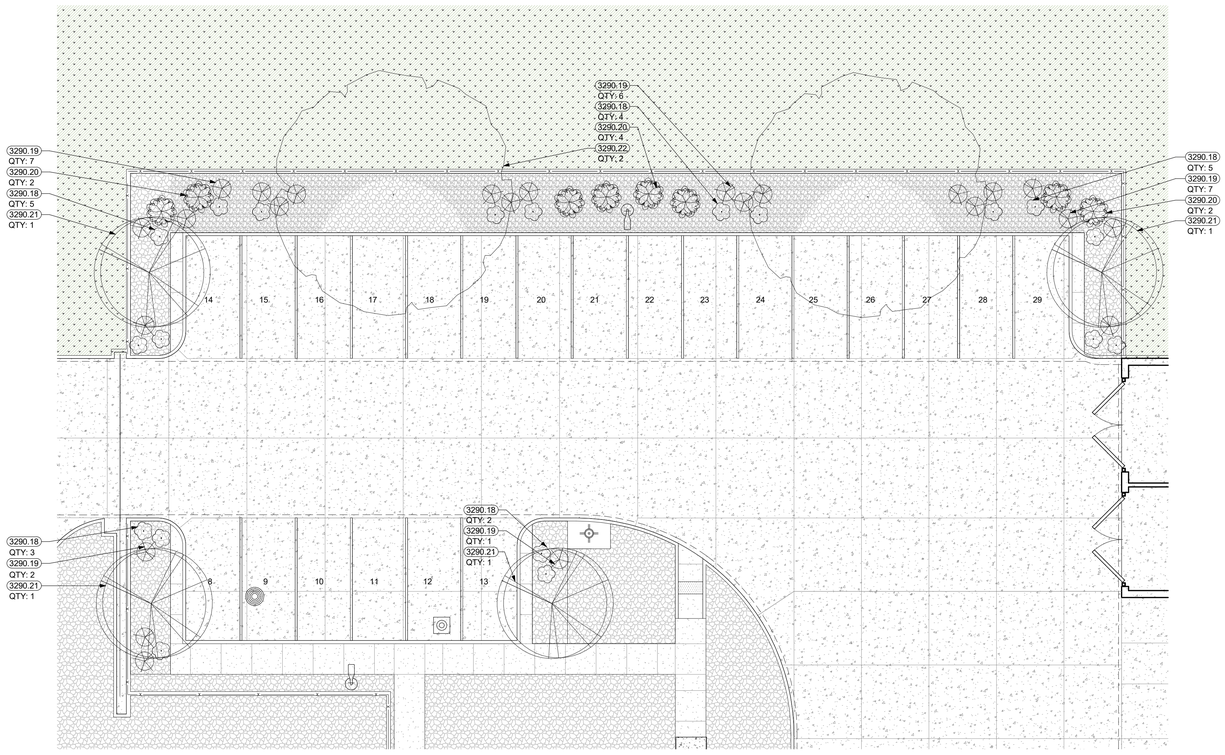
LANDSCAPE PLAN

KEYNOTES

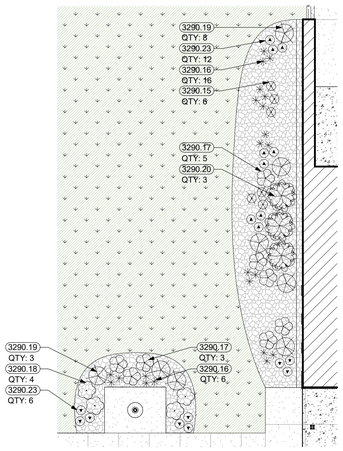
3290.10	RIVER ROCK
3290.15	DAYLILY
3290.16	KATIE'S RUELLIA
3290.17	YELLOW YUCCA
3290.18	RED YUCCA
3290.19	PINE MUHLY GRASS
3290.20	TEXAS SAGE
3290.21	VITEX CHASTE TREE
3290.22	LIVE OAK
3290.23	SOCIETY GARLIC
3290.24	LANDSCAPE BOULDER



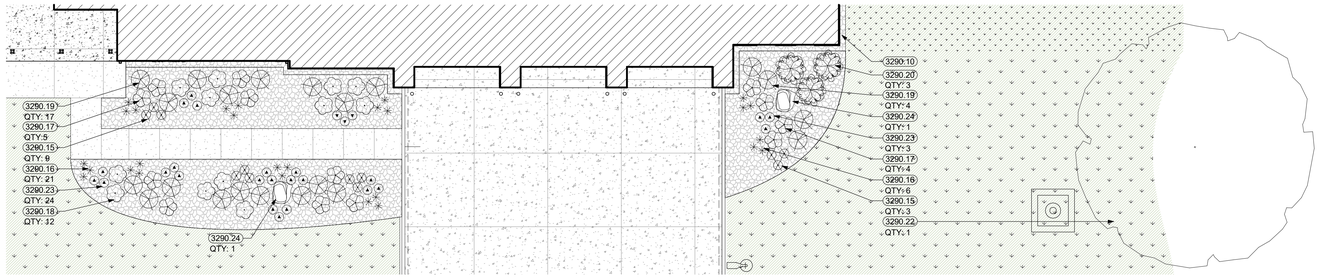
2 LANDSCAPE PLAN
1" = 10'-0"



1 LANDSCAPE PLAN
1" = 10'-0"



4 LANDSCAPE PLAN
1" = 10'-0"



3 LANDSCAPE PLAN
1" = 10'-0"

LANDSCAPE LEGEND

SYMBOL	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
	---	CYNODON DACTYLON	BERMUDA GRASS SOD	---	SEE SPECIFICATIONS
	---	CYNODON DACTYLON	BERMUDA GRASS HYDROMULCH	---	SEE SPECIFICATIONS
	---	---	RIVER ROCK	1774 SF	SEE SPECIFICATIONS
	54	TULBAGHIA VIOLACEA	SOCIETY GARLIC	1 GAL	24" TRIANGULAR SPACING
	28	HEMEROCALLIS 'STELLA DE ORO'	DAYLILY	1 GAL	24" TRIANGULAR SPACING
	59	RUELLIA BRITTONIANA 'KATIE'	KATIE'S DWARF RUELLIA	1 GAL	24" TRIANGULAR SPACING
	32	HESPERALOE PARVIFLORA 'YELLOW'	YELLOW YUCCA	3 GAL	36" SPACING
	41	HESPERALOE PARVIFLORA	RED YUCCA	3 GAL	36" SPACING
	70	MUHLENBERGIA DUBIA	PINE MUHLY GRASS	3 GAL	36" - 48" SPACING
	26	LEUCOPHYLLUM FRUTESCENS 'SILVERADO	'SILVERADO' TEXAS SAGE	3 GAL	36" - 48" SPACING
	5	---	BOULDER	2' DIA	---

LANDSCAPE LEGEND CONTINUED

SYMBOL	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	REMARKS
	20	---	EXISTING TREE	---	--
	6	VITEX AGNUS-CASTUS	VITEX	30 GALLON	MULTI-TRUNK TREE
	3	QUERCUS VIRGINIANA	LIVE OAK	2-1/2" CALIPER MIN.	SINGLE STRAIGHT TRUNK

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

10/24/2024

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

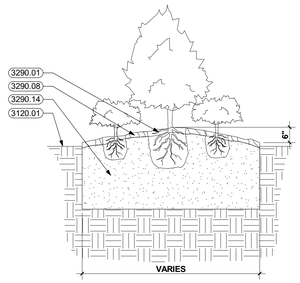
NO.	REVISION	DATE

L1.2

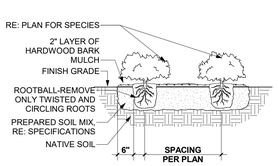
ENLARGED LANDSCAPE PLAN

KEYNOTES

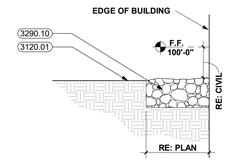
3120.01	GRADE
3120.02	COMPACTED SELECT FILL
3290.01	LANDSCAPE BED
3290.03	METAL EDGING
3290.08	MULCH
3290.10	RIVER ROCK
3290.14	PREPARED SOIL MIX



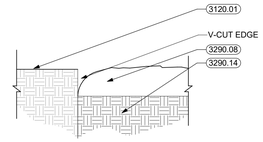
5 LANDSCAPE DETAIL
1/2" = 1'-0"



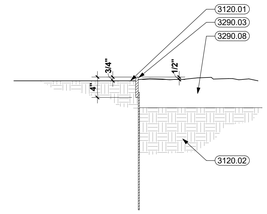
4 LANDSCAPE DETAIL
1/2" = 1'-0"



3 LANDSCAPE DETAIL
1" = 1'-0"



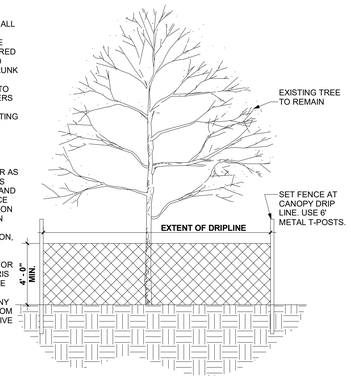
2 METAL EDGE DETAIL
1" = 1'-0"



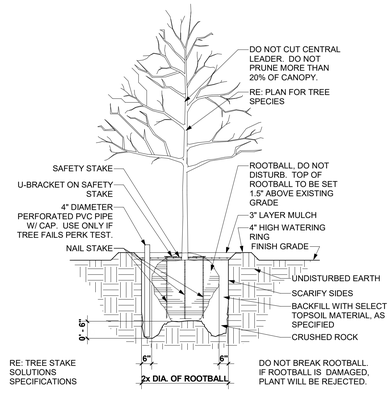
1 LANDSCAPE DETAIL
1" = 1'-0"

NOTES:

1. PRIOR TO SITEWORK, ALL TREES TO RECEIVE PROTECTION MUST BE FLAGGED WITH COLORED VINYL TAPE WRAPPED AROUND THE MAIN TRUNK AT THE HEIGHT OF AT LEAST 4' FEET SO AS TO BE VISIBLE TO WORKERS ON FOOT OR DRIVING EQUIPMENT. ALL EXISTING TREES SHALL REMAIN UNHARMED UNLESS DESIGNATED FOR REMOVAL.
2. TREE PROTECTIVE FENCING MUST OCCUR AS SHOWN ON THE PLANS PRIOR TO SITEWORK AND MUST REMAIN IN-PLACE UNTIL AFTER IRRIGATION TRENCHING HAS BEEN COMPLETE.
3. DURING CONSTRUCTION, NO EXCESS SOIL, ADDITIONAL FILL, EQUIPMENT, LIQUIDS, OR CONSTRUCTION DEBRIS MAY BE PLACED INSIDE THE PROTECTIVE FENCING, NOR MAY ANY SOIL BE REMOVED FROM WITHIN THE PROTECTIVE FENCING.



7 LANDSCAPE DETAIL
1/4" = 1'-0"



6 LANDSCAPE DETAIL
1/4" = 1'-0"

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

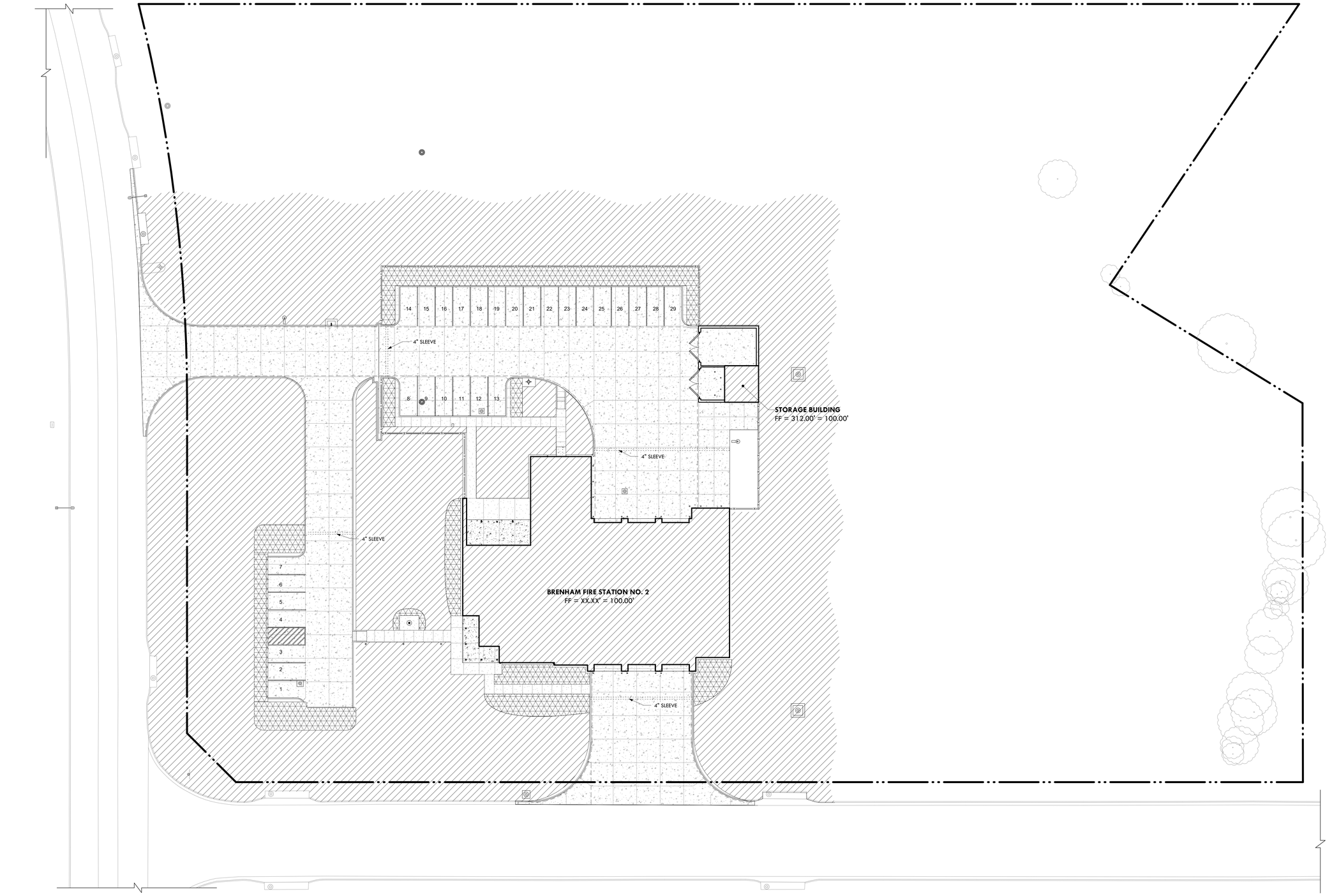
10/24/2024

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

L1.3
LANDSCAPE DETAILS



TRUE NORTH PLAN NORTH

1 IRRIGATION PLAN

1" = 20'-0"

IRRIGATION LEGEND

SYMBOL	DESCRIPTION	MANUFACTURER	MODEL NO.
	AREA TO BE IRRIGATED WITH SPRAY HEADS / ROTARY HEADS	--	--
	PLANTING BEDS AND TREES TO BE DRIP IRRIGATED	--	--

IRRIGATION NOTES

1. PREPARE DESIGN AND COORDINATE INSTALLATION OF REQUIRED SLEEVES WITH OTHER TRADES AS REQUIRED, PRIOR TO PAVING WORK. WHERE EXISTING PAVING TO REMAIN IS IN THE PATH OF IRRIGATION LINES, INCLUDE BORING AS REQUIRED TO INSTALL NEW IRRIGATION SYSTEM, UNLESS OTHERWISE NOTED IN DRAWINGS.
2. ALL UTILITIES UNDER HARD (PAVED) SURFACES SHALL BE SLEEVED.
3. COORDINATE WORK EMBEDDED IN CONCRETE OR MASONRY, OR ROUTED UNDER PAVED AREAS. PROVIDE SLEEVES AS REQUIRED.

REGISTERED ARCHITECT RAIN HOLLIDAY 29435 STATE OF TEXAS
10/24/2024

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

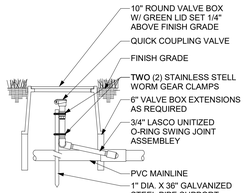
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

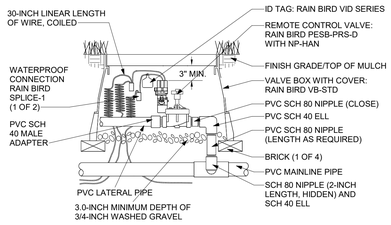
L1.4

IRRIGATION PLAN

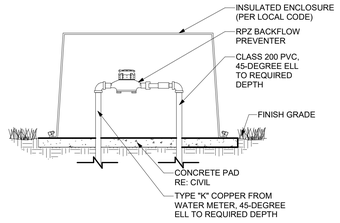
KEYNOTES



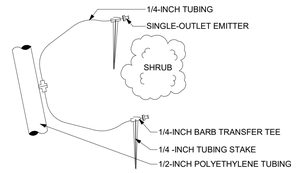
6 COUPLING VALVE
12" = 1'-0"



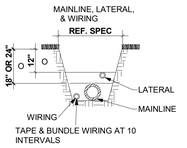
5 PEB VALVE
12" = 1'-0"



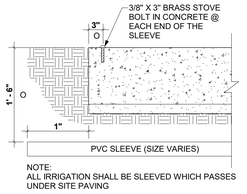
4 BACKFLOW PREVENTER
12" = 1'-0"



3 EMITTER DETAIL
12" = 1'-0"

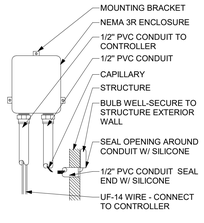


2 TRENCHING DETAIL
12" = 1'-0"

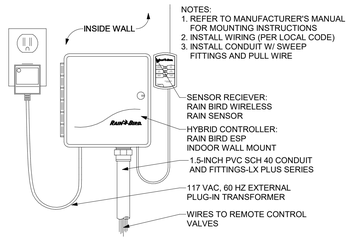


NOTE:
ALL IRRIGATION SHALL BE SLEEVED WHICH PASSES UNDER SITE PAVING

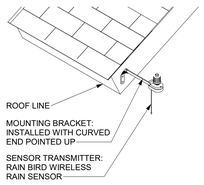
1 PVC SLEEVE DETAIL
N.T.S.



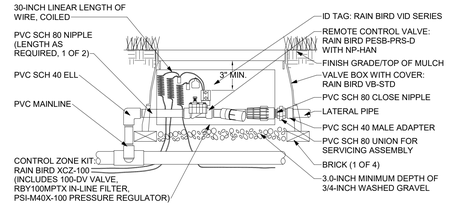
11 TEMPERATURE SENSOR
12" = 1'-0"



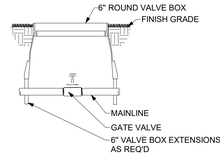
10 SPRINKLER CONTROLLER
12" = 1'-0"



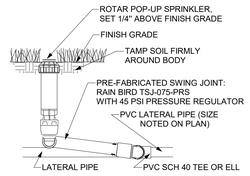
9 RAIN SENSOR
12" = 1'-0"



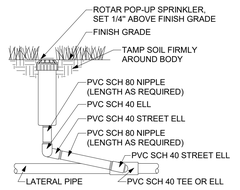
8 GATE VALVE DETAIL
12" = 1'-0"



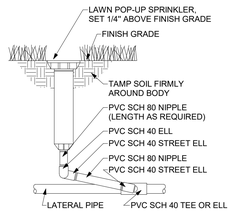
7 GATE VALVE DETAIL
12" = 1'-0"



14 ROTOR 5000 SERIES HEAD
12" = 1'-0"



13 ROTOR 3500 SERIES HEAD
12" = 1'-0"



12 SPRAY 1800 SERIES HEAD
12" = 1'-0"

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

10/24/2024

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

L1.5

IRRIGATION DETAILS

ABBREVIATION LIST

ACP	AUGER CAST PILE	MIN.	MINIMUM
ADD.	ADDITIONAL	MISC.	MISCELLANEOUS
ALT.	ALTERNATIVE	MPH	MILES/ HOUR
ARCH.	ARCHITECT, ARCHITECTURAL	N/A	NOT APPLICABLE
ASI	ARCHITECT'S SUPPLEMENTAL INSTRUCTIONS	NS	NON-SHRINK
BOS	BOTTOM OF STEEL	NTE	NOT TO EXCEED
BP	BASE PLATE	NTS	NOT TO SCALE
CJ	CONTROL JOINT	NWC	NORMAL WEIGHT CONCRETE
CJP	COMPLETE JOINT PENETRATION	OC	ON CENTER
CL, ℄	CENTER LINE	OCEW	ON CENTER EACH WAY
CMU	CONCRETE MASONRY UNIT	OPP.	OPPOSITE
COL.	COLUMN	PAR.	PARALLEL
COMP.	COMPOSITE	PEMB	PRE-ENGINEERED METAL BUILDING
CONT.	CONTINUOUS	PERP.	PERPENDICULAR
CU.	CUBIC	PJP	PARTIAL JOINT PENETRATION
d_b	BAR DIAMETER	PI	PLASTICITY INDEX
DF	DOUGLAS FIR	PLF	LBS/ LINEAR FOOT
DIA., Ø	DIAMETER	PSF	LBS/ SQUARE FOOT
EA.	EACH	PSI	LBS/ SQUARE INCH
EJ	EXPANSION JOINT	PSL	PARALLEL STRAND LUMBER
EMBED.	EMBEDMENT	PW	PUDDLE WELD
EN	EDGE NAILING	QA	QUALITY ASSURANCE
EOR	ENGINEER OF RECORD	QC	QUALITY CONTROL
EP	EMBED PLATE	QTY.	QUANTITY
EQ.	EQUAL	REC.	RECOMMENDED
EQUIP.	EQUIPMENT	REF.	REFERENCE
EXT.	EXTERIOR	REINF.	REINFORCEMENT
FFE	FINISH FLOOR ELEVATION	REQ.	REQUIRED
GA.	GAUGE	RFI	REQUEST FOR INFORMATION
GALV.	GALVANIZED	SEC.	SECOND
GC	GENERAL CONTRACTOR	SF	SQUARE FEET
GFCMU	GROUT FILLED CONCRETE MASONRY UNIT	SIM.	SIMILAR
GR.	GRADE	SPEC.	SPECIFICATION
HCA	HEADED CONCRETE ANCHOR	SPF	SPRUCE PINE FIR
IN^2	SQUARE INCHES	STD.	STANDARD
INFO.	INFORMATION	SYP	SOUTHERN YELLOW PINE
INT.	INTERMEDIATE	T&B	TOP AND BOTTOM
K	KIP (1,000 LBS)	TBS	TO BE SIZED
KD	KILN DRIED	THK.	THICKNESS
LBS	POUNDS	TJI	TRUSS JOIST I-JOIST
LG	LIGHT GAUGE	TOC	TOP OF CONCRETE
LW	LIGHT WEIGHT	TOS	TOP OF STEEL
LSL	LAMINATED STRAND LUMBER	TSW	TOP SEAM WELD
LVL	LAMINATED VENEER LUMBER	TYP.	TYPICAL
LW	LIGHT WEIGHT	UNO	UNLESS NOTED OTHERWISE
MAX.	MAXIMUM	US	UNDERSIDE
MECH.	MECHANICAL	W/	WITH
MEP	MECHANICAL ELECTRICAL PLUMBING	W/C	WATER-CEMENT RATIO
MFR	MANUFACTURER	W/O	WITHOUT
MIL	0.001"	WWF	WELDED WIRE FABRIC

GENERAL

1. STRUCTURAL DESIGN BASED ON ARCHITECTURAL PLANS PROVIDED BY BRW ARCHITECTS.
2. FOR REFERENCED STANDARDS OF DESIGN AND CONSTRUCTION REFER TO CHAPTER 35 OF THE INTERNATIONAL BUILDING CODE (IBC). WHERE OTHER STANDARDS ARE NOTED IN THE DRAWINGS, USE THE LATEST EDITION OF THE STANDARD UNLESS A SPECIFIC DATE IS INDICATED. REFERENCE TO A SPECIFIC SECTION IN A CODE DOES NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE ENTIRE STANDARD. ALL SPECIFICATIONS AND CODES NOTED SHALL BE THE LATEST APPROVED EDITIONS AND REVISIONS BY THE AUTHORITY HAVING JURISDICTION OVER THIS PROJECT.
3. WHERE CONFLICTS EXISTS AMONG THE VARIOUS PARTS OF THE STRUCTURAL CONTRACT DOCUMENTS, STRUCTURAL DRAWINGS, GENERAL NOTES, AND SPECIFICATIONS, THE STRICTEST REQUIREMENTS SHALL GOVERN, UNLESS APPROVED OTHERWISE.
4. STRUCTURAL DRAWINGS SHALL BE COORDINATED WITH MECHANICAL, ELECTRICAL, PLUMBING, CIVIL, AND ARCHITECTURAL DRAWINGS. WHERE DISCREPANCIES OCCUR BETWEEN STRUCTURAL DOCUMENTS AND OTHER DISCIPLINES, THE STRUCTURAL ENGINEER SHALL BE CONTACTED.
5. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO OBTAIN ALL CONTRACT DOCUMENTS AND LATEST RFI, ASI, AND/OR ADDENDA AND TO SUBMIT SUCH DOCUMENTS TO ALL SUBCONTRACTORS AND MATERIAL SUPPLIERS PRIOR TO THE SUBMITTAL OF SHOP DRAWINGS, FABRICATION OF ANY STRUCTURAL MEMBERS, OR CONSTRUCTION.
6. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS PRIOR TO STARTING CONSTRUCTION. THE CONTRACTOR SHALL FIELD VERIFY STRUCTURES NOTED IN THE DRAWINGS AS EXISTING. ANY DISCREPANCIES SHALL BE REPORTED TO THE ARCHITECT AND STRUCTURAL ENGINEER.
7. DO NOT SCALE DRAWINGS FOR QUANTITY, LENGTH, OR FIT OF MATERIALS.
8. THE STRUCTURAL DRAWINGS ARE INTENDED TO SHOW THE GENERAL CHARACTER AND EXTENT OF THE PROJECT AND ARE NOT INTENDED TO SHOW ALL DETAILS OF THE WORK. DETAILS, SECTIONS, AND NOTES SHOWN ON THESE DRAWINGS ARE INTENDED TO BE TYPICAL AND SHALL APPLY TO SIMILAR CONDITIONS ELSEWHERE UNLESS NOTED OR SHOWN OTHERWISE. IF LOCATIONS ARE FOUND WHERE NO TYPICAL OR SPECIFIC DETAIL OR TYPICAL SCHEDULE APPLIES, NOTIFY THE ARCHITECT AND STRUCTURAL ENGINEER.
9. THE CONTRACTOR IS RESPONSIBLE FOR THE MEANS AND METHODS OF CONSTRUCTION AND ALL JOB RELATED SAFETY STANDARDS SUCH AS OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA). THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING, BUT NOT LIMITED TO: ADEQUATE EXCAVATION PROCEDURES, SHORING, BRACING, AND ERECTION PROCEDURES COMPLYING WITH NATIONAL, STATE, AND LOCAL SAFETY ORDINANCES.
10. THE STRUCTURE HAS BEEN DESIGNED FOR THE LOADS IDENTIFIED WITHIN THESE STRUCTURAL DRAWINGS THAT ARE ANTICIPATED TO BE APPLIED TO THE FINAL STRUCTURE ONCE COMPLETED AND OCCUPIED.
    A. THESE DRAWINGS DO NOT DEPICT ANY SECONDARY STRUCTURAL ELEMENTS WHICH MAY BE REQUIRED UNLESS SPECIFICALLY NOTED OTHERWISE. SECONDARY STRUCTURAL ELEMENTS INCLUDE, BUT ARE NOT LIMITED TO: SUPPORT BEAMS ABOVE THE PRIMARY ROOF STRUCTURE TO SUPPORT MECHANICAL EQUIPMENT, ROOFTOP MECHANICAL CURBS, ELEVATOR SUPPORT RAILS AND BEAMS, RETAINING WALLS INDEPENDENT OF THE PRIMARY BUILDING, LIGHT POLE OR FLAG POLE FOUNDATIONS, ANCHORAGE AND SUPPORT OF MECHANICAL AND ELECTRICAL EQUIPMENT/PIPING/DUCTWORK, NON-BEARING PARTITIONS, GUARD RAILS AND POSTS, STAIR FRAMING, STAIR RAILINGS, AND EXTERIOR CURTAIN WALLS AND CLADDING.
    B. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING THE ADEQUACY OF THE STRUCTURE TO SUPPORT ANY APPLIED CONSTRUCTION LOADS, INCLUDING, BUT NOT LIMITED TO: THOSE DUE TO CONSTRUCTION VEHICLES OR EQUIPMENT, MATERIAL HANDLING OR STORAGE, SHORING OR RESHORING, AND ANY OTHER CONSTRUCTION ACTIVITY. THE CONTRACTOR SHALL CONTACT GESSNER ENGINEERING FOR ANY CONSTRUCTION LOADS THAT ARE IN EXCESS OF THE STATED DESIGN LOADS.
    C. CONSTRUCTION MATERIALS SHALL BE SPREAD OUT IF PLACED ON FRAMED FLOORS OR ROOFS AND SHALL NOT EXCEED THE DESIGN LIVE LOAD PER SQUARE FOOT. DO NOT IMPACT POURED OR ERECTED FLOORS OR ROOFS WHEN PLACING MATERIALS.
11. THE BUILDING OWNER SHALL ESTABLISH A PLANNED PROGRAM OF MAINTENANCE TO ENSURE STRUCTURAL INTEGRITY FROM EXPOSURE TO THE ENVIRONMENT. THIS PROGRAM SHALL INCLUDE, BUT IS NOT LIMITED TO: PAINTING OF STRUCTURAL STEEL, PROTECTIVE COATING FOR CONCRETE, SEALANTS, CAULKED JOINTS, EXPANSION JOINTS, CONTROL JOINTS, SPALLS AND CRACKS IN CONCRETE, AND PRESSURE WASHING OF EXPOSED STRUCTURAL ELEMENTS EXPOSED TO A CORROSIVE ENVIRONMENT.

DESIGN CRITERIA

1. THE STRUCTURE IS DESIGNED IN ACCORDANCE WITH THE INTERNATIONAL BUILDING CODE (IBC), 2018 EDITION.
2. DEAD LOADS:
    A. DESIGN DEAD LOADS INCLUDE THE WEIGHT OF THE STRUCTURE, MATERIALS, COMPONENTS, PERMANENT FIXTURES, AND 4 PSF MECHANICAL DUCT ALLOWANCE.
    B. LOADING FOR MECHANICAL AND ELECTRICAL EQUIPMENT IS BASED ON THE WEIGHTS OF ASSUMED EQUIPMENT AS INDICATED ON THE STRUCTURAL DRAWINGS (INCLUDING THE WEIGHT OF CONCRETE PADS WHERE INDICATED ON MEP DRAWINGS). ANY DISCREPANCIES OR CHANGES IN THE TYPE, SIZE, LOCATION, OR NUMBER OF PIECES OF EQUIPMENT SHOULD BE REPORTED TO THE STRUCTURAL ENGINEER FOR VERIFICATION OF THE ADEQUACY OF SUPPORTING MEMBERS PRIOR TO PLACEMENT OF EQUIPMENT.
    C. MAXIMUM FACADE DEAD LOADS:
        - STONE/BRICK VENEER - 40 PSF
        - CURTAIN WALLS - 15 PSF
        - METAL PANEL - 3 PSF
        - ROOF ASSEMBLIES - 8 PSF
3. LIVE LOADS:
    A. FOOTNOTES ACCORDING TO THE IBC AND ASCE 7 SHALL PERTAIN AS APPLICABLE.
    B. IN AREAS WHERE PARTITIONS ARE ERECTED OR WILL BE REARRANGED, AN ALLOWANCE OF 15 PSF HAS BEEN MADE FOR PARTITIONS AS A UNIFORMLY DISTRIBUTED LIVE LOAD WHERE THE LIVE LOAD AS STATED BELOW IS 80 PSF OR LESS.
    C. DESIGN LIVE LOADS ARE BASED ON THE MORE RESTRICTIVE OF THE UNIFORM LOAD LISTED BELOW OR THE CONCENTRATED LOAD LISTED ACTING OVER AN AREA 2' - 6" SQUARE OR, IN THE CASE OF PARKING GARAGES 20 IN^2, OR STAIR TREADS, 4 IN^2.
    D. LIVE LOADS HAVE BEEN REDUCED USING THE STANDARD PROCEDURE FROM THE ABOVE REFERENCE CODES.
    E. FOR LIVE LOADS EXCEEDING 100 PSF, NO REDUCTION HAS BEEN MADE, EXCEPT THAT THE DESIGN LIVE LOAD ON MEMBERS SUPPORTING (2) OR MORE FLOORS HAS BEEN REDUCED A MAXIMUM OF 20% BUT THE LIVE LOAD IS NOT TO BE LESS THAN APPLICABLE REDUCTION LIMITS.

CATEGORY	UNIFORM	CONCENTRATED
• ASSEMBLY AREAS, LOBBIES, SUITES, PLAZAS, & TERRACES	100 PSF	2,000 LBS
• UNINHABITABLE ATTIC (NOTE 3)		
WITH STORAGE	20 PSF	-
WITHOUT STORAGE	10 PSF	-
• CORRIDORS & EXITS		
FIRST FLOOR	100 PSF	2,000 LBS
OTHER FLOORS	80 PSF	2,000 LBS
• HEAVY VEHICLE/APPARATUS BAY	250 PSF	AASHTO HS20
• MECHANICAL ROOMS	40 PSF	NOTE 2
• RESTROOMS	60 PSF	-
• ROOF	20 PSF	300 LBS
• STAIRS	100 PSF	300 LBS
• STORAGE ABOVE CEILING (NON-ATTIC)	20 PSF	-

FOOTNOTES:
1. 1.5 TIMES THE UNIFORM LOAD OF THE OCCUPANCY SERVED, NOT REQUIRED TO EXCEED 100 PSF.
2. DESIGN CONCENTRATED LOAD IS THAT REQUIRED BY ASSUMED EQUIPMENT WEIGHT.
3. REFERENCE CODE FOR APPLICABILITY CRITERIA.

4. RISK CATEGORY OF BUILDING: IV
5. WIND DESIGN CRITERIA:
    - ULTIMATE DESIGN WIND SPEED (3 SEC. GUST, V_{ULT}) 130 MPH
    - NOMINAL DESIGN WIND SPEED (V_{ASD}) $V_{ULT} \times \sqrt{0.6}$
    - IMPORTANCE FACTOR 1.0
    - EXPOSURE CATEGORY B
    - INTERNAL PRESSURE COEFFICIENT (GC_{PI}) ±0.18
    - DIRECTIONALITY FACTOR (K_d) 0.85
    - TOPOGRAPHY FACTOR (K_{zt}) 1.0
    - BASIC WIND PRESSURE, (q_h) 24.1 PSF

C&C WALL PRESSURE (PSF)	
ZONE 4	-28.2 / +26
ZONE 5	-34.7 / +26

NOTES:
1. a = 5' - 1"
2. PRESSURES ARE BASED OFF A 10 SF TRIBUTARY AREA

6. SEISMIC DESIGN CRITERIA:
    - IMPORTANCE FACTOR (I_E) 1.0
    - MAPPED SPECTRAL RESPONSE ACCELERATIONS
      S_S 0.064
      S_1 0.038
    - SITE CLASS D
    - SPECTRAL RESPONSE COEFFICIENTS
      S_{DS} 0.043
      S_{D1} 0.025
    - SEISMIC DESIGN CATEGORY A
    - BASIC SEISMIC-FORCE-RESISTING SYSTEM TYPE IV
    - DESIGN BASE SHEAR, (V) N/A
    - SEISMIC RESPONSE COEFFICIENT (C_S) N/A
    - RESPONSE MODIFICATION FACTOR (R) (REF. SYSTEM TYPES)
    - ANALYSIS PROCEDURE USED EQUIVALENT LATERAL FORCE

    SYSTEM TYPES:
    1. LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE, R = 6 1/2
    2. LIGHT-FRAME (COLD-FORMED STEEL) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE OR STEEL SHEETS, R = 6 1/2
    3. ORDINARY REINFORCED MASONRY SHEAR WALLS, R = 2
    4. STEEL SYSTEMS NOT SPECIFICALLY DETAILED FOR SEISMIC RESISTANCE, R = 3
7. SNOW DESIGN CRITERIA:
    - GROUND SNOW LOAD (P_G) 5 PSF
    - FLAT-ROOF SNOW LOAD (P_F) 5 PSF
    - EXPOSURE FACTOR (C_E) 1.0
    - IMPORTANCE FACTOR (I_S) 1.0
    - THERMAL FACTOR (C_T) 1.0
8. RAIN DESIGN CRITERIA:
   THE ROOF DRAINAGE SYSTEM SHALL BE DESIGNED SO THAT RAINWATER LOADS DO NOT EXCEED THE ROOF SNOW OR LIVE LOADS AS STATED IN THE APPLICABLE SECTION.
9. GEOTECHNICAL DESIGN CRITERIA:
    A. SOIL DESIGN PARAMETERS BELOW ARE BASED ON THE GEOTECHNICAL REPORT PROVIDED BY GESSNER ENGINEERING DATED 03/25/2024
    B. THE FOLLOWING DESIGN INFORMATION IS PROVIDED SOLELY FOR REFERENCE AND IS NOT INTENDED TO SUPERSEDE ANY INFORMATION PROVIDED IN THE GEOTECHNICAL REPORT. SHOULD DISCREPANCIES EXIST THROUGHOUT THE DRAWINGS RELATIVE TO THE GEOTECHNICAL REPORT, THE CONTRACTOR SHALL CONTACT GESSNER ENGINEERING FOR ADDITIONAL INFORMATION.
    C. STIFFENED SLAB DESIGNS ARE BASED ON "CRITERIA FOR SELECTION AND DESIGN OF RESIDENTIAL SLABS-ON-GRADE" (REPORT #33) BY THE BUILDING RESEARCH ADVISORY BOARD (BRAB) AND "DESIGN OF SLAB ON GROUND FOUNDATIONS" (TF 700-R-07) BY THE WIRE REINFORCEMENT INSTITUTE (WRI). THE FOLLOWING PARAMETERS ARE USED IN THE DESIGN:
        - EFFECTIVE PLASTICITY INDEX 34
        - CLIMATIC RATING (C_W) 21
    D. ALLOWABLE BEARING CAPACITIES:

		CAPACITY (PSF)
DRILLED PIERS	END BEARING (FS = 2,3)	13,500 / 9,000
	SKIN FRICTION (FS = 2)	1,600

NOTES:
1. FACTOR OF SAFETY (FS) = (TOTAL LOAD), (DEAD + SUSTAINED LIVE)
2. CAPACITIES LISTED REFLECT THOSE SHOWN IN THE GEOTECHNICAL REPORT.
3. REF. DETAILS FOR MINIMUM BEARING DEPTHS.

SPECIAL INSPECTIONS AND REPORTS

1. SPECIAL INSPECTIONS AND TESTING SHALL BE DONE IN ACCORDANCE WITH THE STATEMENT OF SPECIAL INSPECTIONS PER IBC CHAPTER 17, AS APPLICABLE PER THE FOLLOWING CRITERIA.
2. THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE (RDPIRC) FOR THIS PROJECT SHALL BE DESIGNATED BY THE OWNER. SUBMIT ALL SPECIAL INSPECTION REPORTS DIRECTLY TO THE RDPIRC AND BUILDING OFFICIAL FOR REVIEW. THE RDPIRC SHALL FORWARD ALL THE STRUCTURALLY RELATED SPECIAL INSPECTION REPORTS TO THE STRUCTURAL ENGINEER FOR REVIEW.
3. SPECIAL INSPECTORS SHALL BE CONTRACTED BY THE OWNER OR THE OWNER'S AUTHORIZED AGENT. SPECIAL INSPECTORS SHALL BE QUALIFIED PER THE REQUIREMENTS LISTED IN SECTION 1704.2.
4. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR COORDINATING ALL TESTING, INSPECTIONS, AND NOTIFYING THE ARCHITECT/ENGINEER, SPECIAL INSPECTORS, AND BUILDING OFFICIAL PER SECTION 110.3, OF WORK READY FOR INSPECTION. THE GENERAL CONTRACTOR MUST PROVIDE ACCESS TO AND MEANS FOR PROPER INSPECTION OF SUCH WORK.
5. THE SPECIAL INSPECTOR SHALL OBSERVE THE WORK ASSIGNED FOR CONFORMANCE WITH THE APPROVED, MOST CURRENT DESIGN DOCUMENTS AND SPECIFICATIONS, AND SHALL PROVIDE REPORTS TO THE BUILDING OFFICIAL, THE ARCHITECT/ENGINEER, AND OTHER DESIGNATED PERSONS.
6. THE SPECIAL INSPECTOR SHALL REPORT ALL DISCREPANCIES TO THE IMMEDIATE ATTENTION OF THE CONTRACTOR FOR CORRECTION, THEN IF UNCORRECTED, TO THE PROPER DESIGN AUTHORITY AND TO THE BUILDING OFFICIAL.
7. THE SPECIAL INSPECTOR SHALL SUBMIT A FINAL SIGNED REPORT STATING WHETHER THE WORK REQUIRING SPECIAL INSPECTION WAS, TO THE BEST OF THE INSPECTOR'S KNOWLEDGE, IN CONFORMANCE WITH THE APPROVED PLANS AND SPECIFICATIONS AND APPLICABLE STANDARDS OF QUALITY AND WORKMANSHIP OF THE IBC.
8. ADDITIONAL INSPECTIONS MAY BE REQUIRED BY THE GOVERNING JURISDICTION. THE BELOW REQUIREMENTS ARE MINIMUM PROJECT STANDARDS.
9. STRUCTURAL OBSERVATIONS SHALL BE PERFORMED BY A LICENSED DESIGN PROFESSIONAL OR THEIR REPRESENTATIVE DURING PERIODIC SITE VISITS. THESE OBSERVATIONS DO NOT CONSTITUTE A SPECIAL INSPECTION. STRUCTURAL OBSERVATIONS SHALL BE PERFORMED FOR THE WORK LISTED BELOW:
    A. CONCRETE CONSTRUCTION
       OBSERVE PLACEMENT OF REINFORCING STEEL, ANCHOR RODS, AND OTHER EMBEDDED COMPONENTS PRIOR TO PLACEMENT OF CONCRETE.
    B. STRUCTURAL STEEL
       REVIEW INSTALLATION OF FRAMING COMPONENTS AND CONNECTORS IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS.
    C. COLD FORMED METAL FRAMING
       REVIEW INSTALLATION OF FRAMING COMPONENTS AND CONNECTORS IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS.
    D. WIND RESISTANCE (WOOD OR COLD-FORMED)
       REVIEW INSTALLATION OF NAILING/SCREW ATTACHMENT, BOLTING, ANCHORING, AND OTHER FASTENING OF ELEMENTS OF THE MAIN WIND FORCE RESISTING SYSTEM, INCLUDING SHEAR WALLS, DIAPHRAMS, DRAG STRUTS, BRACES, AND HOLDOWNS IN ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS.
10. SPECIAL INSPECTIONS REQUIRED FOR THIS PROJECT INCLUDE, BUT ARE NOT LIMITED TO:
    A. CONCRETE CONSTRUCTION (PER IBC SECTION 1705.3)
        1. PERIODIC INSPECTIONS:
            a. PLACEMENT OF STEEL REINFORCEMENT.
            b. WELDING OF STEEL REINFORCEMENT.
            c. PLACEMENT OF HEADED BOLTS AND EMBEDDED FABRICATIONS.
            d. VERIFY USE OF REQUIRED DESIGN MIXTURE.
            e. VERIFY CURING PROCEDURES AND MAINTENANCE OF CURING TEMPERATURE.
            f. VERIFY CONCRETE STRENGTH BEFORE REMOVAL OF SHORES AND FORMS FROM BEAMS AND SLABS.
        2. CONTINUOUS INSPECTIONS:
            a. PLACEMENT OF CONCRETE.
            b. FABRICATION OF SPECIMENS FOR STRENGTH TEST; MINIMUM (1) SET FOR 100 YDS.
            c. DETERMINATION OF SLUMP, AIR CONTENT, AND TEMPERATURE.
    B. STRUCTURAL MASONRY
        1. SPECIAL INSPECTIONS PER IBC SECTION 1705.4 AND ACI 530.
            A. PERIODIC INSPECTIONS:
                a. VERIFY COMPLIANCE WITH APPROVED SUBMITTALS.
                b. PROPORTIONS OF SITE-PREPARED MORTAR.
                c. GRADE, TYPE, AND SIZE OF REINFORCEMENT ANCHOR BOLTS.
                d. PLACEMENT OF MASONRY UNITS AND CONSTRUCTION OF MORTAR JOINTS.
                e. SIZE AND LOCATION OF STRUCTURAL ELEMENTS.
                f. PROTECTION OF MASONRY DURING HOT WEATHER (ABOVE 90˚F) OR COLD WEATHER (BELOW 40˚ F)
            B. CONTINUOUS INSPECTION:
                a. PLACEMENT OF REINFORCEMENT AND CONNECTORS.
                b. GROUT SPACE PRIOR TO GROUTING.
                c. TYPE, SIZE, AND LOCATION OF ANCHORS INCLUDING OTHER DETAILS OF ANCHORAGE OF MASONRY TO STRUCTURAL MEMBERS, FRAMES, OR OTHER CONSTRUCTION OF REINFORCEMENT, CONNECTORS, AND ANCHORAGES.
                d. INSPECTION AND OBSERVATION OF GROUT SPECIMENS, MORTAR SPECIMENS AND/OR PRISMS. MINIMUM (1) SET PER 5,000 SF OF WALL AREA.
    C. SOILS CONSTRUCTION (PER IBC SECTION 1705.6)
        1. PERIODIC INSPECTIONS:
            a. VERIFY EXCAVATIONS ARE EXTENDED TO PROPER DEPTH AND HAVE REACHED PROPER MATERIAL.
            b. VERIFY MATERIALS BELOW SHALLOW FOUNDATIONS ARE ADEQUATE TO ACHIEVE THE DESIGN BEARING CAPACITY.
            c. INSPECT SUBGRADE AND VERIFY THAT SITE HAS BEEN PREPARED PROPERLY PRIOR TO PLACEMENT OF COMPACTED FILL.
            d. PERFORM CLASSIFICATION AND TESTING OF MATERIALS TO BE USED FOR FILL.
        2. CONTINUOUS INSPECTIONS:
            a. VERIFY USE OF PROPER MATERIALS, MOISTURE CONTENT, DENSITIES, AND LIFT THICKNESS DURING PLACEMENT AND COMPACTION OF COMPACTED FILL.
            b. REVIEW APPROVED GEOTECHNICAL REPORT FOR COMPLIANCE AND ADDITIONAL TESTING REQUIREMENTS.
    D. CAST-IN-PLACE DEEP FOUNDATIONS (PER IBC SECTION 1705.8)
        1. CONTINUOUS INSPECTIONS:
            a. INSPECT DRILLING OPERATIONS AND MAINTAIN COMPLETE AND ACCURATE RECORDS FOR EACH ELEMENT.
            b. VERIFY PLACEMENT LOCATIONS AND PLUMBNESS.
            c. CONFIRM ELEMENT DIAMETERS, BELL DIAMETERS (IF APPLICABLE), LENGTHS, EMBEDMENT INTO BEDROCK (IF APPLICABLE) AND ADEQUATE END-BEARING STRATA CAPACITY.
            d. RECORD CONCRETE OR GROUT VOLUMES.
            e. PERFORM TEST AND ADDITIONAL SPECIAL INSPECTIONS FOR CONCRETE ELEMENTS AS NOTED IN THE CONCRETE CONSTRUCTION SECTION.
        2. REVIEW APPROVED GEOTECHNICAL REPORT FOR COMPLIANCE AND ADDITIONAL TESTING REQUIREMENTS.
    E. STRUCTURAL STEEL (PER IBC SECTION 1705.2 AND AISC 360, CHAPTERS M & N.)
        1. PERIODIC INSPECTIONS:
            a. PRIOR TO THE START OF FABRICATION:
                - VERIFY SHOP COMPLIANCE WITH AISC CHAPTER N, SECTIONS N2 AND N3, AND AWS D1.1 FOR COMPLETENESS AND ADEQUACY OF FABRICATION AND QUALITY CONTROL PROCEDURES.
            b. INSPECTION PERSONNEL SHALL BE AN AWS CERTIFIED WELD INSPECTOR (CWI) UNLESS OTHERWISE APPROVED BY THE ENGINEER OF RECORD (EOR).
            c. INSPECTION OF WELDING SHALL BE IN ACCORDANCE WITH TABLES N5.4-1, N5.4-2, AND N5.4-3.
            d. NON-DESTRUCTIVE TESTING OF WELDED JOINTS WITH TABLE N5.5:
                - CJP GROOVE WELDS OF MATERIALS IN THICKNESS EQUAL TO OR GREATER THAN 5/16" IS REQUIRED PER SECTION N5.5b.
            e. INSPECTION OF HIGH-STRENGTH BOLTING SHALL BE IN ACCORDANCE WITH TABLES N5.6-1, N5.6-2, AND N5.6-3.
            f. INSPECTION OF GALVANIZED MATERIALS SHALL BE IN ACCORDANCE WITH SECTION N5.7.
            g. INSPECT ERECTED STEEL FRAME FOR COMPLIANCE WITH THE CONSTRUCTION DOCUMENTS.
        2. SPECIAL INSPECTION RESPONSIBILITIES BY THE OWNER ARE PERMITTED TO BE WAIVED WHEN THE REQUIREMENTS OF SECTION N6 ARE MET.
    F. COLD-FORMED METAL FRAMING
       PERFORM TESTS AND ADDITIONAL SPECIAL INSPECTIONS IN ACCORDANCE WITH THE STRUCTURAL STEEL SECTION.
    G. POST-INSTALLED ANCHORS TO CONCRETE AND MASONRY
       SPECIAL INSPECTIONS PER MANUFACTURER'S ICC EVALUATION REPORT OR AT A MINIMUM AS SPECIFIED BELOW:
        1. PERIODIC INSPECTIONS:
            a. INSPECT MECHANICAL ANCHORS AND ADHESIVE ANCHORS FOR COMPLIANCE WITH CONSTRUCTION DOCUMENTS.
        2. CONTINUOUS INSPECTIONS:
            a. ADHESIVE ANCHORS INSTALLED HORIZONTALLY OR UPWARDLY INCLINED ORIENTATIONS TO RESIST SUSTAINED TENSION LOADS.
    H. FABRICATED ITEMS
        1. FABRICATORS SHALL BE APPROVED TO PERFORM SUCH WORK IN ACCORDANCE WITH SECTION 1704.2.5.1 WITHOUT SPECIAL INSPECTION.
        2. SHOULD A NON-APPROVED FABRICATOR BE USED, ADDITIONAL SPECIAL INSPECTION REQUIREMENTS SHALL BE MET IN ACCORDANCE WITH SECTION 1704.2.5.
    I. WIND RESISTANCE (PER IBC SECTION 1705.11)
        1. PERIODIC INSPECTIONS (FOR WOOD & COLD-FORMED FRAMING):
            a. INSPECT NAILING/SCREW ATTACHMENT, BOLTING, ANCHORING, AND OTHER FASTENING OF ELEMENTS OF THE MAIN WIND FORCE RESISTING SYSTEM, INCLUDING SHEAR WALLS, DIAPHRAGMS, DRAG STRUTS, BRACES, AND HOLDOWNS.
            b. INSPECT ROOF COVERING, ROOF DECK, AND ROOF FRAMING CONNECTIONS.
            c. INSPECT EXTERIOR WALL COVERING& WALL CONNECTIONS TO THE ROOF, FLOOR, AND DIAPHRAGM FRAMING.
        2. CONTINUOUS INSPECTIONS (FOR WOOD):
            a. INSPECT GLUING OPERATIONS OF ELEMENTS OF THE MAIN-WIND FORCE RESISTING SYSTEM.
        3. CONTINUOUS INSPECTIONS (FOR COLD-FORMED FRAMING):
            a. INSPECT WELDING OPERATIONS OF ELEMENTS OF THE MAIN-WIND FORCE RESISTING SYSTEM.
        4. EXCEPTIONS TO THE INSPECTIONS MAY BE MADE IN ACCORDANCE WITH THE CODE, AND AS APPROVED BY THE RDPIRC.

GENERAL FOUNDATION

1. DIMENSIONS OF FOUNDATION ELEMENTS INDICATE MINIMUM ACCEPTABLE SIZES. LARGER SIZES FORMED BY LESS ACCURATE CONSTRUCTION MAY REQUIRE ADDITIONAL REINFORCING NOT SHOWN, WHICH SHALL BE DETERMINED BY THE STRUCTURAL ENGINEER DURING THE CONSTRUCTION OBSERVATION PROCESS. CUT HAUNCHES ON EACH SIDE OF TRENCHES OF ADEQUATE SIZE TO MAINTAIN THE VERTICAL SIDES OF THE TRENCH.
2. GRADE BEAMS AND FOOTINGS SHALL BEAR A MINIMUM OF 12" INTO COMPACTED STRUCTURAL FILL OR COMPETENT NATIVE SOILS. REDUCED PENETRATION DEPTHS INTO BEDROCK SHALL BE PER THE GEOTECHNICAL REPORT OR A MINIMUM OF 3". WHERE NOTED, FOUNDATIONS SHALL BE CONSTRUCTED ON APPROVED VOID FORMS.
3. PLACE MEP LINES BELOW SLABS AND OUTSIDE OF GRADE BEAMS AND FOOTINGS. DO NOT PLACE LINES PARALLEL WITHIN OR PARALLEL BELOW GRADE BEAMS AND FOOTINGS. REFERENCE TYPICAL DETAILS FOR ALLOWABLE PENETRATIONS PERPENDICULAR TO GRADE BEAMS, FOOTINGS AND SLABS. PROVIDE PROTECTION OF MEP LINES CROSSING GRADE BEAMS OR PROJECTING THROUGH THE SLAB TO ALLOW FOR FOUNDATION MOVEMENT.
4. A 2"- 4" PERVIOUS SAND OR GRANULAR LAYER MAY BE PLACED UNDER THE SLAB AT THE CONTRACTOR'S DISCRETION.
5. EXTEND FORMWORK AT LEAST 6" BELOW THE FINISHED GRADE ELEVATION AT PERIMETER BEAMS.
6. A VAPOR RETARDER SHALL BE PLACED UNDER ALL FOUNDATION CONCRETE.
    A. AT A MINIMUM THE VAPOR RETARDER SHALL CONFORM TO IBC "CLASS I" WITH A PERMEANCE OF 0.1 PERMS OR LESS, ASTM E1745 "CLASS C", AND ACI 302.2R WITH A MINIMUM THICKNESS OF 15 MIL. WHERE ARCHITECTURAL PLANS CALL FOR SENSITIVE FLOOR MATERIALS, A VAPOR RETARDER EXCEEDING THE ABOVE SPECIFICATIONS MAY BE REQUIRED.
    B. VAPOR RETARDERS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM E1643, WITH THE MATERIAL CONTINUOUS BELOW FOUNDATION CONCRETE AREAS AND WITH JOINTS LAPPED AT LEAST 6", OR AS INSTRUCTED BY THE MANUFACTURER.
    C. SEAMS, TEARS, AND PENETRATIONS IN THE VAPOR RETARDER SHALL BE SEALED WITH THE MANUFACTURER'S RECOMMENDED ADHESIVE OR PRESSURE SENSITIVE TAPE.
    D. AT SLAB EDGES THE VAPOR RETARDER SHALL BE SEALED TO THE EXTERIOR FACE OF THE PERIMETER FOUNDATION ELEMENT.
7. EXPANSION JOINTS SHALL BE FORMED BY A BITUMINOUS FILLER MATERIAL, COMPLYING WITH ASTM D1751, ASPHALT-SATURATED CELLULOSIC FIGURE. SET 1/2" - 1" BELOW THE SURFACE IN ORDER TO FILL THE JOINT WITH A FLEXIBLE JOINT FILLER. EXTERIOR JOINTS SHALL BE SEALED WITH A TRAFFIC GRADE SEALANT.

REINFORCEMENT

1. ALL REINFORCEMENT WORK SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN:
    A. ACI 318 - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE.
    B. ACI 315 - DETAILS AND DETAILING OF CONCRETE REINFORCEMENT.
2. MATERIALS SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:
    A. REINFORCEMENT - ASTM A615, GRADE 60.
    B. WELDED WIRE FABRIC - ASTM A185, SMOOTH, FLAT SHEET.
3. BARS #3, #4, AND #5 MAY BE COLD BENT IN THE FIELD. FIELD BENDING BEYOND #5 IS NOT PERMISSIBLE.
4. REINFORCEMENT SHALL BE ADEQUATELY SECURED BY WIRE TIES AND SUPPORTED BY PLASTIC, METAL, OR MASONRY SUPPORTS. SPACING OF SUPPORTS SHALL BE AS NECESSARY TO PREVENT SAGGING OF THE REINFORCEMENT UNDER THE WEIGHT OF CONSTRUCTION WORKERS AND WET CONCRETE.
5. WHERE REINFORCEMENT MUST TRANSITION BETWEEN STEPPED ELEMENTS, SLOPE SHALL NOT BE GREATER THAN 1:6 UNLESS NOTED OTHERWISE.
6. CLEAN REINFORCEMENT OF LOOSE RUST AND MILL SCALE, EARTH, ICE, OR OTHER FOREIGN MATERIALS THAT MAY REDUCE BOND TO CONCRETE.
7. THE FOLLOWING MINIMUM CONCRETE COVER SHALL BE PROVIDED FOR REINFORCEMENT FOR CAST-IN-PLACE CONCRETE CONSTRUCTION:

CONCRETE STRUCTURE	INTERIOR			EXTERIOR		
	TOP	SIDE	BOTTOM	TOP	SIDE	BOTTOM
BEAMS	1 1/2"	1 1/2"	1 1/2"	2"	2"	2"
COLUMNS	1 1/2"	1 1/2"	1 1/2"	2"	2"	2"
GRADE BEAMS/FOOTING W/O VAPOR RETARDER	1 1/2"	N/A	N/A	3"	3"	3"
GRADE BEAMS/FOOTING W/ VAPOR RETARDER	1 1/2"	2"	2"	2"	2"	2"
SLAB ON GRADE	3/4"	2"	2"	2"	2"	2"
WALLS	1 1/2"	1 1/2"	1 1/2"	2"	2"	2"
WIDE PAN JOIST (BEAMS)	1 1/2"	1 1/2"	1 1/2"	2"	2"	2"
DRILLED PIERS	N/A	N/A	N/A	3"	3"	3"

NOTES: "EXTERIOR" IS EXPOSURE TO EARTH OR WEATHER.

SLAB-ON-VOID SITE PREPARATION

1. ALL FILL PLACED BELOW THE FOUNDATION SLAB SHALL BE GENERAL FILL FREE OF DEBRIS AND ORGANICS AND CONSISTING OF A SOIL WITH A PLASTICITY INDEX NO GREATER THAN 30.
2. THE BUILDING PAD SHALL EXTEND A MINIMUM OF 5' - 0" FROM THE EDGE OF THE SITE FOOTPRINT IN ALL DIRECTIONS.
3. CONSTRUCTION AREAS SHALL BE STRIPPED OF ALL VEGETATION, LOOSE TOPSOIL, SURFICIAL CONCRETE, ETC. ROOTS OF TREES WITHIN THE CONSTRUCTION AREAS SHALL BE EXCAVATED AND REMOVED.
4. ONCE FINAL SUBGRADE ELEVATION HAS BEEN ACHIEVED, EXPOSED SOIL SUBGRADE AREAS SHALL BE PROOFROLLED WITH A 15 TON ROLLER (MINIMUM) OR EQUIVALENT EQUIPMENT AS APPROVED BY THE GEOTECHNICAL ENGINEER. WEAK AREAS DETECTED DURING THE PROOF ROLLING PROCESS SHALL BE REMOVED AND REPLACED WITH SOILS EXHIBITING SIMILAR CLASSIFICATION, MOISTURE CONTENT, AND DENSITY AS THE ADJACENT IN SITU SOILS.
5. GENERAL FILL SHALL BE COMPACTED IN PLACE TO FORM A LEVEL BUILDING PAD.
6. ALL GENERAL FILL SHALL BE PLACED ON PREPARED SURFACES IN LIFTS NOT TO EXCEED 8" IN LOOSE MEASURE, WITH COMPACTED THICKNESS NOT TO EXCEED 6".
7. GENERAL FILL SHALL BE COMPACTED TO AT LEAST 92% OF THE STANDARD PROCTOR (ASTM D 698) DENSITY AT A MOISTURE CONTENT RANGING WITHIN 2% OF OPTIMUM MOISTURE CONTENT.
8. SLOPES ADJACENT TO FOUNDATIONS SHALL FALL A MINIMUM OF 6" IN THE FIRST 10' - 0". WHERE SITES DO NOT ALLOW THIS, DRAINAGE STRUCTURES SHALL BE IMPLEMENTED TO ACCOMMODATE THE RUNOFF.
9. FOR SITE AREAS NOT BELOW PAVEMENTS OR GROUND SUPPORTED STRUCTURES, A CLAY CAP SHALL BE PLACED AROUND THE PERIMETER OF THE STRUCTURE FOR THE TOP 12" OF ADJACENT GRADE TO EXTEND A MINIMUM OF 2' - 0" BETOND THE BUILDING PAD. THE SOILS USED FOR THE CLAY CAP SHALL HAVE A MINIMUM PI OF 30.

VOID FORMS

1. ALL VOID FORM AND EARTH RETAINER WORK SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN:
    - FPA-SC-11- SPECIFICATION AND APPLICATION OF VOID SPACES BELOW CONCRETE FOUNDATIONS (FOUNDATION PERFORMANCE ASSOCIATION)
2. VOID FORMS BELOW SLABS SHALL BE DEGRADABLE CORRUGATED PAPER (NON-COLLAPSIBLE). VOID FORMS BELOW BEAMS MAY BE DEGRADABLE CORRUGATED PAPER OR NON-DEGRADABLE COLLAPSIBLE.
3. MINIMUM VOID DEPTH SHALL BE 8", IN ACCORDANCE WITH THE GEOTECHNICAL REPORT.
4. MATERIALS AND PRODUCT SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:
    A. FULLY WAX-IMPREGNATED CORRUGATED FIBERBOARD IS NOT ACCEPTABLE. IF THE PRODUCT EMPLOYS PARTIAL WAX IMPREGNATION OR COATING, THE SOIL CONTACT AREA SHALL NOT BE FULLY WAX IMPREGNATED.
    B. DO NOT USE POLYETHYLENE SHEATHING UNDER DEGRADABLE VOID FORMS.
    C. NON-DEGRADABLE COLLAPSIBLE VOID-FORMS:
        - SHALL BE CONSTRUCTED OF CORRUGATED PLASTIC, METAL, OR OTHER ACCEPTABLE PRODUCTS. CORRUGATED PAPER IS NOT ACCEPTABLE.
        - THE NET VOLUME OF THE COLLAPSED VOID FORM SHALL BE SUFFICIENT TO ACCEPT THE EXPANDING SOIL.
        - THE VOID FORM MATERIALS MUST COLLAPSE UNDER THE UPLIFT FORCES OF THE SOILS, BUT SHALL BE SUFFICIENTLY STIFF TO WITHSTAND THE WEIGHT OF THE CONCRETE AND ASSOCIATED CONSTRUCTION LOADS.
    D. SOIL RETAINER:
        - SHALL BE CONSTRUCTED OF HIGH DENSITY POLYETHYLENE OR HIGH DENSITY POLYPROPYLENE.
        - SHALL BE RIBBED TYPE RETAINERS CAPABLE OF PREVENTING SOIL MIGRATION TO THE VOIDS.
    E. PIER TOP FORMS:
        - EITHER PRE-SCORED CORRUGATED PAPER/PLASTIC OR FIBER TUBE SHALL BE PROVIDED AT THE TOP 24" OF PIERS BELOW GRADE. ALTERNATIVELY, THE TOP 24" OF THE PIER MAY BE EARTH FORMED WITH THE UNDERSTANDING THAT SUBSEQUENT EXCAVATION WILL TAKE PLACE AROUND THE TOP OF THE PIER SUCH THAT IT IS NOT IN CONTACT WITH THE SOILS.
5. HANDLING AND INSTALLATION:
    A. GENERAL:
        - VOID FORMS AND SOIL RETAINERS SHALL BE STORED AND INSTALLED IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
        - STORE MATERIALS IN A MANNER THAT PROTECTS THEM FROM THE ELEMENTS.
        - DO NOT INSTALL OR USE MATERIALS THAT HAVE BEEN DAMAGED.
        - FORM WITH REMOVABLE OR SACRIFICIAL FORMS ON ALL SIDES OF ALL BELOW GRADE BEAMS, WALLS, PILASTERS, AND PIER CAPS. EARTH FORMING IS NOT PERMITTED. VOID FORMS ARE SACRIFICIAL AND SHALL NOT BE REUSED.
        - PROVIDE APPROPRIATE DRAINAGE WITHIN BEAM TRENCHES AND THROUGHOUT SLAB AREAS TO ENSURE STANDING WATER DOES NOT PERSIST.
        - VAPOR RETARDER SHALL BE INSTALLED DIRECTLY IN CONTACT WITH CONCRETE AND SECURED TO CONCRETE IN ACCORDANCE WITH VAPOR RETARDER NOTES.
        - SEAM PADS, TAPE JOINTS, OR PROTECTIVE FIBERBOARD SHALL BE USED TO COVER OPEN JOINTS TO PREVENT CONCRETE PLACEMENT.
        - RADIUSED VOID FORMS SHALL BE PROVIDED ADJACENT TO PIERS AT THE INTERSECTION OF CONCRETE ABOVE.
    B. ADDITIONAL REQUIREMENTS FOR DEGRADABLE VOID FORMS:
        - DEGRADABLE VOID FORMS SHALL BE STORED IN A MANNER THAT PREVENTS THEM FROM BECOMING WET WHILE ENTRAPPING HUMIDITY AND CONDENSATION.
        - THE USE OF DEGRADABLE VOID FORMS SHALL BE PLANNED TO MINIMIZED EXPOSURE TO ENVIRONMENTAL MOISTURE AND SHALL NOT BE LEFT IN PLACE ON GRADE FOR LONGER THAN (7) DAYS WITHOUT ADDITIONAL EVALUATION BY THE MANUFACTURER.
        - DEGRADABLE VOID FORMS SATURATED BY WATER SHALL BE FULLY REMOVED AND REPLACED.
        - PLACE A MINIMUM 1/4" COVER BOARD OVER DEGRADABLE VOID FORMS TO DISTRIBUTE WORKING LOAD, BRIDGE SMALL GAPS, AND PROTECT FORMS FROM PUNCTURE AND OTHER DAMAGES DURING REINFORCEMENT AND CONCRETE PLACEMENT.
    C. SOIL RETAINERS
        - PLACE SOIL RETAINERS AT SIDES OF VOID SPACE UNDER ALL GRADE BEAMS, WALLS, PILASTERS, AND PIER CAPS.
        - SECURE SOIL RETAINERS TO SACRIFICIAL SIDE FORMS PRIOR TO BACKFILL FOR SLAB OR TO THE EXPOSED FACE OF FOUNDATION ELEMENT AFTER PLACEMENT OF CONCRETE, PRIOR TO BACKFILL FOR SLAB.
        - SOIL RETAINERS SHALL BE PROPERLY KEYED INTO THE UNDERLYING SOILS.
6. CONSTRUCTION OF UNDER-SLAB UTILITIES SHALL BE SUCH THAT UTILITIES ARE NOT SOIL SUPPORTED AND HUNG FROM THE FOUNDATION ABOVE, UNLESS AN ALTERNATE DESIGN IS SUBMITTED AND APPROVED THAT ALLOWS FOR THE UTILITIES TO ADJUST TO THE POTENTIAL FOR DIFFERENTIAL MOVEMENT BETWEEN THE SUBGRADE AND THE FOUNDATION.

CONCRETE

1. ALL CONCRETE WORK SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN.
    - ACI 301 - SPECIFICATIONS FOR STRUCTURAL CONCRETE
    - ACI 117 - SPECIFICATIONS FOR TOLERANCES FOR CONCRETE CONSTRUCTION AND MATERIALS
    - ACI 318 - BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE
2. CONCRETE SHALL BE IN ACCORDANCE WITH THE TABLES BELOW UNLESS NOTED OTHERWISE.

CONCRETE MIX SCHEDULE

CLASS	28 DAY STRENGTH (f'c) (PSI)	MAX. W/C	SLUMP	MAX. AGGREGATE SIZE	AIR CONTENT
A	3,000	0.55	5" - 7"	1 1/2"	3% - 6%
B	3,000	0.55	4" - 6"	1 1/2"	3% - 6%
C	4,000	0.55	4" - 6"	1 1/2"	3% - 6%
D	4,000	0.45	4" - 6"	1 1/2"	≤ 1.5%
E	5,000	0.40	3" - 5"	1"	6% - 10%
F	4,000	0.50	4" - 6"	3/4"	-
G	3,000	0.50	4" - 6"	3/4"	-
H	2,000	0.55	5" - 7"	3/4"	-

NOTES:
1. CONCRETE SHALL BE NORMAL WEIGHT UNLESS NOTED OTHERWISE.
2. FLY ASH MAY BE USED UP TO 25% REPLACEMENT OF PORTLAND CEMENT, EXCEPT AT POLISHED SLABS (LIMITED TO 15%) OR ARCHITECTURALLY EXPOSED CONCRETE (VERIFY WITH ARCHITECT).
3. ALL MIXES SHALL UTILIZE A WATER REDUCING ADMIXTURE.
4. AT POLISHED CONCRETE FINISHES, USE OF CURING COMPOUNDS IS NOT ALLOWED UNLESS SPECIFICALLY APPRVOED BY THE ARCHITECT AND POLIHSING SYSTEM MANUFACTURER.
5. SLUMP SHALL BE DETERMINED AT POINT OF PLACEMENT.
6. FOR TOPPING SLAB LESS THAN 2" THICK, CONTRACTOR SHALL SUBMIT PROPRIETARY MIX DESIGN AND PREPARATION PROCEDURE FOR APPROVAL.

USE	CLASS
DRILLED PIERS	A
PIER CAPS	B
GRADE BEAMS	B
SLABS-ON-CARTON FORMS	C
CONCRETE ON METAL DECK	F
POLISHED SLABS	D
FOOTINGS	B
HOUSEKEEPING PADS	G

3. MATERIALS SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:
    - READY-MIXED CONCRETE ASTM C94
    - PORTLAND CEMENT - ASTM C150, TYPE I/II
    - FLY ASH - ASTM C618, CLASS F OR C
    - NORMAL WEIGHT AGGREGATES - ASTM C33
    - LIGHT WEIGHT AGGREGATES - ASTM C330
    - WATER - ASTM C1602
    - WATER-REDUCING, PLASTICIZING, AND RETARDING ADMIXTURE - ASTM C494
    - AIR ENTRAINING ADMIXTURE - ASTM C260
    - CURING COMPOUNDS - ASTM C309, TYPE 1, CLASS B
    - FLOOR SEALERS, HARDENERS, FINISHES, AND COVERINGS SHALL BE COMPATIBLE WITH CONCRETE PROPERTIES
4. READY-MIXED CONCRETE SHALL BE FURNISHED WITH BATCH TICKET INFORMATION. PROJECT-SITE MIXING IS NOT ACCEPTABLE.
5. PLACEMENT OF CONCRETE SHALL BE COMPLETED WITHIN 90 MINUTES AFTER THE INTRODUCTION OF THE MIXING WATER, PER ASTM C94.
6. COLD WEATHER CONCRETE PLACEMENT SHALL COMPLY WITH ACI 306.1 AND AS FOLLOWS:
    A. WHEN AVERAGE HIGH AND LOW TEMPERATURE IS EXPECTED TO FALL BELOW 40˚ F FOR (3) CONSECUTIVE DAYS, MAINTAIN DELIVERED CONCRETE MIX TEMPERATURE WITHIN THE TEMPERATURE RANGE REQUIRED BY ACI 301.
    B. DO NOT USE OR PLACE CONCRETE ON FROZEN MATERIALS OR MATERIALS CONTAINING ICE OR SNOW.
    C. DO NOT USE CALCIUM CHLORIDE, SALT, OR OTHER MATERIALS CONTAINING ANTIFREEZE AGENTS OR CHEMICAL ACCELERATORS UNLESS APPROVED IN MIX DESIGNS.
    D. PROTECT CONCRETE WORK FROM PHYSICAL DAMAGE OR REDUCED STRENGTH THAT COULD BE CAUSED BY FROST, FREEZING ACTIONS, OR LOW TEMPERATURES.
7. HOT WEATHER CONCRETE PLACEMENT SHALL COMPLY WITH ACI 305.1 AND AS FOLLOWS:
    A. MAINTAIN CONCRETE TEMPERATURE BELOW 95˚ F AT TIME OF PLACEMENT.
    B. CHILLED MIXING WATER OR CHOPPED ICE MAY BE USED TO CONTROL TEMPERATURE, PROVIDED WATER EQUIVALENT OF ICE IS CALCULATED TO TOTAL AMOUNT OF MIXING WATER.
8. BEFORE TEST SAMPLING AND PLACING OF CONCRETE, WATER MAY BE ADDED TO THE PROJECT SITE, SUBJECT TO THE LIMITATIONS OF ACI 301. DO NOT ADD WATER TO THE CONCRETE AFTER ADDING HIGH-RANGE WATER-REDUCING ADMIXTURES.
9. SECURELY POSITION ALL ITEMS TO BE CAST IN PLACE SUCH AS REINFORCING DOWELS, ANCHORS, SLEEVES, ETC. PRIOR TO PLACEMENT OF CONCRETE.
10. EMBEDDED CONDUITS, PIPES, AND SLEEVES SHALL MEET THE REQUIREMENTS OF ACI 318. REFERENCE TYPICAL DETAILS FOR ALLOWABLE PENETRATIONS AND ADDITIONAL REQUIRED REINFORCEMENT.
11. PLACE ALL VERTICAL CONSTRUCTION JOINTS IN THE CENTER OF SPANS IN ACCORDANCE WITH THE TYPICAL DETAILS. CONTRACTOR SHALL SUBMIT PROPOSED LOCATIONS FOR CONSTRUCTION JOINTS NOT SHOWN ON STRUCTURAL DRAWINGS FOR REVIEW BY THE ARCHITECT AND ENGINEER.
12. FOOTING, GRADE BEAM, AND SLAB AREAS SHALL BE CLEANED OF DEBRIS AND STANDING WATER PRIOR TO POURING CONCRETE.
13. WHERE NOTED, SAW CUT JOINTS SHALL BE CUT AS SOON AS THE CONCRETE HAS OBTAINED ADEQUATE STRENGTH TO RESIST RAVELING OF THE JOINT EDGES, GENERALLY BETWEEN 4 TO 12 HOURS AFTER THE CONCRETE HAS BEEN FINISHED. HOWEVER, IF ENTRY IS DELAYED TOO LONG, SAWING CAN BECOME DIFFICULT AND UNCONTROLLABLE CRACKING MAY OCCUR. THE BEST TIME FOR SAWING SHALL BE DETERMINED IN THE FIELD AS TIMING MAY VARY BASED ON MIX DESIGN, PLACEMENT, AND CURING CONDITIONS. SAW CUTS SHALL BE A MINIMUM 1/4 OF THE SLAB THICKNESS, UNLESS NOTED OTHERWISE, WITH REINFORCEMENT CONTINUOUS THROUGH SAW CUTS IN ACCORDANCE WITH THE CONTROL JOINT DETAIL. DO NOT SAWCUT ELEVATED SLABS OR SLABS OVER VOID FORMS.
14. CONCRETE SHALL REACH 70% OF THE SPECIFIED 28 DAY COMPRESSIVE STRENGTH AND BE IN PLACE FOR 7 DAYS PRIOR TO REMOVAL OF FORMS OR CONSTRUCTION ON TOP OF THE SLAB.

STRUCTURAL SUBMITTALS

1. SUBMIT TO THE ENGINEER FOR REVIEW APPROPRIATE SCHEDULES, SHOP DRAWINGS, SAMPLES, TEST REPORTS, AND PRODUCT DATA THAT IS RELATED TO THE STRUCTURAL PORTION OF THE WORK ACCORDING TO AIA DOCUMENT A201 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION. NO WORK SHALL BE FABRICATED UNTIL THE ENGINEER'S REVIEW HAS BEEN OBTAINED. PROVIDED IS A LIST OF STRUCTURAL SUBMITTALS REQUIRED FOR THIS PROJECT, AND REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS:
    A. FABRICATION / ERECTION DRAWINGS:
        - FOUNDATION REINFORCING STEEL
        - MASONRY WALL REINFORCING
        - STRUCTURAL STEEL
        - STRUCTURAL CAST-IN-PLACE COMPONENTS
        - STRUCTURAL ROOF AND FLOOR DECKING
    B. DEFERRED SUBMITTALS (TO BE SEALED BY THE RESPONSIBLE PARTY)
        - COLD FORMED METAL FRAMING & CONNECTIONS
        - CURTAIN WALL & DOOR SYSTEMS AND ATTACHMENTS
    C. PRODUCT DATA SUBMITTALS
        - SOIL RETAINERS
        - VAPOR RETARDER
        - VOID FORMS AND ASSOCIATED COMPONENTS
        - CONCRETE MIX DESIGN
        - CONCRETE/MASONRY/STEEL ACCESSORIES
        - MASONRY PRODUCT SUBMITTALS
        - GROUT MIX DESIGN
        - FACADE ATTACHMENTS
        - FASTENERS
        - STEEL MILL REPORTS AND WELDING CERTIFICATES
    D. REPORTS:
        - EARTHWORK BELOW BUILDING TESTING REPORTS
        - PIER MONITORING RESULTS
        - CONCRETE TEST RESULTS
        - CONCRETE MONITORING DURING PLACEMENT
        - MASONRY
        - STEEL
2. THE CONTRACTOR SHALL REVIEW AND STAMP SHOP DRAWINGS PRIOR TO SUBMISSION TO THE ARCHITECT/ENGINEER. THE CONTRACTOR SHALL REVIEW FOR COMPLETENESS AND COMPLIANCE WITH CONTRACT DOCUMENTS.
3. CONTRACTOR SHALL SUBMIT EQUIPMENT PRODUCT DATA WHERE LOADING IS TO BE IMPARTED ON THE STRUCTURE DURING CONSTRUCTION FOR REVIEW, PRIOR TO USE.
4. SUBMIT SHOP DRAWINGS TO THE ARCHITECT/ENGINEER AS INDICATED OR SPECIFIED FOR REVIEW PRIOR TO FABRICATION. REVIEW WILL BE FOR GENERAL CONFORMANCE WITH DESIGN INTENT CONVEYED IN THE CONTRACT DOCUMENTS.
5. WHEN AN ENGINEER IS REQUIRED TO SIGN AND STAMP SHOP DRAWINGS AND CALCULATIONS, ENSURE SEAL INDICATES ENGINEER AS BEING REGISTERED IN THE STATE OF THE PROJECT.
6. SHOP DRAWINGS ARE NOT A PART OF CONTRACT DOCUMENTS. THEREFORE, ARCHITECT'S/ENGINEER'S REVIEW DOES NOT CONSTITUTE AN AUTHORIZATION TO DEVIATE FROM TERMS AND CONDITIONS OF THE CONTRACT.
7. THE ENGINEER REQUIRES (10) WORKING DAYS AFTER RECEIPT OF SHOP DRAWINGS AND CALCULATIONS FOR PROCESSING.

PIERS

1. DRILLED PIERS SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN.
    - ACI 336.1 - SPECIFICATION FOR THE CONSTRUCTION OF DRILLED PIERS
2. PIERS NOT SPECIFICALLY LOCATED ON THE PLAN OR GRID INTERSECTIONS SHALL BE LOCATED ON CENTERLINE OF THE GRADE BEAM.
3. ELEVATION OF TOP OF PIERS, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS, IS AT THE BOTTOM OF THE DEEPEST INTERSECTING GRADE BEAM SUPPORTED BY THE PIER. HOLD BELOW PIER CAPS AS REQUIRED.
4. REINFORCING CAGE SHALL BE HELD SECURELY AWAY FROM EARTH AT SIDES AND BOTTOM BY SETS OF (4) SPACERS AT A MAXIMUM SPACING OF 8' - 0" ON CENTER AND 2' - 0" FROM THE BOTTOM. OFFSET SPACERS FOR 18"Ø PIERS AND SMALLER. ADDITIONAL SPACERS MAY BE REQUIRED PER MANUFACTURER'S RECOMMENDATIONS.
5. PIERS MUST BE POURED THE SAME DAY THEY ARE DRILLED, PIER SHAFTS SHALL NOT BE LEFT OPEN OVERNIGHT. PIERS THAT ARE UNABLE TO BE POURED ON THE SAME DAY AS THEY ARE DRILLED SHALL BE BACKFILLED AS PER THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
6. TEMPORARY STEEL CASING MAY BE REQUIRED DURING PIER DRILLING OPERATIONS. PRIOR TO THE PLACEMENT OF CONCRETE, ANY SEEPAGE WATER SHALL BE REMOVED FROM THE PIER HOLES.
7. ALL PIERS SHALL BE INSPECTED BY A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER IN ORDER TO ENSURE THAT THE PROPOSED BEARING MATERIAL HAS BEEN REACHED IN ACCORDANCE WITH THE RECOMMENDATIONS GIVEN IN THE GEOTECHNICAL REPORT.
8. THE CONTRACTOR SHALL MAKE AND MAINTAIN ACCURATE RECORDS OF THE DRILLED PIER DEPTHS, BEARING STRATUM, DEPTH OF PENETRATION INTO BEARING STRATUM, DIAMETER AND LOCATION (INCLUDING OFF CENTER ECCENTRICITIES), AND SHALL SUBMIT THIS INFORMATION TO THE ENGINEER.
9. THE CONTRACTOR SHALL PROVIDE A BASE BID ON THE INDICATED NUMBER OF PIERS, FOR
10. EACH TYPE OR SIZE OF PIER.
    A. IF THE GEOTECHNICAL INVESTIGATION RESULTS INDICATE THE PRESENCE OF GRANULAR SOILS, FREE GROUNDWATER, OR LOW STRENGTH OR SLICKENEDSIDED CLAYS ONSITE, IT IS ANTICIPATED THAT COLLAPSE OF THE SIDEWALLS DURING DRILLING OF PIERS IS HIGHLY LIKELY. FOR THESE CONDITIONS AND ANY BID WHERE DRY AUGER INSTALLATION IS THE INTENDED METHOD OF CONSTRUCTION, THE CONTRACTOR SHALL PROVIDE THE COST OF TEMPORARY CASING (TELESCOPING OR SINGLE DIAMETER) IN THE BASE BID FOR ALL OF THE SPECIFIED PIERS.
11. THE CONTRACTOR SHALL PROVIDE UNIT PRICES PER LINEAR FOOT OF EACH PIER SIZE FOR ANY POTENTIAL ITEMS NECESSARY TO COMPLETE PIER INSTALLATION INCLUDING, BUT NOT LIMITED TO: LABOR, MATERIALS, TOOLS, EQUIPMENT, AND INCIDENTALS REQUIRED FOR EXCAVATION, TRIMMING, SHORING, CASINGS, DEWATERING, REINFORCEMENT, CONCRETE FILL, TESTING AND INSPECTING.
    A. IF THE GEOTECHNICAL INVESTIGATION RESULTS INDICATE THE PRESENCE OF GRANULAR SOILS, FREE GROUNDWATER, OR LOW STRENGTH OR SLICKENEDSIDED CLAYS ONSITE, IT IS ANTICIPATED THAT COLLAPSE OF THE SIDEWALLS DURING DRILLING OF PIERS IS HIGHLY LIKELY. FOR THESE CONDITIONS, THE CONTRACTOR SHALL PROVIDE UNIT PRICING FOR ALTRENATE METHODS OF CONSTRUCTION, AT A MINIMUM, UTILIZING DRILLING SLURRY, TREMMIE, AND/OR DRILLING BUCKETS FOR ALL OF THE SPECIFIED PIERS.
12. THE REQUIREMENTS FOR CASING TO BE INCLUDED IN THE BASE BID, THE PROVISION OF AN ALTERNATE FORM OF CONSTRUCTION TO BE INCLUDED AS A UNIT PRICE, AND/OR THE PLACEMENT OF A TEST PIER MAY BE WAIVED WITH WRITTEN APPROVAL BY THE OWNER OR THE OWNER'S AUTHORIZED AGENT, UPON CONSULTING WITH THE RDPIRC.
13. THE CONTRACTOR SHALL DRILL TEST PIERS TO VERIFY LOAD CAPACITY OF DEEP FOUNDATION ELEMENTS, IN ACCORDANCE WITH SPECIFICATIONS.

METAL ROOF DECK

1. METAL ROOF DECK SHALL BE AS FOLLOWS:

LOCATION	GAUGE	SDI DECK TYPE	DECK DEPTH (IN.)	SHEET WIDTH (IN.)	MIN. I_X ($IN.^4$)	MIN. S_P ($IN.^3$)	MIN. S_N ($IN.^3$)
TYP. UNO	20	WR	3	32	0.806	0.448	0.476

S_P - POSITIVE SECTION MODULUS $IN.^3$
S_N - NEGATIVE SECTION MODULUS $IN.^3$
I_X - MOMENT OF INERTIA $IN.^4$
20/20 - CELLULAR DECK GAUGE (HAT/PAN)
DECK TYPE "A" - ACUSTICAL

2. SHEET STEEL FOR GALVANIZED ROOF DECK AND ACCESSORIES SHALL CONFORM TO ASTM A653, STRUCTURAL STEEL, WITH A MINIMUM YIELD STRENGTH OF 33 KSI AND A MAXIMUM YIELD STRENGTH OF 80 KSI. GALVANIZING SHALL CONFORM TO ASTM A653 WITH A MINIMUM COATING OF G90 (TYPICAL AT ALL LOCATIONS) AS DEFINED IN ASTM A653.
3. ROOF DECKS SHALL BE CONSTRUCTED IN A TWO OR THREE SPAN CONDITION.
4. PLACE DECK PANELS ON STRUCTURAL SUPPORTS AND ADJUST TO FINAL POSITION WITH ENDS LAPPED OR BUTTED OVER THE SUPPORTS WITH A MINIMUM END BEARING OF 1 1/2".
5. ROOF DECKS SHALL BE ATTACHED TO FRAMING WITH PUDDLE WELDS AND A FASTENING PATTERN OF 32/3. SIDELAP CONNECTORS TO BE SPACED AT 12" MINIMUM.
6. ALL OPENINGS IN METAL ROOF DECKS SHALL BE REINFORCED IN ACCORDANCE WITH THE STRUCTURAL DETAILS.
7. MECHANICAL, ELECTRICAL, AND PLUMBING SYSTEMS SHALL NOT BE SUPPORTED BY THE METAL ROOF DECK.

STRUCTURAL CONCRETE MASONRY

1. ALL STRUCTURAL CONCRETE MASONRY WORK SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN:
    - TMS 402 - BUILDING CODE REQUIREMENTS FOR SPECIFICATION FOR MASONRY STRUCTURES
    - TMS 602 - SPECIFICATION FOR MASONRY STRUCTURES
2. STRUCTURAL CONCRETE MASONRY SHALL BE IN ACCORDANCE WITH THE TABLES BELOW UNLESS NOTED OTHERWISE.

CLASS	NET COMPRESSIVEST RENGTH (f'm)(PSI)	BLOCK COMPRESSIVE STRENGTH AT 28 DAYS (PSI)	MORTAR TYPE	GROUT COMPRESSIVE STRENGTH AT 28 DAYS (PSI)
1	1,750	2,000	N	2,000
2	2,000	2,000	M OR S	2,000
3	2,000	2,650	N	2,000

NOTES:
1. AGGREGATE SIZE SHALL NOT EXCEED 1/2" DIAMETER.
2. GROUT SLUMP SHALL RANGE FROM 8" - 11".
3. DO NOT USE ADMIXTURES UNLESS APPROVED BY EOR.

USE	CLASS
INTERIOR WALLS	1
EXTERIOR WALLS	3
SITE WALLS	2

3. MATERIAL SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS:
    - CONCRETE MASONRY UNITS - ASTM C90, NORMAL WEIGHT
    - MORTAR - ASTM C270
    - GROUT - ASTM C476, PROPORTIONED PER TABLE 1
    - AGGREGATE - ASTM C404
    - BED JOINT REINFORCEMENT - ASTM A1064, GALVANIZED OR STAINLESS STEEL
4. LAY CMU TO MAXIMUM POUR HEIGHT, NOT TO EXCEED 5' - 4" IN HEIGHT OR COURSE BELOW BOND BEAM UNLESS ADDITIONAL PARAMETERS ARE MET ACCORDING TO TMS 602, SECTION 3.5.
5. LAY BLOCKS IN A RUNNING BOND WITH A MINIMUM JOINT OFFSET OF 1/4 UNIT LENGTH.
6. REINFORCE CONCRETE MASONRY UNIT JOINTS WITH LADDER-TYPE HOT-DIP GALVANIZED COLD-DRAWN STEEL, WITH W1.7 SIDE RODS AND W1.7 CROSS RODS.
    A. PROVIDE JOINT REINFORCEMENT TO MEET THE FOLLOWING PARAMETERS:
        - 16" ON CENTER UNLESS NOTED OTHERWISE.
    B. LAP JOINT REINFORCING 14" AT SPLICES.
    C. ALSO PROVIDE AT:
        - TOP AND BOTTOM OF WALL OPENINGS, EXTENDING THE GREATER OF 24" OR 40 BAR DIAMETERS PAST THE OPENING.
        - CONTINUOUSLY AT STRUCTURALLY CONNECTED ROOF AND FLOOR LEVELS.
        - WITHIN 16" OF THE TOP OF WALLS.
    D. PROVIDE PREFABRICATED JOINT REINFORCING CORNER PIECES AT ALL WALL CORNERS AND INTERSECTIONS.
    E. JOINT REINFORCING SHALL BE DISCONTINUOUS AT CONTROL AND EXPANSION JOINTS.
7. LAP REINFORCING BARS IN GROUTED MASONRY AS NOTED BELOW. SPLICES IN REINFORCING SHALL BE STAGGERED SO THAT NOT MORE THAN 1/2 OF ALL BARS ARE SPLICED AT THE SAME LOCATION.
    - VERTICAL BARS - (40) BAR DIAMETERS FOR #5 OR LESS, (60) BAR DIAMETERS FOR #6 OR GREATER
    - BOND BEAMS - (40) BAR DIAMETERS
    - LINTELS - DO NOT SPLICE
8. PROVIDE MINIMUM 1/2" CLEARANCE FROM REINFORCEMENT TO FACE SHELL OF BLOCK AND A MINIMUM 1" CLEARANCE BETWEEN PARALLEL REINFORCEMENT.
9. REINFORCEMENT SHALL BE ADEQUATELY SECURED TO PREVENT DISPLACEMENT CAUSED BY CONSTRUCTION LOADS OR BY PLACEMENT OF GROUT OR MORTAR BEYOND THE ALLOWABLE TOLERANCES. PROVIDE BAR POSITIONERS AT MANUFACTURER'S RECOMMENDED SPACING, NOT TO EXCEED 48" ON CENTER.
10. ALLOW MASONRY LINTELS TO ATTAIN SPECIFIED STRENGTH BEFORE REMOVING TEMPORARY SUPPORTS.
11. NON-LOAD BEARING MASONRY SHALL MAINTAIN A MINIMUM 1" SPACE BELOW ADJACENT FRAMING.
12. EMBEDDED ITEMS SHALL BE IN BUILT-IN (NOT CUT-IN) IN ACCORDANCE WITH TMS 602, SECTION 3.3D. ALUMINUM SHALL NOT BE USED IN MASONRY UNLESS EFFECTIVELY COATED OR OTHERWISE ISOLATED. CONDUITS SHALL NOT BE SPACED CLOSER THAN (3) DIAMETERS TO ONE ANOTHER.
13. COLD WEATHER AND HOT WEATHER CONSTRUCTION SHALL BE ACCORDANCE WITH TMS 602, SECTION 1.8C AND 1.8D, RESPECTIVELY.
14. INSTALL CONTROL AND EXPANSION JOINTS AT THE FOLLOWING MAXIMUM SPACING UNLESS NOTED OTHERWISE:
    A. 25' - 0" ON CENTER HORIZONTALLY.
    B. TO MAINTAIN A MAXIMUM HEIGHT TO WIDTH RATIO OF 1 1/2:1 BETWEEN JOINTS.
    C. WITHIN 1/2 TYPICAL JOINT SPACING FROM CMU WALL CORNER OR INTERSECTIONS ALONG INTERSECTING WALL.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
WWW.BRWARCH.COM
BRW

STATE OF TEXAS
10.24.2024
EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER

CORPORATE OFFICE
401 W 26TH STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910
GESSNER ENGINEERING

DATE	10.24.24
DRAWN BY	BGL
CHECKED BY	EJR
BRW PROJECT NUMBER	23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

S0.0

NOTES

STRUCTURAL STEEL

1. ALL STRUCTURAL STEEL WORK SHALL CONFORM TO THE FOLLOWING STANDARDS AND ANY STANDARDS REFERENCED THEREIN:
   - AISC 303 - CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS AND BRIDGES
   - AISC 360 - SPECIFICATIONS FOR STRUCTURAL STEEL BUILDINGS
   - AISC 341 - SEISMIC PROVISIONS FOR STRUCTURAL STEEL BUILDINGS
   - RCSC - SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH-STRENGTH BOLTS
   - AWS D1.1 - STRUCTURAL WELDING CODE - STEEL
   - AISC DG - STRUCTURAL STAINLESS STEEL
   - AWS D1.6 - STRUCTURAL WELDING CODE - STAINLESS STEEL
2. MATERIALS SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS, UNLESS NOTED OTHERWISE:
   - W & WT SHAPES — ASTM A992, GRADE 50
   - C, S, & ST SHAPES — ASTM A36
   - ANGLE SHAPES — ASTM A36
   - STRUCTURAL PIPES — ASTM A53, GRADE B
   - ROUND HSS SHAPES — ASTM A500, GRADE C
   - SQUARE & RECTANGULAR HSS SHAPES — ASTM A500, GRADE C
   - STRUCTURAL PLATE & BARS — ASTM A36 OR ASTM A572 GRADE 50 AS NOTED
   - HIGH STRENGTH BOLTS — ASTM A325 (MECHANICALLY GALVANIZED) OR ASTM A490 (BLACK)
   - NUTS — ASTM A563 (MECHANICALLY GALVANIZED)
   - HARDENED STEEL WASHERS — ASTM F436
   - COMPRESSIBLE STEEL WASHERS — ASTM F959
   - HEADED CONCRETE ANCHORS — AWS D1.1 CLAUSE 7 TYPE B
   - DEFORMED BAR ANCHORS — ASTM A1064
   - ANCHOR RODS (STANDARD) — ASTM F1554, GRADE 36
   - ANCHOR RODS (HIGH STRENGTH) — ASTM F1554, GRADE 55, WELDABLE
   - THREADED RODS — ASTM A36
   - WELDING ELECTRODES — AWS CLASS E70XX
3. STRUCTURAL STEEL FABRICATOR TO BE REGISTERED AND APPROVED TO PERFORM SUCH WORK IN ACCORDANCE WITH SECTION 1704.2.5.2 OF THE IBC. ACCEPTABLE CERTIFICATIONS INCLUDE THOSE PROVIDED BY ASTM OR AWS.
4. ANY STEEL PRODUCT PRODUCED THROUGH A MANUFACTURING PROCESS AND USED IN THE PROJECT SHALL BE PRODUCED IN THE UNITED STATES. THE BID DOCUMENTS PROVIDED TO ALL BIDDERS AND THE CONTRACT SHALL INCLUDE THIS SAME REQUIREMENT
5. DIMENSIONAL TOLERANCES OF FABRICATED STRUCTURAL STEEL SHALL CONFORM TO SECTION 6.4 OF THE AISC CODE OF STANDARD PRACTICE UNLESS NOTED OTHERWISE.
6. FABRICATE AND ASSEMBLE STRUCTURAL MEMBERS/ASSEMBLIES IN SHOP TO GREATEST EXTENT POSSIBLE.
7. ENDS OF COLUMNS AT SPLICES AND AT OTHER BEARING CONNECTIONS SHALL BE "FINISHED TO BEAR" TO COMPLETE TRUE BEARING.
8. PROVIDE STIFFENERS "FINISHED TO BEAR" UNDER ALL LOAD CONCENTRATIONS ON SUPPORTING MEMBERS OVER COLUMNS, AND WHERE SHOWN ON DRAWINGS.
9. WORKING POINTS FOR VERTICAL BRACING SHALL BE AT THE INTERSECTION OF THE COLUMN CENTERLINE AND THE BEAM CENTERLINE UNLESS NOTED OTHERWISE. WORKING POINTS FOR VERTICAL BRACING AT COLUMN BASE PLATES SHALL BE AT THE INTERSECTION OF COLUMN CENTERLINE AND THE TOP OF THE BASE PLATE.
10. BEAMS SHALL BE CAMBERED UPWARD WHERE SHOWN ON THE CONTRACT DOCUMENTS, WHERE NO UPWARD CAMBER IS INDICATED, ANY MILL CAMBER SHALL BE DETAILED UPWARD IN THE BEAMS.
11. ALL STRUCTURAL STEEL MEMBERS, ASSEMBLIES, AND HARDWARE EXPOSED TO WEATHER OR INDICATED ON THE DRAWINGS SHALL BE EITHER HOT-DIP GALVANIZED OR PRIMED AND PAINTED. REPAIR ANY MEMBERS WELDED OR DAMAGED AFTER SURFACE PREPARATION WITH ZINC RICH PAINT OR APPROVED ALTERNATE
12. ALL STRUCTURAL STEEL MEMBERS, ASSEMBLIES, AND HARDWARE SHALL BE SHIPPED WITH ONE COAT OF SHOP PRIMER EXCEPT THOSE MEMBERS THAT ARE GALVANIZED OR IN AREAS SCHEDULED TO RECEIVE FIRE PROOFING. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING AREAS TO BE FIRE PROOFED PER ARCHITECTURAL DRAWINGS AND SPECIFICATIONS.
13. WHERE NOTED ON PLAN AS AESS, MEMBERS SHALL BE ARCHITECTURALLY EXPOSED STRUCTURAL STEEL, CATEGORY 1 (AESS 1), PREPARED IN ACCORDANCE WITH AISC 303-16, TABLE 10.1. VERIFY WITH ARCH. EXPOSED STAIRS SHALL BE AESS, CATEGORY 3.
14. SPLICING OF STRUCTURAL STEEL MEMBERS WHERE NOT DETAILED ON THE CONTRACT DOCUMENTS IS PROHIBITED WITHOUT THE PRIOR APPROVAL OF THE STRUCTURAL ENGINEER AS TO LOCATION, TYPE OF SPLICE, AND CONNECTION TO BE MADE.
15. DECK EDGE ANGLES SHALL BE CONTINUOUS AND SHALL BE SPLICED ONLY AT SUPPORTS. SPLICES SHALL BE BUTT WELDED TO DEVELOP FULL CAPACITY OF THE MEMBER.
16. DO NOT CUT STRUCTURAL STEEL MEMBERS UNLESS SO INDICATED IN THE DRAWINGS OR AS REVIEWED BY THE ENGINEER.
17. STRUCTURAL STEEL FRAMING SHALL BE TRUE AND PLUMB BEFORE CONNECTIONS ARE FINALLY BOLTED OR WELDED.
18. COLUMN BASE PLATES, LEVELING PLATES, OR BEARING PLATES SHALL BE SET TO THE ELEVATION INDICATED ON THE STRUCTURAL DRAWINGS AND LEVELED USING SHIMS OR JAM NUTS AND WASHERS ON ANCHOR BOLTS. BASE PLATES SHALL THEN BE GROUTED. GROUT SHALL BE WITH NON-SHRINK, NON-METALLIC GROUT WITH MINIMUM 7 DAY COMPRESSIVE STRENGTH EQUAL TO TWICE THE 28 DAY STRENGTH OF THE SUPPORTING CONCRETE. COMPLETE GROUT WORK BEFORE PLACING CONCRETE ON LEVELS ABOVE (WHERE APPLICABLE). ANCHOR BOLTS SHALL BE PRESET USING TEMPLATES OR SIMILAR METHODS. TIGHTEN ANCHOR BOLTS AFTER SUPPORTED MEMBERS HAVE BEEN POSITIONED AND PLUMBED. HOLE SIZES IN BASE PLATES SHALL BE OVERSIZED PER AISC SECTION J3.2.
19. HEADED CONCRETE ANCHORS AND DEFORMED BAR ANCHORS SHALL BE AUTOMATICALLY END WELDED WITH SUITABLE STUD WELDING EQUIPMENT IN THE SHOP OR IN THE FIELD. WELDING SHALL BE IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE MANUFACTURER.

STEEL CONNECTIONS

1. ALL STRUCTURAL STEEL CONNECTIONS SHALL CONFORM TO REQUIREMENTS DETAILED IN THE "STRUCTURAL STEEL" NOTES AND ALL FOLLOWING PARAMETERS.
2. STRUCTURAL STEEL CONNECTIONS NOT FULLY DETAILED IN THE STRUCTURAL DOCUMENTS SHALL BE DESIGNED AND DETAILED BY THE CONTRACTOR AND THE STEEL FABRICATOR, UNDER THE DIRECT SUPERVISION OF A LICENSED PROFESSIONAL ENGINEER IN THE STATE IN WHICH THE PROJECT IS TO BE CONSTRUCTED.
3. CONCEPTUAL CONNECTION DETAILS ARE SHOWN ON THE DRAWINGS AND ARE APPLICABLE TO ALL CONNECTIONS NOT DESIGNED AND FULLY DETAILED IN THE DRAWINGS. THEY ARE PROVIDED ONLY TO INDICATE THE CONNECTION TYPE REQUIRED AND MAY NOT FULLY REPRESENT THE COMPLEXITY OF THE CONNECTION AS REQUIRED BY THE FINAL CONNECTION DESIGN.
4. ADDITIONAL CONNECTION ELEMENTS NOT SHOWN ON TYPICAL OR CONCEPTUAL DETAILS MAY BE REQUIRED BY THE FINAL CONNECTION DESIGN, SUCH AS STIFFENER PLATES, DOUBLER PLATES, SUPPLEMENTAL/ REINFORCING PLATES, OR OTHER CONNECTION MATERIAL. THE FABRICATOR'S LICENSED PROFESSIONAL ENGINEER IS RESPONSIBLE FOR SPECIFICATION OF THESE ELEMENTS OR CONVEYANCE OF THESE ADDITIONAL REQUIREMENTS TO THE ENGINEER OF RECORD FOR SPECIFICATION.
5. THE FABRICATOR'S LICENSED PROFESSIONAL ENGINEER IN RESPONSIBLE CHARGE OF THE CONNECTION DESIGN SHALL REVIEW AND CONFIRM IN WRITING THAT THE SHOP AND ERECTION DRAWINGS PROPERLY INCORPORATE THE CONNECTION DESIGNS PRIOR TO SUBMITTING THE CONNECTION CALCULATION AND SHOP DRAWINGS TO THE ENGINEER-OF RECORD FOR REVIEW.
6. SEALED CALCULATIONS FOR ALL CONNECTIONS DESIGNED BY THE FABRICATOR'S LICENSED PROFESSIONAL ENGINEER SHALL BE SUBMITTED FOR REVIEW.
7. CONNECTION DESIGN SHALL BE RELATED TO AND/OR REFERENCE THE SUBMITTED SHOP DRAWINGS TO FACILITATE REVIEW.
8. ALL REACTIONS (SHEARS, AXIAL FORCES, MOMENTS, ETC.) SHOWN ON THE STRUCTURAL DRAWINGS ARE FACTORED LOADS CONFORMING TO THE REQUIREMENTS OF AISC LOAD AND RESISTANCE FACTOR DESIGN (LRFD). LOAD AND RESISTANCE FACTOR DESIGN (LRFD) SHALL BE USED IN THE SELECTION, COMPLETION, AND DESIGN OF CONNECTIONS.
9. THE FABRICATOR SHALL WORK TO PRIORITIZE BOLTED FIELD CONNECTIONS OVER FIELD WELDS, WHERE FEASIBLE.
10. WHERE STIFFENER PLATES ARE INDICATED ON THE DRAWINGS, THEY ARE REQUIRED AND SHALL BE PROVIDED AS INDICATED. WHERE SIZES ARE NOT INDICATED, WEB STIFFENERS SHALL BE A MINIMUM 3/8 INCH THICK, OR THE THICKNESS OF THE BEAM WEB, WHICHEVER IS LARGER.
11. PROVIDE A MINIMUM 1/4 INCH THICK CAP PLATE AT THE END OF ALL HOLLOW STEEL SECTIONS NOT OTHERWISE CONNECTED TO AN ABUTTING MEMBER, UNLESS SPECIFICALLY DETAILED OTHERWISE. WHERE EXPOSED TO VIEW, PLATES SHALL MATCH THE INSIDE DIMENSION OF THE HOLLOW SECTION AND BE WELDED ALL AROUND WITH A GROOVE WELD WITHIN THE END OF THE MEMBER. PROVIDE OPENINGS AS REQUIRED FOR ANY HOT DIP GALVANIZATION.
12. SHEAR CONNECTIONS
13. WHERE INDICATED, SHEAR CONNECTIONS SHALL BE DESIGNED FOR THE FORCES INDICATED ON THE STRUCTURAL DRAWINGS. SHEARS ARE INDICATED AT BEAM ENDS AS "# K" AT THE GIVEN MEMBER END.
14. IF NOT INDICATED ON THE STRUCTURAL DRAWINGS, CONNECTIONS SHALL BE DESIGNED FOR 55 PERCENT OF THE TOTAL LOAD CAPACITY FOR THE BEAM SPAN SHOWN IN THE BEAM TABLES IN THE CURRENT EDITION OF THE AISC STEEL CONSTRUCTION MANUAL.
15. SHEAR CONNECTIONS SHALL BE DESIGNED AS BOLTED CONNECTIONS, UNLESS WELDED TAB CONNECTIONS ARE PREFERRED FOR CONSTRUCTABILITY AND APPROVED OTHERWISE.
    a. THE MINIMUM NUMBER OF ROWS OF BOLTS SHALL BE 1/6 OF THE BEAM DEPTH WITH ANY FRACTION TO BE ROUNDED TO THE NEXT HIGHEST MEMBER. WHERE CONSTRUCTABILITY DICTATES SHALLOWER CONNECTIONS, ALTERNATIVES MAY BE PROPOSED AND WILL BE REVIEWED ACCORDINGLY.
16. MOMENT CONNECTIONS:
    a. WHERE INDICATED, MOMENT CONNECTIONS SHALL BE DESIGNED FOR THE FORCES INDICATED ON THE STRUCTURAL DRAWINGS. MOMENTS ARE INDICATED AS "M= ".
    b. IF NOT INDICATED ON THE STRUCTURAL DRAWINGS, CONNECTIONS SHALL BE DESIGNED TO DEVELOP THE FULL FLEXURAL CAPACITY OF THE MEMBER.
    c. MOMENT CONNECTIONS SHALL BE DESIGNED AS WELDED CONNECTIONS, UNLESS DETAILED OR APPROVED OTHERWISE.
17. AXIAL FORCES ON BEAMS
    a. WHERE HORIZONTAL FORCES ARE INDICATED ON PLAN AS "H= ", CONNECTIONS SHALL BE DESIGNED TO TRANSFER THE HORIZONTAL FORCE IN ADDITION TO ANY INDICATED SHEAR AND/OR MOMENT FORCES.
18. MAIN FRAME BRACE AND TRUSS CONNECTIONS:
    a. CONNECTIONS SHALL BE WELDED UNLESS DETAILED OR APPROVED OTHERWISE.
    b. CONNECTIONS SHALL BE DESIGNED FOR THE FORCES INDICATED ON THE STRUCTURAL DRAWINGS.
    c. IF NOT INDICATED ON THE STRUCTURAL DRAWINGS, CONNECTIONS SHALL BE DESIGNED TO DEVELOP THE FULL TENSILE CAPACITY OF THE MEMBERS.
19. STEEL-TO-STEEL BOLTED CONNECTIONS:
    a. SHORT SLOTTED HOLES ARE PERMITTED PROVIDED HARDENED WASHERS ARE INSTALLED IN ACCORDANCE WITH AISC REQUIREMENTS. WHERE HORIZONTAL FORCES ARE SPECIFIED ON THE DRAWINGS, SHORT SLOTTED HOLES ARE NOT PERMITTED PARALLEL TO THE LOAD AXIS.
    b. ALL BOLTS SHALL BE ¾ INCH DIAMETER AND CONFORM TO ASTM A325, UNLESS NOTED OTHERWISE. BOLTS SHALL BE DESIGNED USING VALUES FOR BEARING TYPE BOLTS WITH THREADS ALLOWED IN THE SHEAR PLANE.
    c. BOLTS SHALL BE TIGHTENED TO "SNUG TIGHT" AS DEFINED BY AISC, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DOCUMENTS OR ON THE SEALED CONNECTION DESIGN SUBMITTAL.
    d. BOLTS NOTED AS "SLIP CRITICAL" (SC) ON THE DOCUMENTS SHALL BE TIGHTENED TO THE MINIMUM PRE-TENSIONED AMOUNTS ACCORDING TO SECTION J OF THE AISC SPECIFICATION USING ONE OF THE FOLLOWING METHODS: TURN-OF-THE-NUT METHOD, CALIBRATED TORQUE WRENCH, TWIST-OFF TYPE TENSION CONTROL, OR DIRECT TENSION INDICATORS.
20. WELDED CONNECTIONS:
    a. ALL WELDING SHALL CONFORM TO ANSI/AWS D1.1, LATEST EDITION. MINIMUM FILLET WELD SIZE SHALL BE 3/16 INCHES OR THAT REQUIRED BY AISC, WHICHEVER IS LARGER.
    b. FOR CONNECTIONS NOT SPECIFIED BY THESE NOTES OR STRUCTURAL DRAWINGS, PROVIDE FILLET WELDS AT ALL CONTACT SURFACES SUFFICIENT TO DEVELOP THE FULL TENSILE STRENGTH OF THE SMALLEST MEMBER BEING JOINED.

NON-COMPOSITE METAL DECK AND CONCRETE SLAB

1. NON-COMPOSITE METAL DECK SHALL BE VULCRAFT 2C CONFORM DECK OR APPROVED EQUAL WITH THE FOLLOWING PARAMETERS:

LOCATION	DECK DEPTH	GAUGE	CONCRETE TYPE	TOTAL THICKNESS	FY (KSI)
ALL FLOORS	3"	20	NWT	6"	50

2. SHEET STEEL FOR COMPOSITE DECK AND ACCESSORIES SHALL CONFORM TO ASTM A653 STRUCTURAL QUALITY. GALVANIZING SHALL CONFORM TO ASTM A924 WITH A MINIMUM COATING CLASS OF G60 (TYPICAL AT ALL LOCATIONS) AS DEFINED IN ASTM A653.
3. DECK SHALL BE CONSTRUCTED IN A TWO OR THREE-SPAN CONDITION (10' - 0" MAX.) SO AS NOT TO REQUIRE ANY INTERMEDIATE SHORING TO SUPPORT CONSTRUCTION LOADS AND WET CONCRETE, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS. DECK THAT ARE CONSTRUCTED IN LESS THAN A TWO-SPAN CONDITION SHALL BE SHORED AS NEEDED.
4. REINFORCE THE SLAB OVER THE COMPOSITE DECK WITH 6X6-W2.9XW2.9 WELDED WIRE MESH CHAIRED TO BE LOCATED 3/4" BELOW THE TOP OF THE SLAB. PROVIDE A 6' - 0" WIDE EXTRA LAYER OF MESH OVER ALL INTERIOR BEAMS AND GIRDERS SPANNING PARALLEL TO THE DECK SPAN.
5. METAL EDGE FORMS SHALL BE AS NOTED ON THE DRAWINGS. WELD EDGE FORM TO SUPPORTING BEAMS AT 12" SPACING, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.
6. SLABS OVER COMPOSITE DECK SHALL BE PLACED AND FINISHED TO PROVIDE A FLOOR WITHIN SPECIFIED TOLERANCES. SLAB THICKNESSES MAY VARY AWAY FROM THE COLUMNS DUE TO DEFLECTIONS OF THE BEAMS AND DECK. THE CONTRACTOR SHALL ACCOUNT FOR EXTRA CONCRETE NEEDED TO PROVIDE A LEVEL FLOOR DUE TO BEAM DEFLECTION.
7. INSTALL DECK ENDS OVER SUPPORTING FRAME WITH A MINIMUM END BEARING OF 2".
8. FASTEN FLOOR DECK PANELS TO STEEL SUPPORTING MEMBERS WITH 5/8"Ø PUDDLE WELDS AS FOLLOWS:
   A. PERPENDICULAR TO FRAMING: EACH DECK FLUTE AT EACH SUPPORT.
   B. PARALLEL TO SUPPORTS: 12" OC.
   C. SHEAR CONNECTORS WELDED THROUGH DECK CAN REPLACE A REQUIRED DECK WELD.
9. FASTEN SIDE LAPS AND PERIMETER EDGES OF PANELS BETWEEN SUPPORTS, AT INTERVALS NOT EXCEEDING THE LESSER OF 1/2 OF THE SPAN OR 36" USING ONE OF THE FOLLOWING METHODS:
   A. MECHANICALLY FASTEN WITH SELF-DRILLING NO. 10 Ø SCREWS.
   B. CRIMP OR BUTTON PUNCH.
   C. ARC SPOT (PUDDLE) WELDS 5/8" NOMINAL DIAMETER.
   D. FILLET WELDS, 1" LONG MINIMUM.
10. DO NOT USE ADMIXTURES WITH CHLORIDE SALTS IN CONCRETE FOR SLABS OVER METAL DECK.
11. ALL OPENINGS GREATER THAN 0' - 6"X0' - 6" IN PLAN (0' - 6"Ø) SHALL BE REINFORCED IN ACCORDANCE WITH THE STRUCTURAL DETAILS.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

STATE OF TEXAS
10-24-24
EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER

CORPORATE OFFICE
4051 TEXAS AVENUE
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

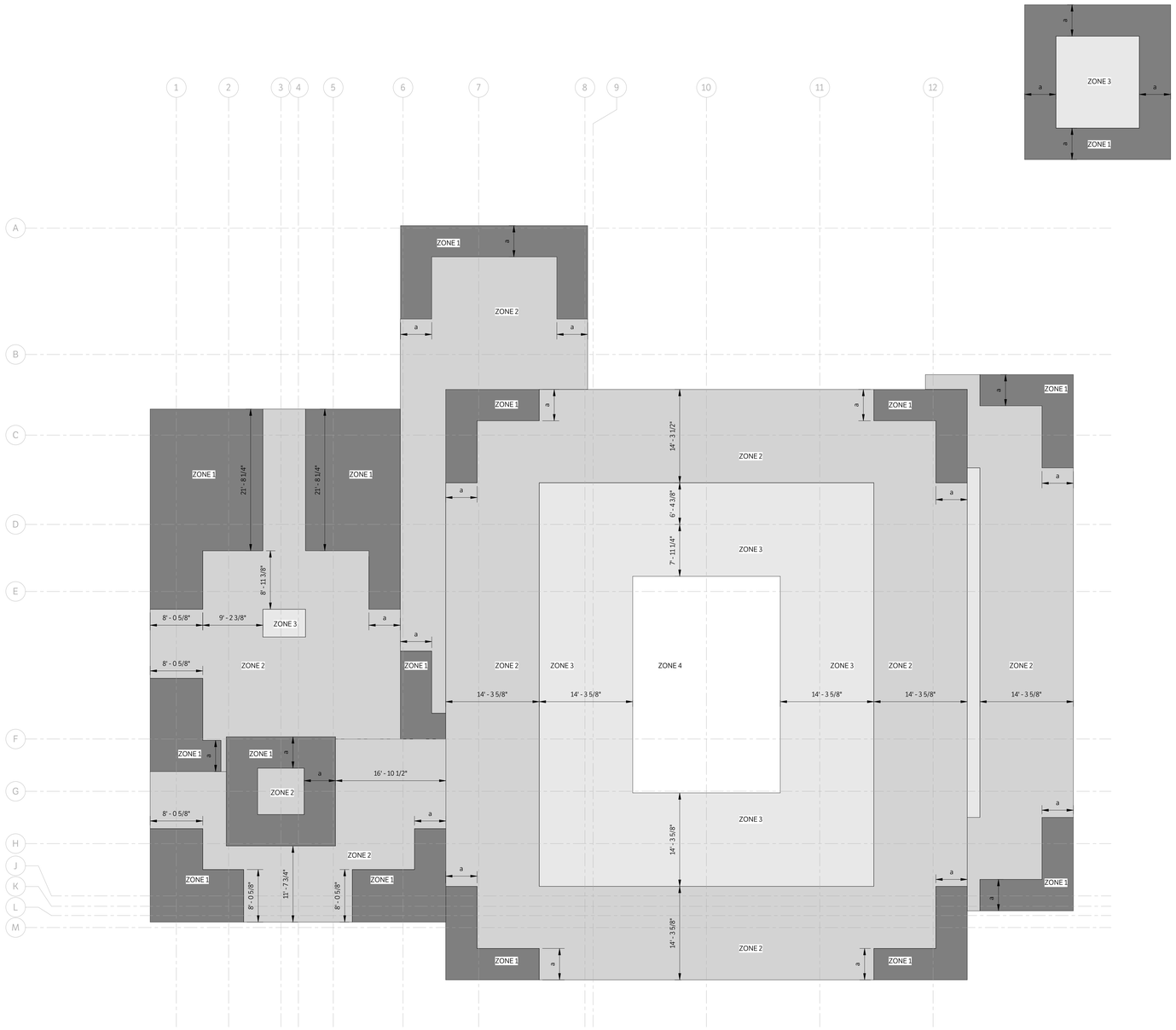
NO.	REVISION	DATE

S0.1

NOTES

UPLIFT TABLE			
ZONE	HATCH	WIND UPLIFT PRESSURES BASED ON TRIBUTARY AREA (PSF)	
		10 SF	100 SF
1		+16/-81.5	+16/-56
2		+16/-59.8	+16/-47
3		+16/-45.3	+16/-35.4
4		+16/-26	+16/-26

UPLIFT:
1. a = 5.1'
2. ALL NOTED PRESSURES SHOWN ARE STRENGTH LEVEL (LRFD) UPLIFT PRESSURES APPLIED TO THE TOP OF THE ROOF SURFACE.



PLAN NORTH TRUE NORTH

1 UPLIFT PLAN
1/8" = 1'-0"

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4 DOMAIN DRIVE
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7461, TBPLS F-10193910

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

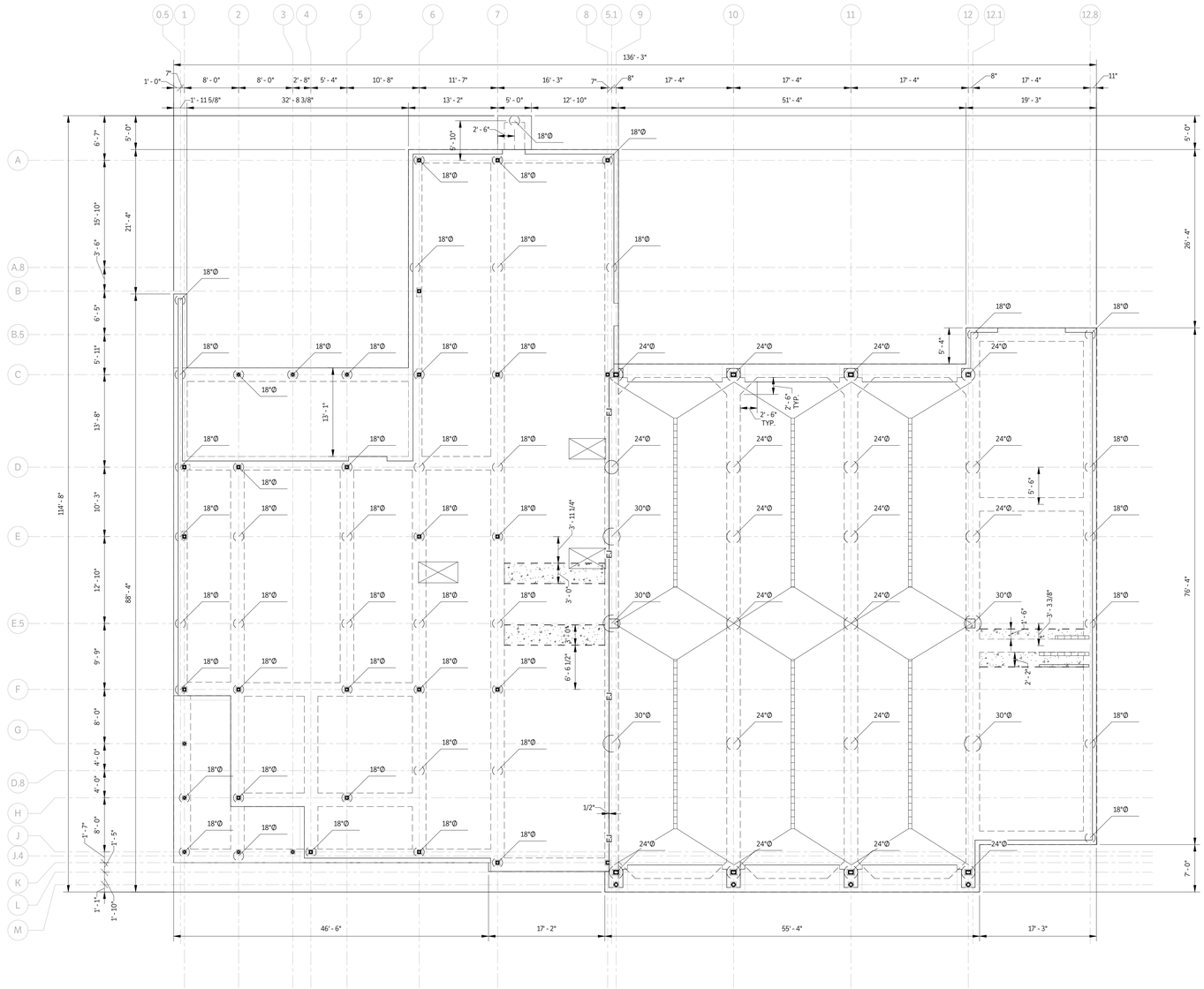
NO.	REVISION	DATE

S0.2
UPLIFT PLAN

NOTES:
1. TOP OF PIER ELEVATIONS RELATIVE TO FOUNDATION FINISH FLOOR = 0' - 0", UNLESS NOTED OTHERWISE.
2. REF. 1 / S5.1 FOR PIER REINF. & BEARING DEPTH.
3. TOP OF CONCRETE ELEVATION = FINISH FLOOR, UNO.
4. PIERS MUST BE POURED THE SAME DAY THEY ARE DRILLED. PIER SHAFTS SHALL NOT BE LEFT OPEN OVERNIGHT. PIERS THAT ARE UNABLE TO BE POURED ON THE SAME DAY AS THEY ARE DRILLED SHALL BE BACKFILLED AS PER GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
5. CONTRACTOR SHALL VERIFY LOCATIONS AND TYPES OF PLUMBING FIXTURES WITH ARCHITECTURAL DRAWINGS PRIOR TO COMMENCING CONSTRUCTION.
6. VERIFY ALL DIMENSIONS & DROPS WITH ARCHITECT AND OWNER PRIOR TO COMMENCING CONSTRUCTION.

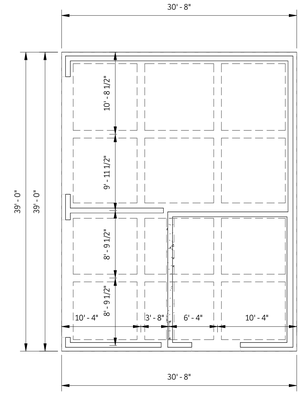
LEGEND

24" Ø — PIER DIAMETER



PLAN NORTH TRUE NORTH

1 DIMENSION CONTROL PLAN
1/8" = 1'-0"



PLAN NORTH TRUE NORTH

2 DIMENSION CONTROL PLAN - STORAGE
1/8" = 1'-0"

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

GESSNER ENGINEERING
CORPORATE OFFICE
4103 VALLEY STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER
10 31 2023

DATE	10.24.24
DRAWN BY	BGL
CHECKED BY	EJR
BRW PROJECT NUMBER	23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

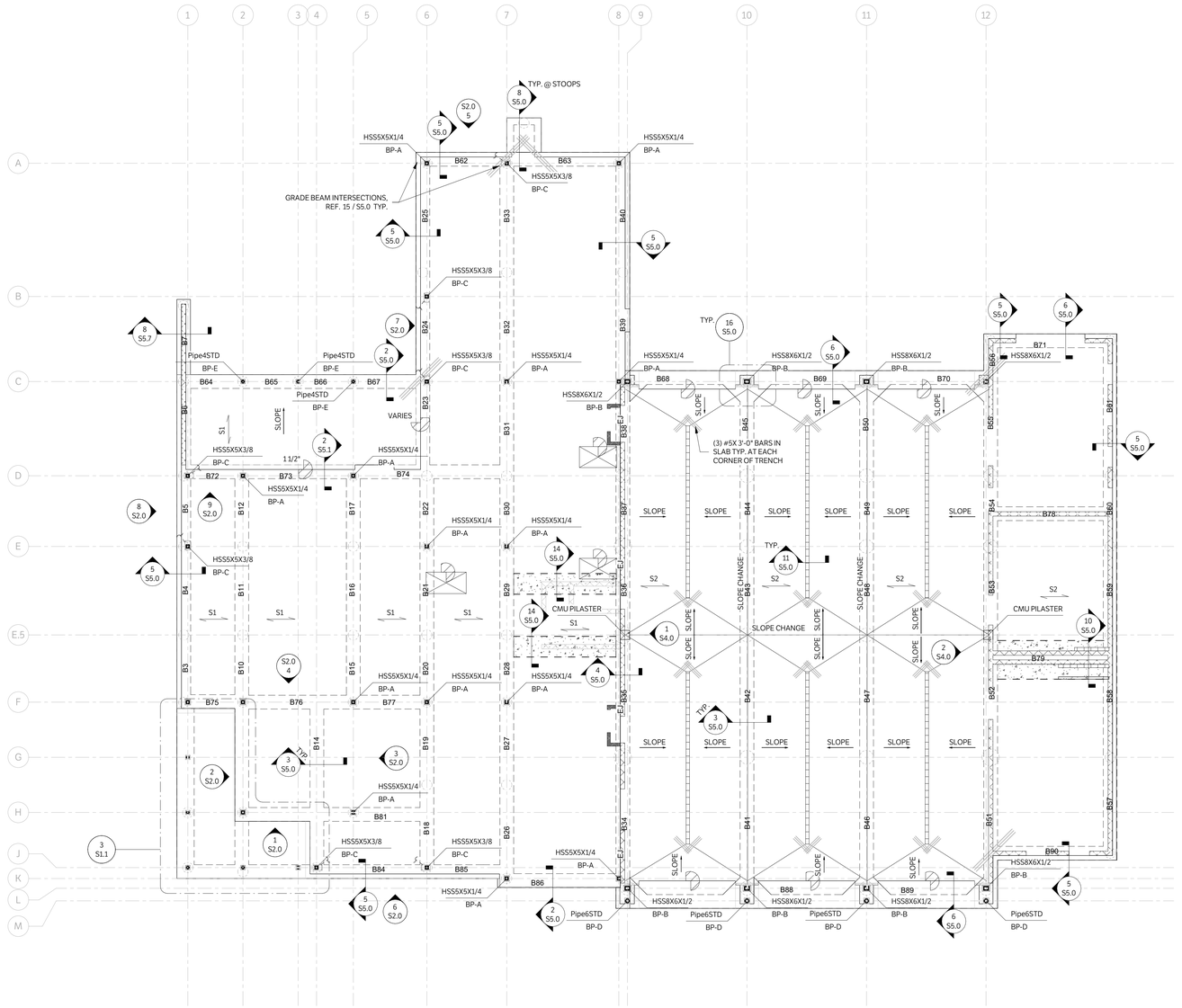
S1.0
DIMENSION CONTROL PLAN

BASEPLATE SCHEDULE												
		PLATE DIMENSIONS						ANCHORS			ADDITIONAL REINF.	
MARK	TYPE	V	W	U	T	X	THICKNESS	QTY	Ø	EMBEDMENT	TENSION	SHEAR
BP-A	1	10"	10"	5"	5"	1 1/2"	3/4"	(4)	3/4"	1' - 0"		
BP-B	3	1' - 2"	11"	7"	5 1/2"	1 1/2"	3/4"	(8)	3/4"	1' - 0"		
BP-C	2	1' - 4"	10"	1' - 0"	5"	1 1/2"	3/4"	(6)	3/4"	1' - 0"		
BP-D	4	10"	10"	5"	5"	2"	3/4"	(4)	3/4"	1' - 0"		
BP-E	4	8"	8"	4"	4"	1 1/2"	3/4"	(4)	3/4"	1' - 0"		

NOTES:
1. FINISH FLOOR ELEVATION SHALL BE RELATIVE TO 0 - 0". 0' - 0" FFE ELEVATION IS BASED UPON DATUM ELEVATION OF 312.33 FEET.
2. TOP OF CONCRETE ELEVATION = FINISH FLOOR, UNO.
3. REFERENCE GENERAL NOTES AND DETAILS FOR ADDITIONAL INFORMATION.
4. CONTRACTOR SHALL VERIFY LOCATIONS AND TYPES OF PLUMBING FIXTURES WITH ARCHITECTURAL DRAWINGS PRIOR TO COMMENCING CONSTRUCTION.
5. VERIFY ALL DIMENSIONS & DROPS WITH ARCHITECT AND OWNER PRIOR TO COMMENCING CONSTRUCTION.
6. PIERS MUST BE POURED THE SAME DAY THEY ARE DRILLED. PIER SHAFTS SHALL NOT BE LEFT OPEN OVERNIGHT. PIERS THAT ARE UNABLE TO BE POURED ON THE SAME DAY AS THEY ARE DRILLED SHALL BE BACKFILLED AS PER THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
7. TOP OF PIER ELEVATION SHALL BE BOTTOM OF SUPPORTED GRADE BEAM ELEVATION. BOTTOM OF GRADE BEAM ELEVATION SHALL BE DETERMINED FROM FOUNDATION FFE, LESS SLAB AND GRADE BEAM DEPTHS PER DETAILS PROVIDED ON S5.0
8. BOTTOM OF PIER ELEVATION SHALL BE REFERENCED TO EXISTING GROUND ELEVATION PER DETAILS. TOTAL PIER LENGTH SHALL ACCOUNT FOR SITE BUILD-UP AS REQUIRED

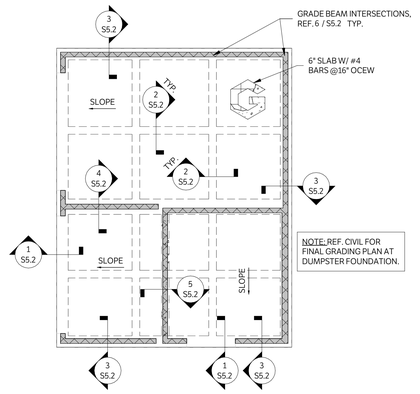
LEGEND

- DROP
- SLOPE — 1:50 SLOPE, UNO
- S1 — SLAB TYPE; DIRECTION OF SLAB SPAN
- B# — BRACE ABOVE
- HSS5X5X1/4 / BP-A — COLUMN SIZE; BASE PLATE TYPE
- 8" CMU FULLY GROUTED W/ #5 BARS @32", REF. 1 / S5.7
- 8" CMU PARTIALLY GROUTED W/ #5 BARS @ 32" OC
- 8" CMU WALL NON-LOAD BEARING PARTIALLY GROUTED W/ #5 BARS @48"
- 4" CMU WALL NON-LOAD BEARING PARTIALLY GROUTED W/ #5 BARS @48"
- 6" CMU WALL NON-LOAD BEARING PARTIALLY GROUTED W/ #5 BARS @48"



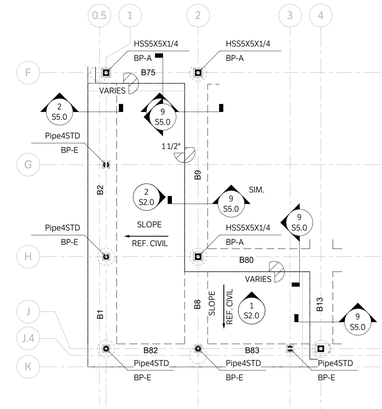
1 FOUNDATION PLAN
1/8" = 1'-0"

PLAN NORTH / TRUE NORTH



2 FOUNDATION PLAN - STORAGE
1/8" = 1'-0"

PLAN NORTH / TRUE NORTH



3 ENTRY FOUNDATION PLAN
3/16" = 1'-0"

PLAN NORTH / TRUE NORTH

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER
10 31 2024

CORPORATE OFFICE
4001 MAPLE AVENUE
BRYAN, TEXAS 77801
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

S1.1

FOUNDATION PLAN

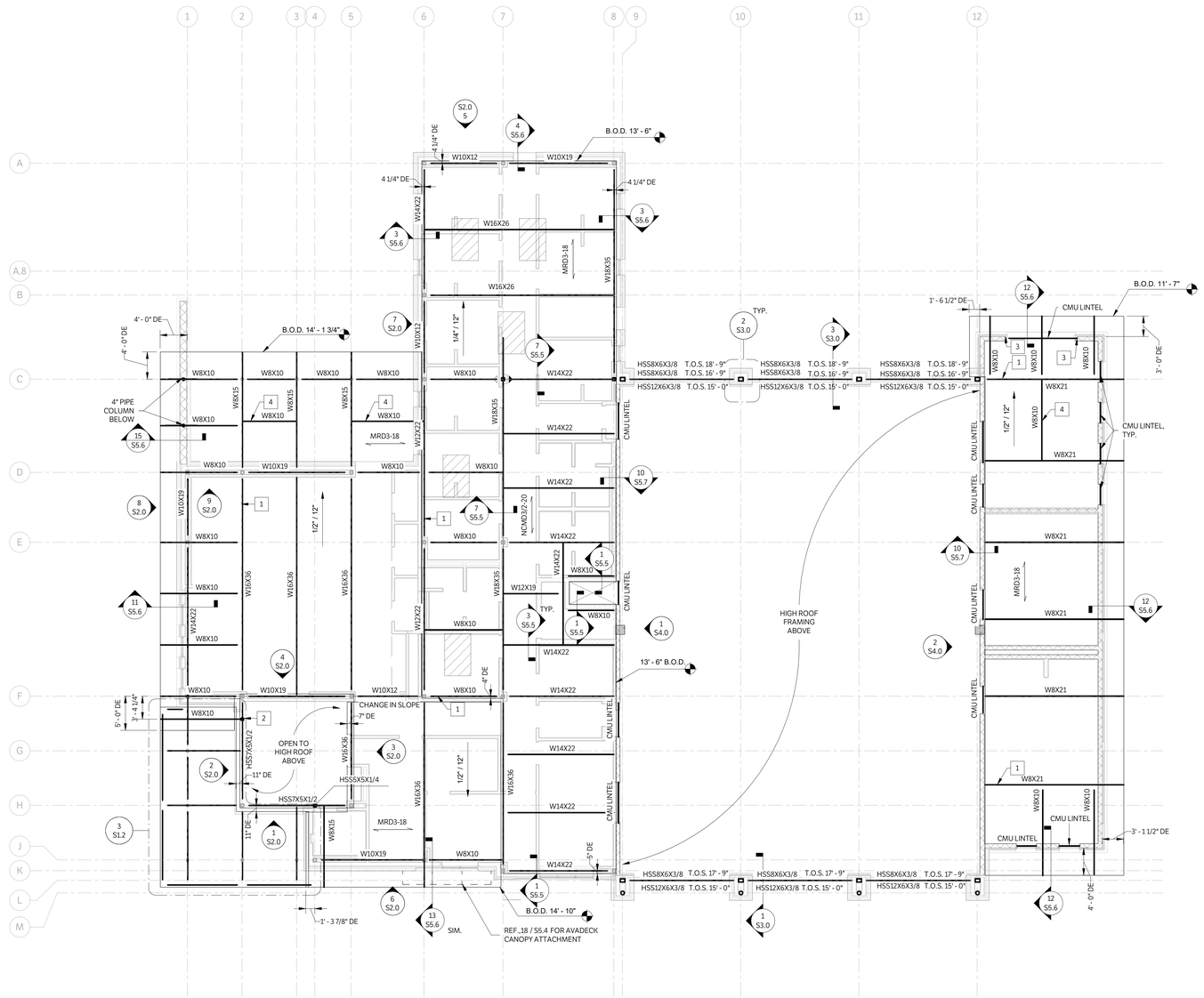
MEZZANINE & LOW ROOF FRAMING NOTES	
1	CHANGE IN DECK DIRECTION, REF. 5 / S5.6
2	HSS4X4X1/4 STUB COLUMN SUPPORTED BY HSS7X5X1/2" BELOW, REF. 8 / S5.4. SUPPORTING W8X10 BEAM ABOVE, REF. 7 / S5.4
3	SECURE OVERHEAD DOOR ASSEMBLY DIRECTLY TO CMU WALL. CONTRACTOR TO VERIFY W/ SUBMITTAL AND PROVIDE GROUTED CELLS AT CONNECTION POINT.
4	LOCATED STEEL BEAM ABOVE FANS BELOW. SECURE FANS DIRECTLY TO THE STEEL BEAM PER MANUF. INSTALLATION REQUIREMENTS

NOTES:
1. REFERENCE PLAN AND SECTIONS FOR DECK ELEVATIONS, UNLESS NOTED OTHERWISE. DATUM ELEVATION: 312.33' = 0'-0"
2. TOP OF STEEL ELEVATION = BOTTOM OF DECK, UNLESS NOTED OTHERWISE.
3. STEEL BEAMS AND JOISTS ARE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.
4. ALL BEAM TO BEAM AND BEAM TO COLUMN CONNECTIONS SHALL BE SINGLE PLATE OR DOUBLE ANGLE SHEAR CONNECTIONS, UNLESS NOTED OTHERWISE. CONNECTIONS SHALL BE SELECTED FROM WITH A CORRESPONDING CAPACITY THAT EXCEEDS THE NOTED SHEAR REACTION. REACTIONS NOTED ON PLAN ARE STRENGTH LEVEL, IN KIPS. BEAMS LOCATED IN BRACED FRAMES SHALL BE ATTACHED TO COLUMNS WITH DOUBLE ANGLE SHEAR CONNECTIONS
5. ALL MOMENT CONNECTIONS SHALL BE END PLATE BOLTED CONNECTIONS PER DETAIL 2 / S5.4 NOTED OTHERWISE.
6. TAGGED COLUMNS BEGIN AT THIS LEVEL. HALFTONED COLUMNS TERMINATE AT THIS LEVEL. COLUMNS NOT TAGGED ON PLAN CONTINUE UP FROM BELOW.
7. REFERENCE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF FLOOR RECESSES, DROPS 13" / S5.4 OPES.
8. REFERENCE MEP DRAWINGS FOR LOCATION AND DIMENSIONS OF FLOOR PENETRATIONS HOUSEKEEPING PADS AND ITEMS TO BE EMBEDDED IN SLAB.
9. COORDINATE AND VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
10. REFERENCE GENERAL NOTES, TYPICAL DETAILS, AND PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION.
11. REFERENCE BUILDING ELEVATIONS FOR ADDITIONAL STEEL.
12. REFERENCE THE FOLLOWING SHEETS FOR TYPICAL DETAILS AND SCHEDULES:
    - S-5.4 - TYPICAL STEEL CONNECTION DETAILS
    - S-5.5 - TYPICAL FLOOR FRAMING DETAILS
    - S-5.6 - TYPICAL ROOF FRAMING DETAILS

VENEER MASONRY NOTES:
1. PROVIDE LOOSE LINTELS OVER ALL OPENINGS WITH MASONRY IF NOT SUPPORTED BY THE BUILDING STRUCTURE.
2. LOOSE LINTELS MAY BE ONE OF THE FOLLOWING:A. PRECAST CONCRETE OR STONE LINTELS, IN ACCORDANCE W/ MANUFACTURER SPECIFICATIONS.
3. GALVANIZED L4X4X3/8 FOR OPENINGS NO WIDER THAN 10' -0", EXTENDING A MINIMUM 8" TO BEAR ON MASONRY AT EACH END OF THE OPENING.

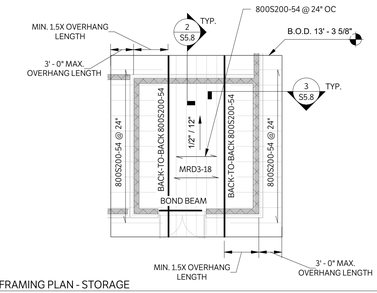
LEGEND:

- HSS5X5X1/4 / BP-8 — COLUMN SIZE / BASE PLATE TYPE
- W14X90 (12) c-3/4" — NUMBER OF HEADED CONCRETE ANCHORS
- BEAM CAMBER
- BRACES CONTINUING ABOVE ARE INDICATED BY HIDDEN LINES ABOVE BEAM
- BRACES CONTINUING BELOW ARE INDICATED BY HIDDEN LINES BELOW BEAM
- DECK TYPE: *CMD*=COMPOSITE METAL DECK *NCMD*=NON-COMPOSITE METAL DECK
- CONCRETE DEPTH ABOVE METAL DECK
- CMD4/2-16 — DECK SPAN DIRECTION / METAL DECK GAUGE / METAL DECK DEPTH
- DECK TYPE: *MRD*=METAL ROOF DECK
- MRD3-18 — DECK SPAN DIRECTION / METAL DECK GAUGE / METAL DECK DEPTH
- MOMENT CONNECTION ON BEAM 14 / S5.4
- BOTTOM FLANGE BRACE (L3X3X1/4, UNO) REF. 2 / S5.5
- MECHANICAL OPENING
- MECHANICAL UNIT, REF. MEP FOR SIZING



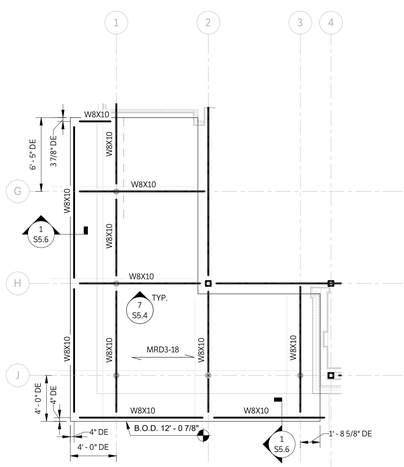
1 MEZZANINE & LOW ROOF FRAMING PLAN
1/8" = 1'-0"

PLAN NORTH / TRUE NORTH



2 ROOF FRAMING PLAN - STORAGE
1/8" = 1'-0"

PLAN NORTH / TRUE NORTH



3 ENTRANCE CANOPY FRAMING
3/16" = 1'-0"

PLAN NORTH / TRUE NORTH

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER
10 31 2024

CORPORATE OFFICE
4101 LYNCH STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

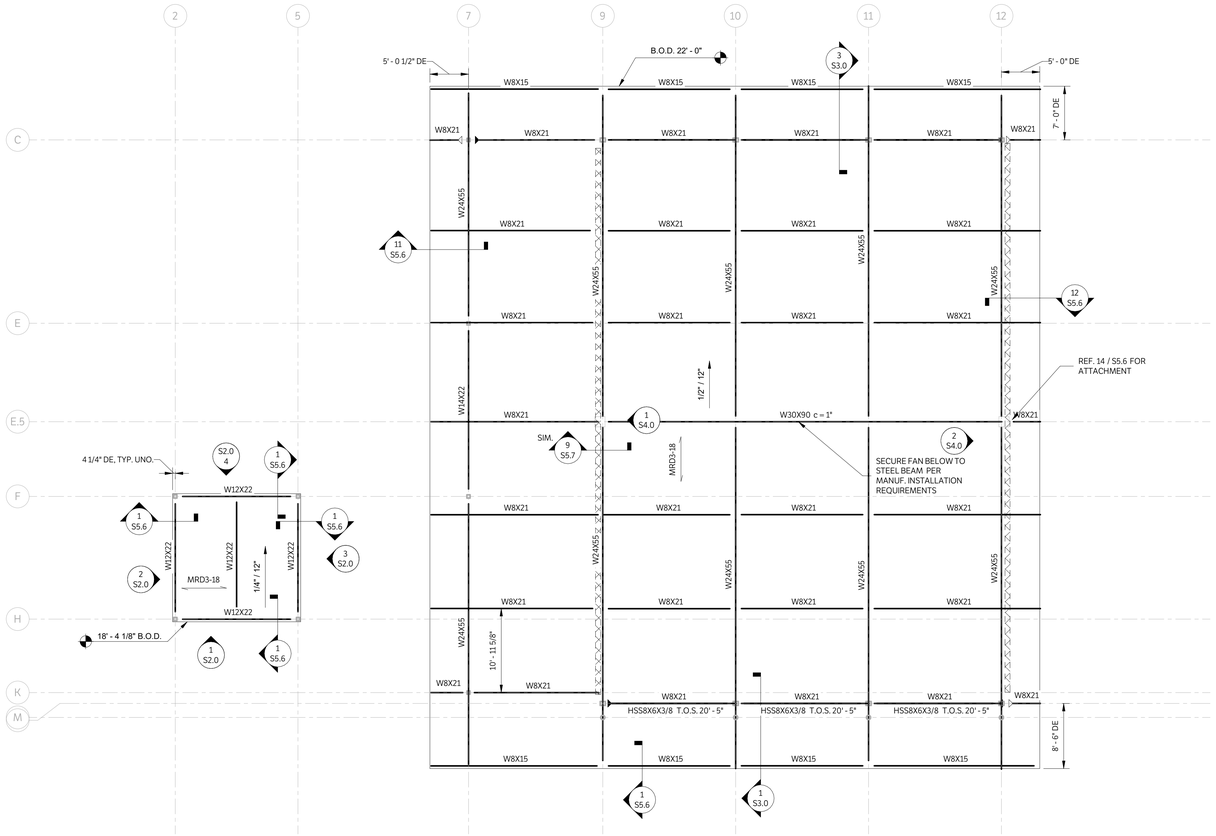
DATE	10.24.24
DRAWN BY	BGL
CHECKED BY	EJR
BRW PROJECT NUMBER	23-0693

BRENHAM FIRE STATION NO. 2
2007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

S1.2

MEZZANINE & LOW ROOF FRAMING PLAN



NOTES:
1. REFERENCE PLAN AND SECTIONS FOR DECK ELEVATIONS, UNLESS NOTED OTHERWISE. DATUM ELEVATION: 312.33' = 0' - 0"
2. TOP OF STEEL ELEVATION = BOTTOM OF DECK, UNLESS NOTED OTHERWISE.
3. TYPICAL ROOF DECK IS 3" STEEL DECK, REFERENCE GENERAL NOTES.
4. TYPICAL FLOOR DECK IS 3" NW CONCRETE OVER 2" COMPOSITE STEEL DECK (5" TOTAL) UNLESS NOTED OTHERWISE. REFFERENCE STRUCTURAL NOTES, TYPICAL DETAILS, AND PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION.
5. STEEL BEAMS AND JOISTS ARE CENTERED ON AND EQUALLY SPACED BETWEEN COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.
6. ALL BEAM TO BEAM AND BEAM TO COLUMN CONNECTIONS SHALL BE SINGLE PLATE OR DOUBLE ANGLE SHEAR CONNECTIONS, UNLESS NOTED OTHERWISE. CONNECTIONS SHALL BE SELECTED FROM 2 / S5.4 WITH A CORRESPONDING CAPACITY THAT EXCEEDS THE NOTED SHEAR REACTION. REACTIONS NOTED ON PLAN ARE STRENGTH LEVEL, IN KIPS. BEAMS LOCATED IN BRACED FRAMES SHALL BE ATTACHED TO COLUMNS WITH DOUBLE ANGLE SHEAR CONNECTIONS
7. ALL MOMENT CONNECTIONS SHALL BE END PLATE BOLTED CONNECTIONS PER DETAIL 13 / S5.4 , UNLESS NOTED OTHERWISE.
8. TAGGED COLUMNS BEGIN AT THIS LEVEL. HALFTONED COLUMNS TERMINATE AT THIS LEVEL. COLUMNS NOT TAGGED ON PLAN CONTINUE UP FROM BELOW.
9. REFERENCE ARCHITECTURAL DRAWINGS FOR LOCATIONS OF FLOOR RECESSES, DROPS, AND SLOPES.
10. REFERENCE MEP DRAWINGS FOR LOCATION AND DIMENSIONS OF FLOOR PENETRATIONS HOUSEKEEPING PADS AND ITEMS TO BE EMBEDDED IN SLAB.
11. COORDINATE AND VERIFY ALL DIMENSIONS WITH ARCHITECTURAL DRAWINGS.
12. REFERENCE GENERAL NOTES, TYPICAL DETAILS, AND PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION.
13. REFERENCE BUILDING ELEVATIONS FOR ADDITIONAL STEEL.
14. REFERENCE THE FOLLOWING SHEETS FOR TYPICAL DETAILS AND SCHEDULES:
    - S-5.2 - TYPICAL STEEL DETAILS
    - S-5.3 - FLOOR FRAMING DETAILS
    - S-5.4 - ROOF FRAMING DETAILS

VENEER MASONRY NOTES:
1. PROVIDE LOOSE LINTELS OVER ALL OPENINGS WITH MASONRY IF NOT SUPPORTED BY THE BUILDING STRUCTURE.
2. LOOSE LINTELS MAY BE ONE OF THE FOLLOWING:A. PRECAST CONCRETE OR STONE LINTELS, IN ACCORDANCE W/ MANUFACTURER SPECIFICATIONS.
3. GALVANIZED L6X4X3/8 FOR OPENINGS NO WIDER THAN 10' -0", EXTENDING A MINIMUM 8" TO BEAR ON MASONRY AT EACH END OF THE OPENING.

LEGEND:

HSS5X5X1/4 / BP-1 — COLUMN SIZE; BASE PLATE TYPE; NUMBER OF HEADED CONCRETE ANCHORS

W14X90 [1/2] c=3/4" — BEAM CAMBER

BRACES CONTINUING ABOVE ARE INDICATED BY HIDDEN LINES ABOVE BEAM

BRACES CONTINUING BELOW ARE INDICATED BY HIDDEN LINES BELOW BEAM

DECK SPAN — DIRECTION OF DECK SPAN

MOMENT CONNECTION ON BEAM 14 / S5.4

BOTTOM FLANGE BRACE (L3X3X1/4, UNO) REF. 2 / S5.5

MECHANICAL OPENING

PLAN NORTH / TRUE NORTH

1 HIGH ROOF FRAMING PLAN
1/8" = 1'-0"

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4101 LINDELL STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

STATE OF TEXAS — 10 31 2024 — EVAN J. ROE — 141174 — LICENSED PROFESSIONAL ENGINEER

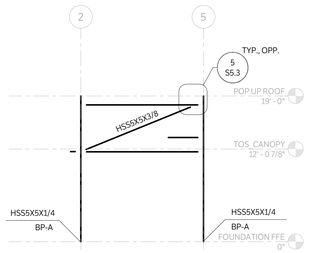
BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

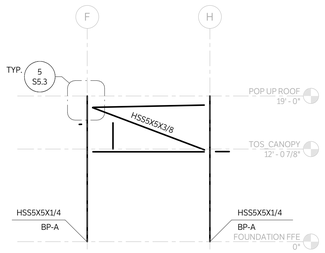
NO.	REVISION	DATE

S1.3

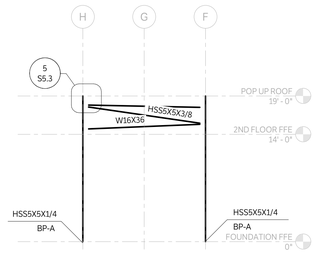
HIGH ROOF FRAMING PLAN



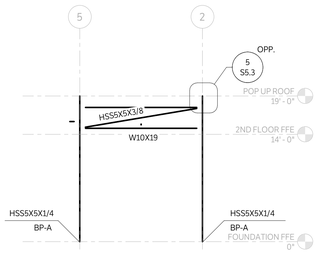
1 BRACE FRAME ELEVATION - (H/2 - H/5)
1/8" = 1'-0"



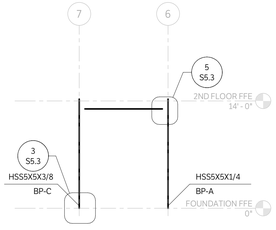
2 BRACE FRAME ELEVATION - (2/F - 2/H)
1/8" = 1'-0"



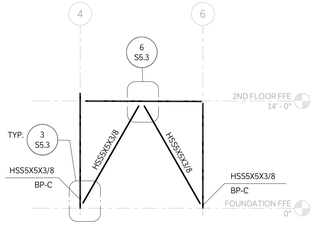
3 BRACE FRAME ELEVATION - (5/F - 5/H)
1/8" = 1'-0"



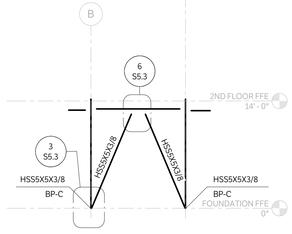
4 BRACE FRAME ELEVATION - (F/2 - F/5)
1/8" = 1'-0"



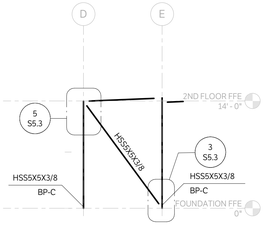
5 BRACE FRAME ELEVATION - (A/6 - A/7)
1/8" = 1'-0"



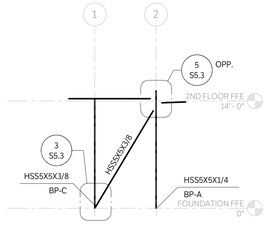
6 BRACE FRAME ELEVATION - (J/4 - J/6)
1/8" = 1'-0"



7 BRACE FRAME ELEVATION - (6/B - 6/C)
1/8" = 1'-0"



8 BRACE FRAME ELEVATION - (1/D - 1/E)
1/8" = 1'-0"



9 BRACE FRAME ELEVATION - (D/1 - D/2)
1/8" = 1'-0"

BROWN REYNOLDS WATFORD
ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4001 WHITE STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

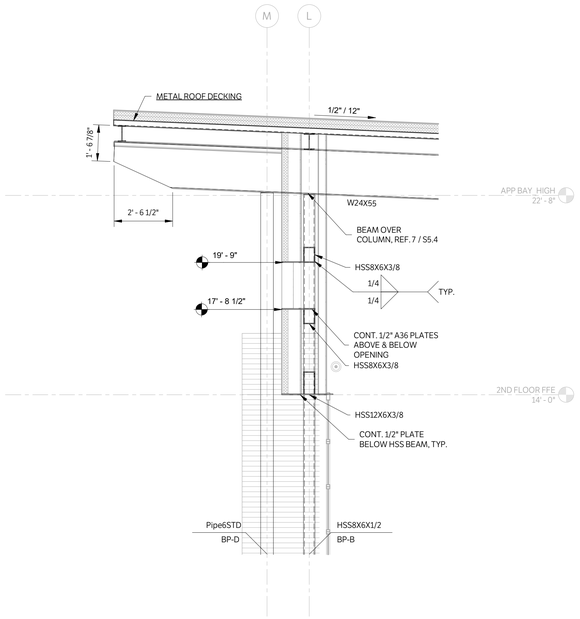
BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

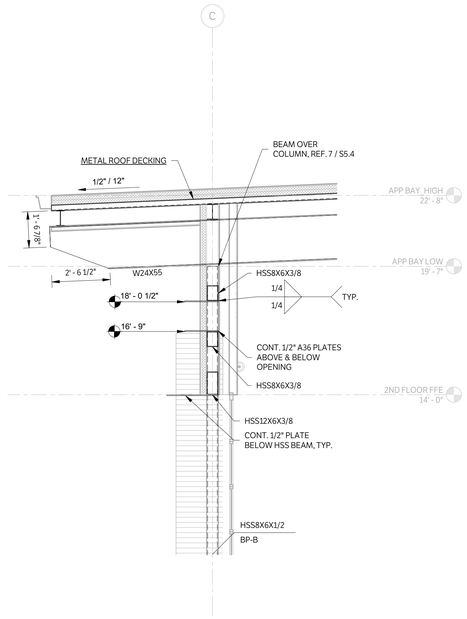
NO.	REVISION	DATE

S2.0

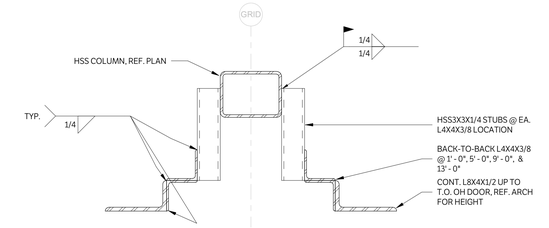
BRACE ELEVATIONS



1 WALL SECTION - TYPICAL APPARATUS OH DOOR OPENING
3/8" = 1'-0"



3 WALL SECTION APPARATUS
3/8" = 1'-0"



2 JAMB COLUMN TO STEEL COLUMN ASSEMBLY
N.T.S.

BROWN REYNOLDS WATFORD
ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

STATE OF TEXAS
10 31 2024
EVAN J. ROE
141174
LICENSED
PROFESSIONAL ENGINEER

CORPORATE OFFICE
4001 MAPLE STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER
ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

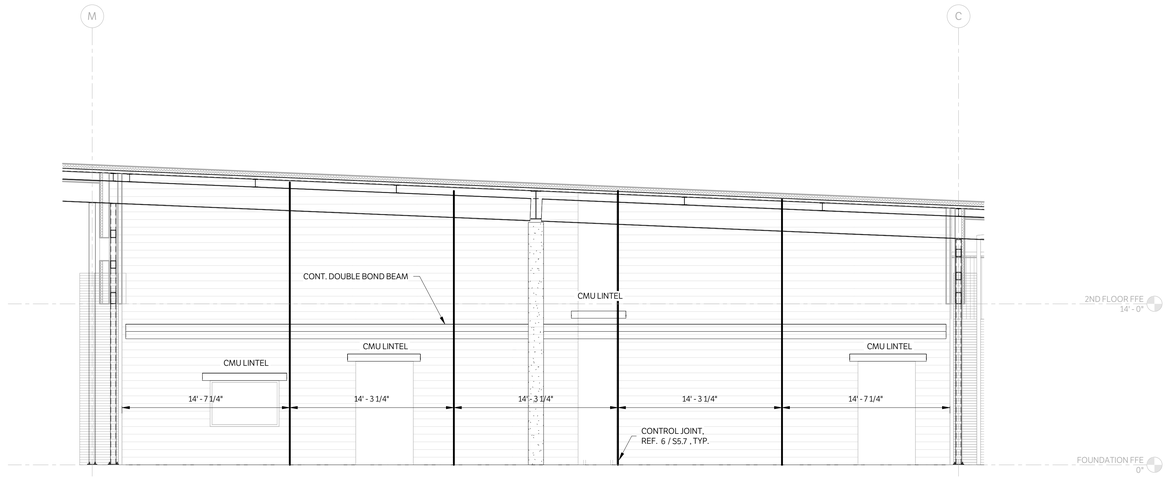
BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

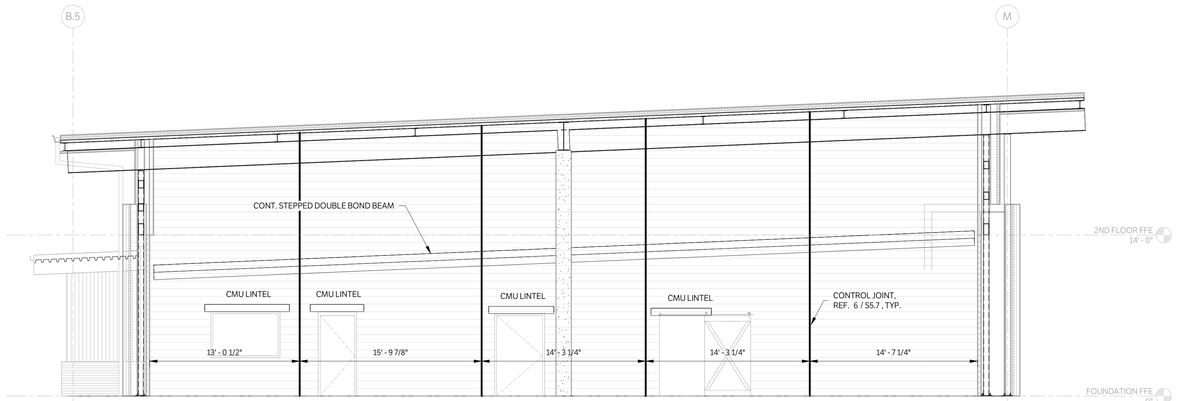
NO.	REVISION	DATE

S3.0

STRUCTURAL WALL SECTIONS



1 APPARATUS BAY ELEVATION - PLAN WEST
3/16" = 1'-0"



2 APPARATUS BAY ELEVATION - PLAN EAST
3/16" = 1'-0"

BROWN REYNOLDS WATFORD
ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

BRW

STATE OF TEXAS
10 31 2024
EVAN J. ROE
141174
LICENSED
PROFESSIONAL ENGINEER

CORPORATE OFFICE
4001 BOYETT STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

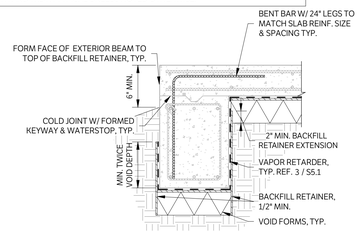
NO.	REVISION	DATE

S4.0

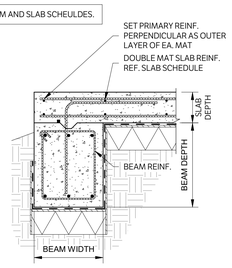
BUILDING ELEVATIONS

SHEET NOTES:
1. REFERENCE PLANS FOR SLOPING SLAB CONDITIONS.
2. WHERE SLAB DROP IS LESS THAN OR EQUAL TO 1 1/2", SLAB REINFORCEMENT MAY BE CONTINUOUS AND BENT BELOW DROP IN LIEU OF PROVIDING BENT BARS AS SHOWN.
3. VAPOR RETARDER AS DETAILED TO BE INSTALLED BELOW ALL FOUNDATION CONCRETE.
4. ALL SPLICES SHALL BE AS SPECIFIED IN THE GENERAL NOTES.
5. BEAM REINFORCEMENT TYPICAL UNLESS NOTED OTHERWISE.
6. BEAM DEPTH AND WIDTH TYPICAL UNLESS NOTED OTHERWISE.

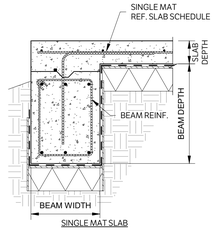
NOTE: REF. S6.0 FOR BEAM AND SLAB SCHEULDES.



1 VOID FORM AND BACKFILL RETAINERS
N.T.S.

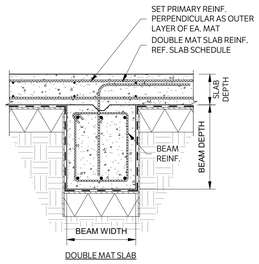


DOUBLE MAT SLAB

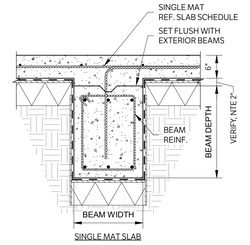


SINGLE MAT SLAB

2 EXTERIOR BEAM
N.T.S.

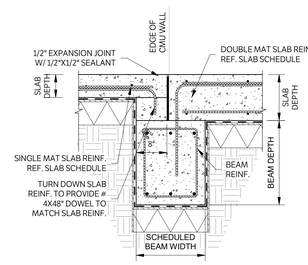


DOUBLE MAT SLAB

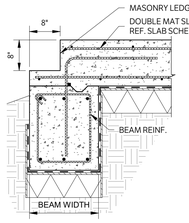


SINGLE MAT SLAB

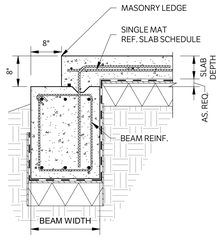
3 INTERIOR BEAM
N.T.S.



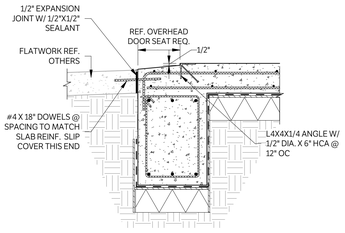
4 SLAB TRANSITION
N.T.S.



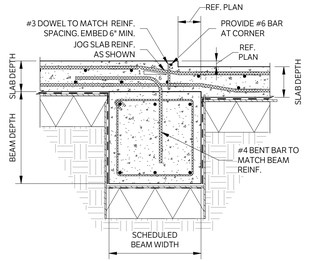
5 EXTERIOR BEAM W/ MASONRY LEDGE
N.T.S.



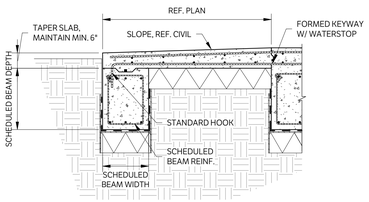
6 GARAGE FLATWORK
N.T.S.



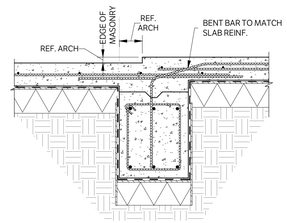
7 DROP IN SLAB OVER BEAM
N.T.S.



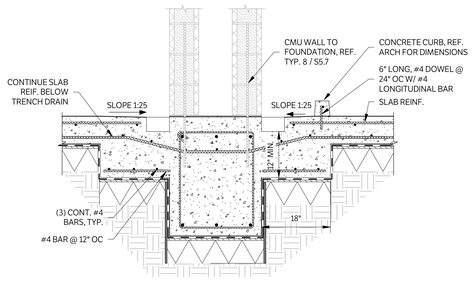
NOTES:
1. CONTRACTOR MAY FORM ELEVATED CONCRETE IN LIEU OF USING CARTON FORMS.
2. PROVIDE 1/2"X8" RECESS IN EXTERIOR BEAM AT BRICK LOCATIONS.
3. WHERE STOOP BEAM INTERSECTS EXTERIOR BEAM FOR MAIN BUILDING FOUNDATION, PROVIDE 6"X6"X1 1/2" SHEAR KEY AND (4) #6X18" DOWELS IN CENTER OF BEAM.



8 TYPICAL SECTION AT STOOP
N.T.S.

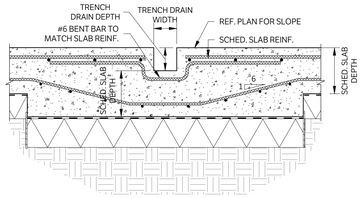


9 INTERIOR BEAM W/ MASONRY POCKET
N.T.S.

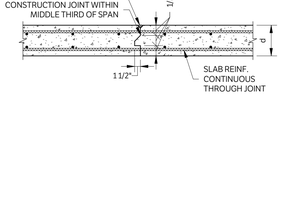


10 INTERIOR BEAM @ TRENCH DRAINS
N.T.S.

TRENCH DRAIN NOTES:
1. TRENCH DRAIN WIDTH AND DEPTH SHALL BE DETERMINED BY TRENCH DRAIN MANUFACTURER'S WRITTEN REQUIREMENTS AND INSTRUCTIONS FOR INSTALLATION.
2. NO REINFORCEMENT SHALL BE CUT OR MODIFIED TO ACCOMMODATE THE TRENCH DRAIN AND/OR ALL ASSOCIATED PLUMBING. PLACEMENT OF THE STEEL REINFORCEMENT AND FORMWORK SHALL BE COORDINATED WITH THE TRENCH DRAINS AND ASSOCIATED PLUMBING PRIOR TO CONSTRUCTION.

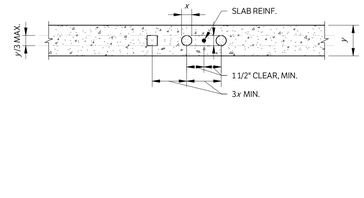


11 SOV TRENCH DRAIN
N.T.S.

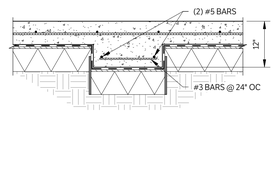


12 CONSTRUCTION JOINT IN SLAB
N.T.S.

NOTES:
1. PLACE THE CONDUITS BETWEEN TOP AND BOTTOM SLAB REINFORCEMENT AND LOCATE AS CLOSE AS POSSIBLE TO THE MID-DEPTH OF THE SLAB.
2. DO NOT SPACE CONDUITS CLOSER THAN (3) DIAMETERS OR WIDTHS ON CENTER.
3. DO NOT PLACE CONDUIT ADJACENT TO NOR TIE CONDUIT TO PARALLEL REINFORCING BARS.



13 CONDUITS IN STRUCTURAL SLAB
N.T.S.

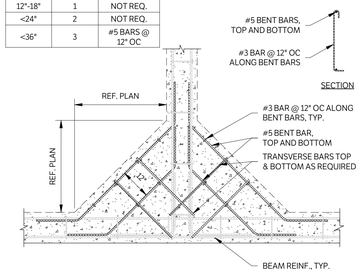


14 THICKENED SLAB
N.T.S.

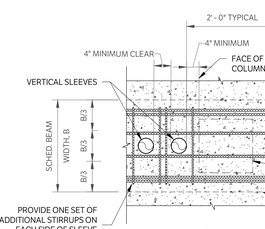
NOTES:
1. NO ADDITIONAL REINFORCEMENT IS REQUIRED FOR SINGLE OPENINGS LESS THAN 6" WIDE.
2. REINFORCEMENT NOTED IS IN ADDITION TO SCHEDULED SLAB REINFORCEMENT.
3. PROVIDE HALF OF INTERRUPTED REINF. PLUS (1) ADDITIONAL BAR OF SAME SIZE ON EA. SIDE OF OPENINGS.
4. WHERE CLEAR SPACING BETWEEN ADJACENT SLEEVES IS LESS THAN 3", THE SLEEVE GROUP SHALL BE TREATED AS AN EQUIVALENT RECTANGULAR OPENING AS SHOWN.
5. WHERE CLEAR SPACING BETWEEN ADJACENT SLEEVES IS GREATER THAN OR EQUAL TO 3", SCHEDULED SLAB BAR REINFORCEMENT SHALL BE OFFSET AS REQUIRED TO MIS SLEEVES.
6. ISOLATED PIPE SLEEVES THAT ARE SMALLER THAN 5" AND DO NOT INTERRUPT REINFORCEMENT DO NOT REQUIRE THE USE OF THIS DETAIL.

15 GRADE BEAM INTERSECTIONS
N.T.S.

FOOTING WIDTH	# OF BENT BARS	TRANSVERSE BARS
12"-18"	1	NOT REQ.
<24"	2	NOT REQ.
<36"	3	#5 BARS @ 12" OC

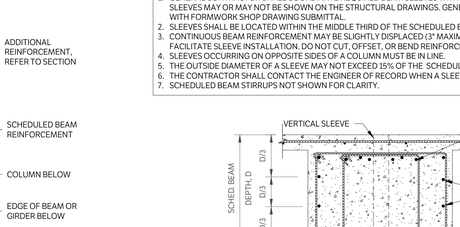


16 FOOTING AT EXTERIOR INTERSECTION
N.T.S.

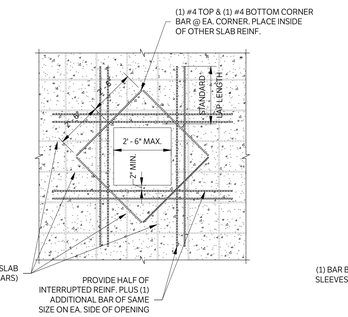


PLAN

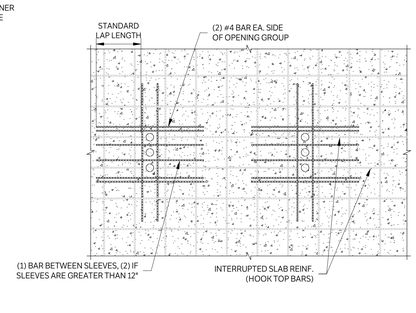
17 VERTICAL PENETRATION IN CONCRETE BEAM - ON VOID
N.T.S.

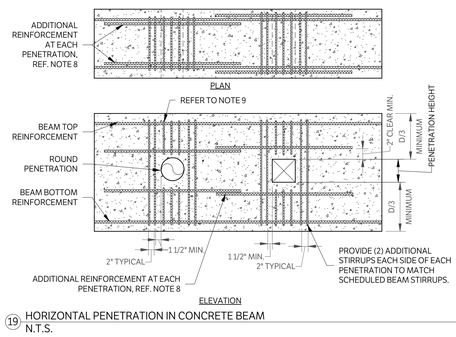


SECTION



18 TYPICAL SLAB OPENING REINF.
N.T.S.





ELEVATION

19 HORIZONTAL PENETRATION IN CONCRETE BEAM
N.T.S.

NOTES:
1. GENERAL CONTRACTOR SHALL COORDINATE REQUIRED BEAM SLEEVES WITH MECHANICAL, ELECTRICAL, AND PLUMBING CONTRACTORS. REQUIRED SLEEVES MAY OR MAY NOT BE SHOWN ON THE STRUCTURAL DRAWINGS. GENERAL CONTRACTOR SHALL SUBMIT PLAN SHOWING LAYOUT OF ALL SLEEVES WITH FORMWORK SHOP DRAWING SUBMITTAL.
2. SLEEVES SHALL BE LOCATED WITHIN THE MIDDLE THIRD OF THE SCHEDULED BEAM WIDTH.
3. CONTINUOUS BEAM REINFORCEMENT MAY BE SLIGHTLY DISPLACED (3" MAXIMUM) OR ADJACENT BARS BUNDLED (2 BAR BUNDLES MACIMUM) TO FACILITATE SLEEVE INSTALLATION. DO NOT CUT, OFFSET, OR BEND REINFORCEMENT.
4. SLEEVES OCCURRING ON OPPOSITE SIDES OF A COLUMN MUST BE IN LINE.
5. THE OUTSIDE DIAMETER OF A SLEEVE MAY NOT EXCEED 15% OF THE SCHEDULED WIDTH OF THE BEAM THROUGH WHICH IT MUST PASS.
6. THE CONTRACTOR SHALL CONTACT THE ENGINEER OF RECORD WHEN A SLEEVE SIZE OR LOCATION DOES NOT MEET THE ABOVE CONDITIONS.
7. SCHEDULED BEAM STIRRUPS NOT SHOWN FOR CLARITY.

NOTES:
1. "D" DENOTES BEAM DEPTH
2. CLEAR SPACING BETWEEN PENETRATIONS SHALL BE 24" MINIMUM UNLESS NOTED OTHERWISE BY THE STRUCTURAL ENGINEER.
3. PENETRATIONS SHALL BE LOCATED ACCORDING TO THE FOLLOWING CRITERIA:
   A. FOR BEAMS NOT SUPPORTING INTERSECTING BEAMS LOCATE PENETRATIONS WITHIN TWO FEET EITHER SIDE OF BEAM MIDSPAN.
   B. FOR BEAMS SUPPORTING INTERSECTING BEAMS CHECK WITH STRUCTURAL ENGINEER.
4. PENETRATION WIDTH MUST NOT EXCEED PENETRATION HEIGHT, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS.
5. FOR LOCATIONS AND/OR SIZES OF PENETRATIONS NOT CONFORMING TO THE ABOVE CRITERIA AND NOT OTHERWISE DETAILED ON THE STRUCTURAL DRAWINGS, CONTRACTOR SHALL COORDINATE REQUIRED ADDITIONAL REINFORCEMENT WITH THE STRUCTURAL ENGINEER.
6. PROVIDE THE FOLLOWING REINFORCEMENT AT EACH SLEEVE, UNLESS NOTED OTHERWISE ON THE STRUCTURAL DRAWINGS:
   A. (1) #5 TOP AND BOTTOM AT BEAMS WITH WIDTHS LESS THAN 9".
   B. (2) #5 TOP AND BOTTOM AT BEAMS WITH 2-LEG STIRRUPS.
   C. (4) #5 TOP AND BOTTOM AT BEAMS WITH 4-LEG STIRRUPS.
   D. (N) #5 TOP AND BOTTOM AT BEAMS WITH "N" LEG STIRRUPS.
7. PROVIDE ADDITIONAL STIRRUPS ABOVE AND BELOW PENETRATIONS AT SPACING NOT TO EXCEED ONE HALF OF THE SCHEDULED STIRRUP SPACING, UNLESS DETAILED OTHERWISE ON THE STRUCTURAL DRAWINGS.
8. SCHEDULED BEAM STIRRUPS NOT SHOWN FOR CLARITY.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER
10 31 2024

CORPORATE OFFICE
4301 BOONVILLE ROAD
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

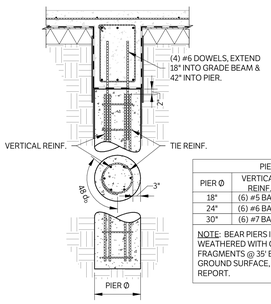
DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

S5.0

FOUNDATION DETAILS

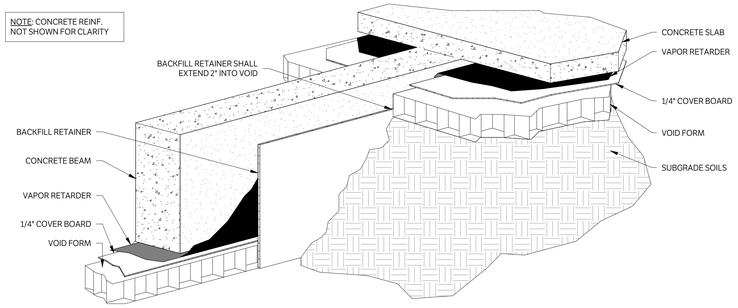


PIER TABLE		
PIER Ø	VERTICAL REINF.	TIE REINF. & SPACING
18"	(6) #5 BARS	#3 TIES @ 10" OC
24"	(6) #6 BARS	#3 TIES @ 12" OC
30"	(6) #7 BARS	#3 TIES @ 14" OC

NOTE: BEAR PIERS IN TAN MARL WEATHERED WITH CLAY AND LIMESTONE FRAGMENTS @ 35' BELOW EXISTING GROUND SURFACE, REF. GEOTECHNICAL REPORT.

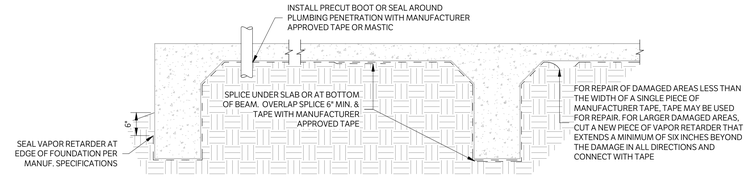
1 PIER - STRAIGHT SHAFT PIER
N.T.S.

NOTE: CONCRETE REINF. NOT SHOWN FOR CLARITY



2 CARTON FORM BEAM PLACEMENT SCHEMATIC
N.T.S.

NOTE: VAPOR RETARDER AS DETAILED TO BE INSTALLED BELOW ALL FOUNDATION CONCRETE



3 VAPOR RETARDER DETAIL
N.T.S.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

STATE OF TEXAS
10 31 2024
EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER

CORPORATE OFFICE
4 DOMAIN DRIVE
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10.24.24
DRAWN BY	BGL
CHECKED BY	EJR
BRW PROJECT NUMBER	23-0693

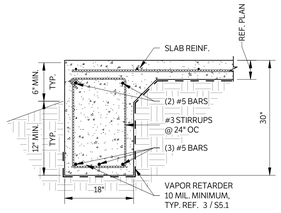
BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

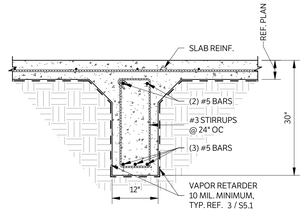
NO.	REVISION	DATE

S5.1

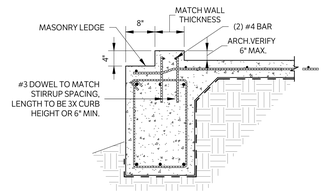
FOUNDATION DETAILS



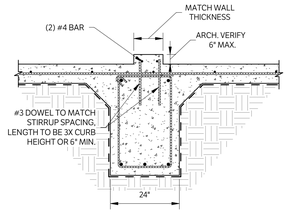
1 EXTERIOR BEAM
N.T.S.



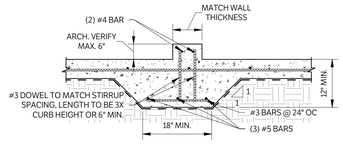
2 INTERIOR BEAM
N.T.S.



3 EXTERIOR BEAM W/ MASONRY LEDGE & WALL CURB
N.T.S.

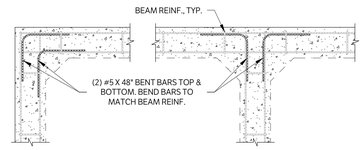


4 INTERIOR BEAM W/ WALL CURB
N.T.S.



5 THICKENED SLAB
N.T.S.

NOTES:
1. PROVIDE CORNER BARS AS SHOWN AT ALL EXTERIOR BEAM INTERSECTIONS.
2. THIS IS A SCHEMATIC ONLY. SEE BEAM SECTIONS FOR ACTUAL BEAM REINFORCEMENT. (SLAB NOT SHOWN)



6 GRADE BEAM INTERSECTIONS
N.T.S.

7 BEAM PENETRATION VERTICAL
N.T.S.

NOTE: WHEN PIPE SLEEVE IS WITHIN 1" OF BEAM REINF. BEAM REINF. SHALL BE STOPPED AND BENT BARS ADDED AS SHOWN BELOW.

8 BEAM PENETRATION DETAIL
N.T.S.

BROWN REYNOLDS WATFORD
ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

STATE OF TEXAS
10-31-2024
EVAN J. ROE
141174
LICENSED
PROFESSIONAL ENGINEER

CORPORATE OFFICE
4001 E. 29TH STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
TBPE F-7461, TBPLS F-10193910
GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

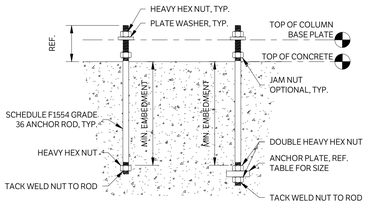
NO.	REVISION	DATE

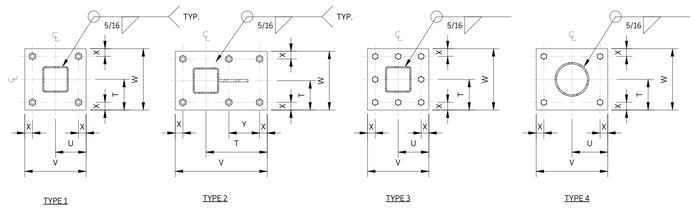
S5.2
FOUNDATION DETAILS - SLAB ON GRADE

NOTES:
1. REFER TO COLUMN SCHEDULE FOR ANCHOR ROD SIZE & EMBEDMENT.
2. ANCHOR ROD NUTS SHALL BE TIGHTENED TO A "SNUG TIGHT" CONDITION AS DEFINED BY AISC AFTER THE CONCRETE IS AT LEAST 14 DAYS OLD, UNO.
3. THE HOLE IN THE PLATE WASHER SHALL BE 1/16" LARGER THAN THE ROD DIAMETER.

ANCHOR ROD	ANCHOR PLATE SIZE
1"Ø	3 1/2X3 1/2X1/2
1 1/2"Ø	3 1/2X3 1/2X1/2
2"Ø	5X5X3/4

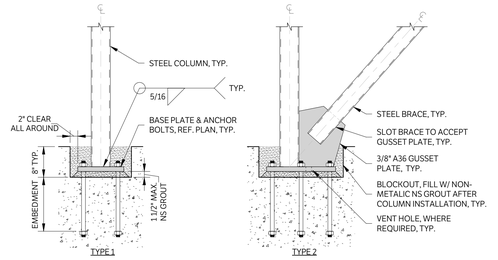
NOTE: REF. DETAIL 3 / S5.3 FOR BASE PLATE ELEVATIONS.





1 ANCHOR BOLT TYPES
N.T.S.

2 BASE PLATE - HSS COLUMN
N.T.S.



3 BASE PLATE ELEVATION HSS (RECESSED)
N.T.S.

4 BRACE TO BEAM AND COLUMN WEB (HSS BEAM)
N.T.S.

5 BRACE TO BEAM & COLUMN
N.T.S.

6 CHEVRON BRACING - GUSSET TO BEAM
N.T.S.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4001 TEXAS STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

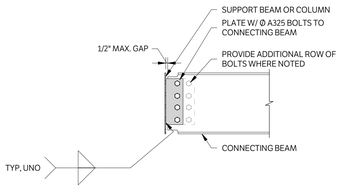
DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

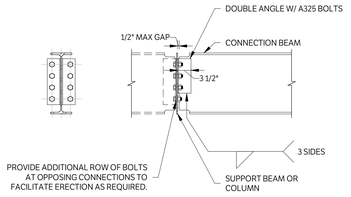
S5.3
BASE PLATE DETAILS

NOTES:
1. PROVIDE THIS CONNECTION WHERE NOTED AND FOR THE FOLLOWING CONDITIONS:
   A. WIDE FLANGE BEAM TO HSS COLUMN.



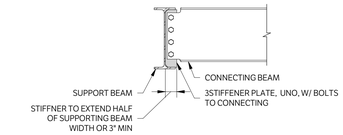
1 SHEAR CONNECTION - SINGLE PLATE
N.T.S.

NOTES:
1. PROVIDE THIS CONNECTION WHERE NOTED AND FOR THE FOLLOWING CONDITIONS:
   A. WIDE FLANGE BEAM TO WIDE FLANGE BEAM CONNECTIONS

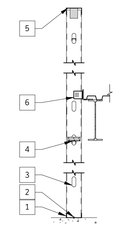


2 SHEAR CONNECTION - DOUBLE ANGLE
N.T.S.

NOTES:
1. PROVIDE THIS CONNECTION WHERE NOTED AND FOR THE FOLLOWING CONDITIONS:
   A. WIDE FLANGE BEAMS CONNECTING TO GIRDERS CONTINUOUS OVER SUPPORT COLUMNS AT THE LOCATION OF SUPPORT.
   B. WIDE FLANGE BEAMS CONNECTING TO GIRDERS SUPPORTING COLUMNS ABOVE AT THE LOCATION OF SUPPORT.

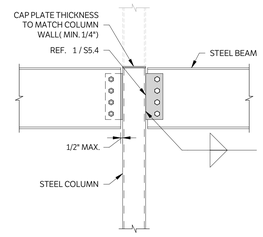


3 SHEAR CONNECTION - STIFFENER PLATE
N.T.S.



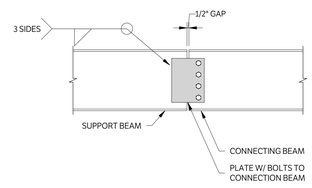
COLD FORMED WALL COMPONENTS	
1	PROVIDE TOP TRACK TO MATCH DEPTH AND GAUGE OF STUDS AT ENDS OF STUDS. ATTACH TRACK TO EACH STUD W/ SCREW IN EA FLANGE. LOCATE TRACK SPLICES A MINIMUM OF 4" FROM LAST STUD
2	ATTACH TRACKS TO CONCRETE SUPPORTS W/ HILTI POWDER ACTUATED FASTENERS
3	PUNCHOUTS AT 24" OC AND 12" FROM END OF STUDS. PROVIDE MINIMUM 10" FROM EDGE OF PUNCHOUT TO SUPPORT LOCATIONS
4	PROVID GA U-CHANNEL BRIDGING BETWEEN STUDS AT POINTS VERTICALLY. ATTACH TO EACH STUD W/ CLARK DEITRICH FB43 FASTBRIDGE CLIP, PER DETAIL 16 / SS.4 . OR APPROVED EQUAL
5	ATTACH TOP TRACKS TO PARAPET STUDS WITH CLARK-DIETRICH EASY CLIP OR APPROVED EQUAL.
6	WHERE STUDS ARE GROUND SUPPORTED, PROVIDE SLOTTED DEFLECTION CLIP TO DECK EDGE ANGLE (CLARK DIETRICH FCSC OR SIM.). WHERE STUDS ARE OVER A WINDOW, PROVIDE RIGID CONNECTION CLIP TO DECK EDGE ANGLE (CLARK DIETRICH UCEC OR SIM.). ALT. CLARK DIETRICH UBC MAY BE PROVIDED FOR ALL CONNECTIONS, W/ APPROPRIATE SCREWS FOR EA. CONDITION.

4 TYPICAL WALL FRAMING
N.T.S.



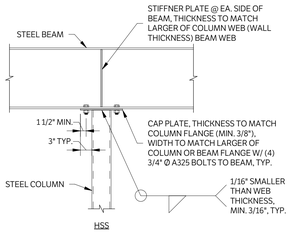
5 BEAM TO HSS COLUMN SHEAR CONNECTION
N.T.S.

NOTES:
1. PROVIDE THIS CONNECTION WHERE NOTED AND FOR THE FOLLOWING CONDITIONS:
   A. SPLICES AT WIDE FLANGE BEAMS AT SHEAR CONNECTIONS



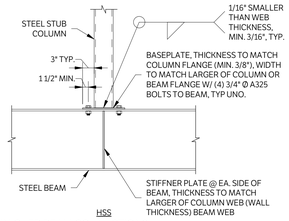
6 BEAM TO BEAM SPLICE CONNECTION
N.T.S.

NOTES:
1. PROVIDE THIS CONNECTION WHERE BEAMS ARE SHOWN CONTINUOUS OVER COLUMNS UNO.
2. FOR INTERSECTING BEAMS TO STIFFENER PLATE, REF. 3 / SS.4 .



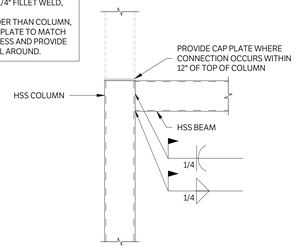
7 BEAM OVER COLUMN CONNECTION
N.T.S.

NOTES:
1. REF. ROOF PLAN FOR SLOPE AND SLOPE CAPS ACCORDINGLY.
2. FOR INTERSECTING BEAMS TO STIFFENER PLATE, REF. 3 / SS.4
3. PROVIDE BASEPLATES AS SCHEDULED WHERE NOTED ON PLANS.
4. REF. SPECIFIC SECTIONS WHERE FULLY WELDED COLUMN TO BEAM CONNECTIONS MAY BE REQUIRED.

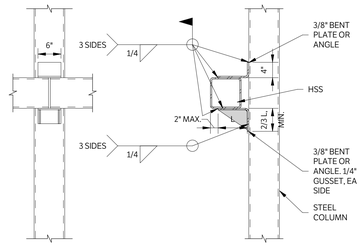


8 STUB COLUMN OVER BEAM CONNECTION2
N.T.S.

NOTES:
1. WHERE BEAM IS NARROWER THAN COLUMN, PROVIDE 1/4" FILLET WELD, ALL AROUND.
2. WHERE BEAM IS WIDER THAN COLUMN, PROVIDE BEAM CAP PLATE TO MATCH BEAM WALL THICKNESS AND PROVIDE 1/4" FILLET WELD ALL AROUND.

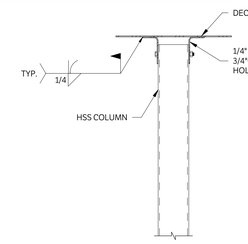


9 HSS BEAM TO HSS COLUMN
N.T.S.



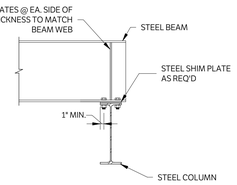
10 HSS BEAM TO HSS COLUMN CONNECTION - BYPASS
N.T.S.

NOTE: DECK EDGE BRACING AT EACH COLUMN LOCATION.



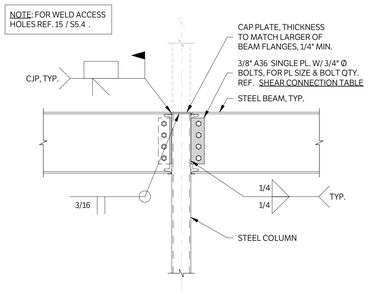
11 NON-LOAD BEARING COLUMN TOP CONNECTION
N.T.S.

NOTES:
1. PROVIDE THIS CONNECTION WHERE BEAMS ARE SHOWN CONTINUOUS OVER COLUMNS UNO.
2. FOR INTERSECTING BEAMS TO STIFFENER PLATE, REF. 7 / SS.4 .

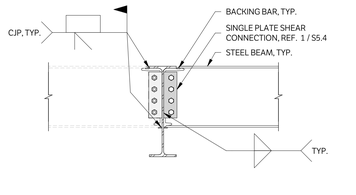


12 BEAM OVER BEAM CONNECTION
N.T.S.

NOTE: FOR WELD ACCESS HOLES REF. 15 / SS.4 .

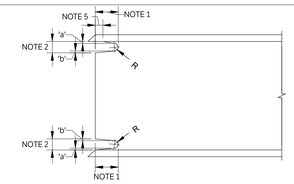


13 BEAM TO HSS COLUMN MOMENT CONNECTION
N.T.S.

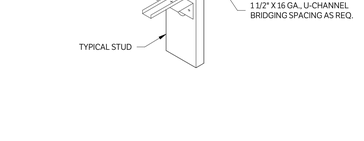


14 MOMENT CONNECTION ACROSS BEAM
N.T.S.

NOTES:
1. LENGTH: GREATER OF 1.5 t_w OR 1 1/2".
2. HEIGHT: GREATER OF 1.0tw OR 3/4" BUT NEED NOT EXCEED 2".
3. R: 3/8" MIN. GRIND THE THERMALLY CUT SURFACES OF WELD ACCESS HOLES IN HEAVY SHAPES AS DEFINED IN SECTION A3.1(c) AND (d) OF THE AISC MANUAL OF STEEL CONSTRUCTION.
4. SLOPE 'a' FORMS A TRANSITION FROM THE WEB TO THE FLANGE. SLOPE 'b' MAY BE HORIZONTAL.
5. THE BOTTOM OF THE FLANGE IS TO BE CONTOURED TO PERMIT THE TIGHT FIT OF BACKING BARS WHERE THEY ARE TO BE USED.
6. THE WEB-TO-FLANGE WELD OF BUILT-UP MEMBERS IS TO BE HELD BACK A DISTANCE OF AT LEAST THE WELD SIZE FROM THE EDGE OF THE ACCESS HOLE.

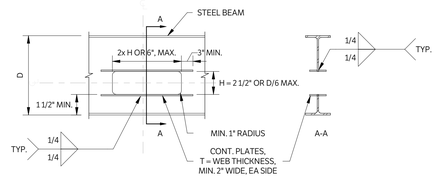


15 WELD ACCESS HOLES
N.T.S.



16 U-CHANNEL BRIDGING CONNECTION
N.T.S.

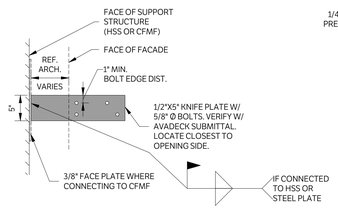
NOTE: OPENING SHALL OCCUR WITHIN MIDDLE 1/3 OF BEAM SPAN, AND MIN. 2X "D" FROM PERPENDICULAR BEAMS.



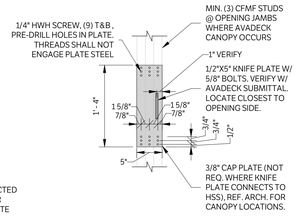
17 WIDE FLANGE BEAM WEB PENETRATION
N.T.S.

NOTES:
1. CONNECTION AND FRAMING DESIGNED TO ACCOMODATE A MAXIMUM OF 0.95 KIP VERTICAL REACTION & 1.95 K-FT MOMENT (UNFACTRED).
2. KNIFE PLATE AND BOLTS SHALL BE A193 B8 CLASS 2 STAINLESS STEEL. KNIFE PLATE SHALL BE HOT DIP GALVANIZED.
3. WHERE STEEL COLUMN WILL NOT ALLOW THE ADDITION OF THIRD STUD AS SHOWN, WELD PLATE TO COLUMN FACE, WITH SHIM PLATES AS REQUIRED, MIN. 3", 5/16" FILLET WELDS, TOP AND BOTTOM. AT LOCATION NEAR BRACE, PROVIDE 3RD STUD AND WELD PLATE TO BRACE WHERE OVERLAP OCCURS.

PROFILE



FRONT (ATTACHED TO CFMF CONDTION)



18 AVADECK CANOPY SUPPORT PLATES
N.T.S.

MIN. BEAM END REACTION	
BEAM DEPTH	REACTION (KIPS)
W8	4
W10	5
W12	18
W14	19
W16	22
W24	30
W30	45

NOTE: BEAM END REACTIONS PROVIDED ARE FACTORED (LRFD). REFERENCE GENERAL NOTES FOR FURTHER CONNECTION DESIGN REQUIREMENTS.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4301 EARLY LANE
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

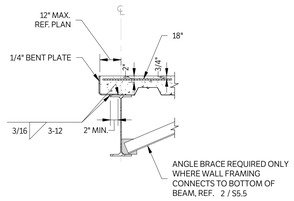
BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

S5.4

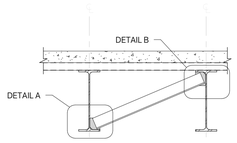
TYPICAL STEEL CONNECTION DETAILS

NOTES:
1. REF. ELEVATIONS AND SECTIONS FOR MISC. STEEL AT SLAB EDGES.
2. DECK SPAN MAY BE PARALLEL (AS SHOWN) OR PERPENDICULAR TO BEAM.

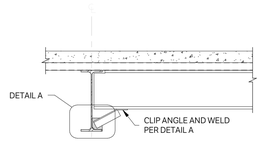


CONNECTION SCHEDULE			
BRACE SIZE	PLATES A&B	WELDS A&B	CONNECTION ANGLE
L2X2X1/4	4X4X1/4	3/16	L3X3X1/4
L3X3X1/4	4X4X1/4	3/16	L4X4X1/4
L4X4X1/4	4X4X1/4	3/16	L5X5X5/16
L5X5X5/16	4X4X1/4	1/4	L6X6X1/2

NOTES:
1. REFERENCE PLANS AND DETAILS FOR LOCATION OF ANGLE BRACES.
2. IF NOT SHOWN ON PLANS OR DETAILS, BRACE SIZE SHALL BE L3X3X1/4.
3. FILED WELDING OF CONNECTION PLATES SHALL BE FABRICATOR'S OPTION.
4. BOTTOM FLANGE OF PERIMETER BEAMS SHALL BE BRACED AT EVERY 5' - 0" WHERE EXTERIOR WALL FRAMING CONNECTS TO UNDERSIDE OF BEAM, UNO IN SECTIONS, NOT REQUIRED AT FLOOR FRAMING OTHERWISE.

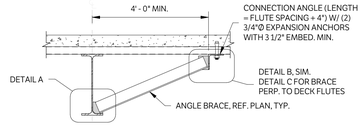


DETAIL 1 - BRACE CONNECTION TO BEAM TOP FLANGE



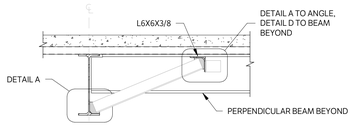
DETAIL 2 - BRACE CONNECTION TO PERPENDICULAR BEAM

NOTE: DETAIL MAY NOT BE UTILIZED AT ROOF DECKS, UTILIZE DETAIL D

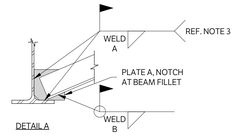


DETAIL 3 - BRACE CONNECTION TO DECK BETWEEN JOISTS - TO DECK

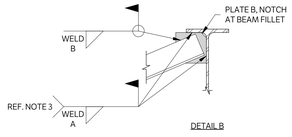
NOTE: DETAIL MAY BE UTILIZED AT ROOF & FLOOR DECKS.



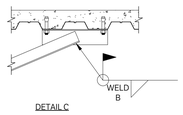
DETAIL 4 - BRACE CONNECTION BETWEEN JOISTS - TO BLOCKING



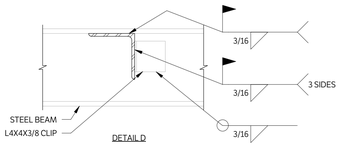
DETAIL A



DETAIL B



DETAIL C



DETAIL D

1 DECK EDGE - FLOOR CONDTION
N.T.S.

NOTE: PROVIDE WIRE MESH REINFORCEMENT OVER ENTIRE SLAB AREA, NOT SHOWN ON OTHER DETAILS FOR CLARITY, TYP.

DECK PARALLEL TO BEAM

2 BEAM BRACING
N.T.S.

3 TYPICAL NON-COMPOSITE DECK DETAIL
N.T.S.

4 SMALL MECHANICAL OPENING IN CONCRETE OVER METAL DECK
N.T.S.

5 LARGE MECHANICAL OPENING IN CONCRETE OVER METAL DECK
N.T.S.

7 NCMD AND MRD INTERFACE
N.T.S.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4001 E. 29TH STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

STATE OF TEXAS
10 31 2024
EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2

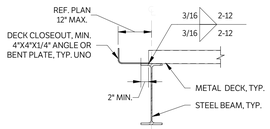
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

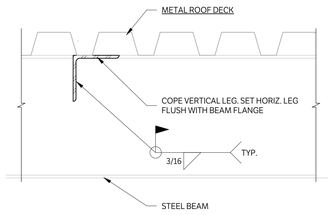
S5.5

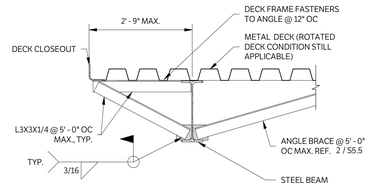
TYPICAL FLOOR FRAMING DETAILS

NOTE: WHERE DECK OVERHANG EXCEEDS THE PROVIDED PARAMETERS, REF. 2 / S5.6 .

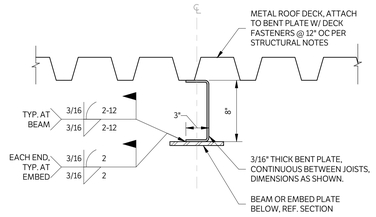


1 TYPICAL DECK CLOSEOUT AT ROOF
N.T.S.

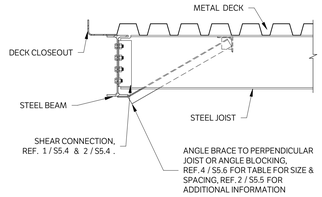


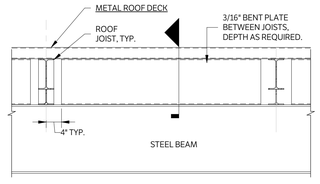


2 EXTERIOR BEAM W/ LONG OVERHANG
N.T.S.



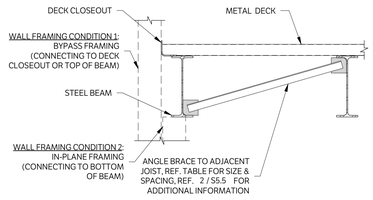
3 EXTERIOR BEAM PERPENDICULAR TO STEEL JOIST
N.T.S.

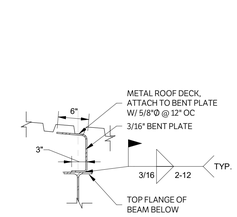




4 EXTERIOR ROOF BEAM PARALLEL TO STEEL JOIST
N.T.S.

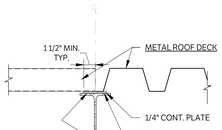
WALL FRAMING CONDITION	ANGLE BRACE
1	L2X2X3/16 @ 10' - 0" OC, MAX.
2	L3X3X1/4 @ 5' - 0" OC, MAX.

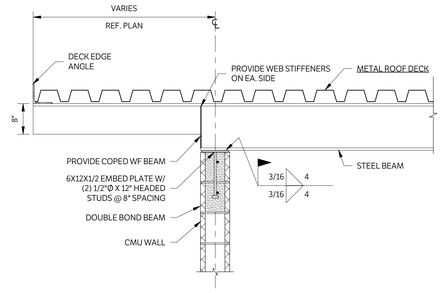




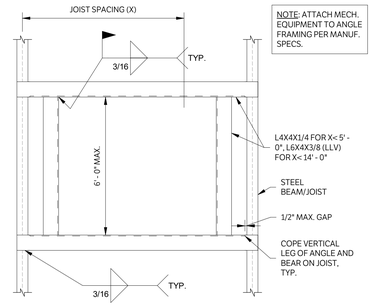
SECTION

5 ROOF DECKING ORIENTATION CHANGE
N.T.S.





6 STANDARD ROOF OPENING
N.T.S.



NOTE: ATTACH MECH. EQUIPMENT TO ANGLE FRAMING PER MANUF. SPECS.

7 SECTION AT ANGLE BLOCKING
N.T.S.

8 CLOSEOUT BENT PLATE
N.T.S.

9 DIAPHAGM CONNECTION TO BEAM
N.T.S.

10 TYPICAL COPED STEEL JOIST OVER CMU WALL
N.T.S.

11 TYPICAL STEEL JOIST OVER STEEL GIRDER
N.T.S.

12 TYPICAL STEEL JOIST OVER CMU WALL
N.T.S.

13 TYPICAL COPED STEEL JOIST OVER STEEL GIRDER
N.T.S.

14 BEAM OVER CMU WALL
N.T.S.

15 PIPE STUB OVER CMU SITE WALL
N.T.S.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4001 PENNSYLVANIA
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

GESSNER ENGINEERING

STATE OF TEXAS
10 31 2023
EVAN J. ROE
141174
LICENSED
PROFESSIONAL ENGINEER

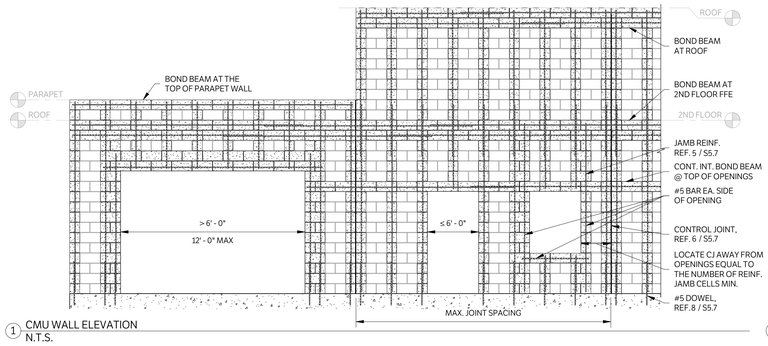
DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

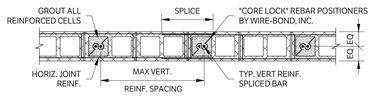
S5.6

TYPICAL ROOF FRAMING DETAILS



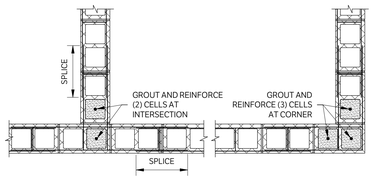
1 CMU WALL ELEVATION
N.T.S.

NOTE:
1. MAINTAIN MINIMUM 3"X3" CLEAR UNOBSTRUCTED CONTINUOUS VERTICAL CELL AT EACH REBAR. PLACE WALLS TO MAX. 5' - 0" HEIGHT BEFORE GROUTING.
2. PLACE REBAR IN WALL WITH LAP SPLICE LENGTH PER SCHEDULE.
3. STOP GROUT POUR 1 1/2" BELOW TOP OF COURSE, AT EACH GROUT LIFT, EXCEPT AT LINTELS & BOND BEAMS EXTEND GROUT TO TOP OF GROUTED COURSE.
4. PROVIDE REBAR POSITIONS AT MANUFACTURER RECOMMENDED SPACING, BUT NOT TO EXCEED 48" OC.



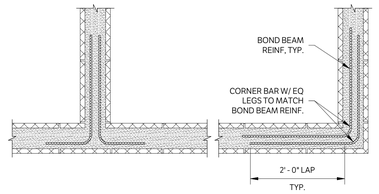
2 CMU WALL REINFORCING DETAIL
N.T.S.

NOTE: AT CONTRACTORS OPTION, IN LIEU OF INTERLOCKING CMU COURSING AT CORNER, REMOVE WEB AND FACE SHELL AT INTERFACE AND GROUT MONOLITHICALLY.



3 CMU WALL CORNER REINFORCING DETAIL
N.T.S.

NOTE: CORNER BAR AND DOWELS SHALL MATCH SIZE OF TYPICAL BOND BEAM REINFORCING.



4 CMU BOND BEAM CORNER REINFORCMENT
N.T.S.

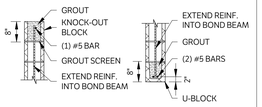
NOTES:
1. WHERE CONTROL JOINTS ARE TO BE PLACED ADJACENT TO OPENINGS, MASONRY OVER NON-LOAD BEARING HEADER SPECIFIED ABOVE SHALL NOT EXCEED 4' - 0" IN HEIGHT. WHERE THIS REQUIREMENT IS NOT MET, GESSNER ENGINEERING SHALL BE CONTACTED FOR ADDITIONAL INFORMATION.
2. BARS SHALL NOT BE SPLICED OVER OPENINGS.
3. SPLICE BARS WITHIN WALL AS REQUIRED. STAGGER LAP SPLICING WITHIN COURSE.

	BOND BEAM WITHIN WALL	BOND BEAM OVER OPENING

SINGLE

PROVIDE WITHIN WALL:
- WHERE NOTED
- VERTICALLY EVERY 7' - 4"
- AT TOP OF ALL PARAPET & NON-LOAD BEARING WALLS
- AT ENDS OF ASSOCIATED BOND BEAM OVER OPENING EXTENDED OVER JAMB CELLS

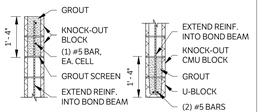
PROVIDE OVER OPENING:
- WHERE NOTED
- OVER NON-LOAD BEARING OPENINGS NOT GREATER THAN 3' - 8"



DOUBLE

PROVIDE WITHIN WALL:
- WHERE NOTED
- AT FLOOR & ROOF BEARING LINES
- AT ENDS OF ASSOCIATED BOND BEAM OVER OPENING EXTENDED OVER JAMB CELLS

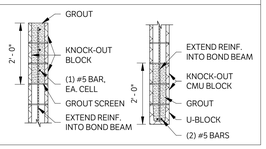
PROVIDE OVER OPENING:
- WHERE NOTED
- OVER NON-LOAD BEARING OPENINGS NOT GREATER THAN 7' - 0"



TRIPLE

PROVIDE WITHIN WALL:
- WHERE NOTED
- AT ENDS OF ASSOCIATED BOND BEAM OVER OPENING EXTENDED OVER JAMB CELLS

PROVIDE OVER OPENING:
- WHERE NOTED



11 BOND BEAM SCHEDULE
N.T.S.

JAMB REINFORCING SCHEDULE	
W	REINFORCING
< 4' - 0"	(1) #5
< 8' - 0"	(2) #5 (1 PER CELL)
< 12' - 0"	(3) #5 (1 PER CELL)

5 CMU JAMB DETAIL
N.T.S.

NOTE: INSTALL CONTROL AND EXPANSION JOINTS AT THE FOLLOWING MAX. SPACING UNO:
A. 25' - 0" ON CENTER HORIZONTALLY.
B. TO MAINTAIN A MAXIMUM LENGTH TO HEIGHT RATIO OF 1.5:1 BETWEEN JOINTS.
C. WITHIN 1/2 TYPICAL JOINT SPACING FROM CMU WALL CORNERS OR INTERSECTIONS ALONG INTERSECTING WALL.

6 CMU CONTROL JOINT DETAIL
N.T.S.

7 CMU PILASTER DETAIL
N.T.S.

8 CMU WALL TO FOUNDATION
N.T.S.

*TACK WELD UPON ERECTION. WELD FULL LENGTH ONCE DEAD LOAD IS FULLY APPLIED

9 BEAM TO CMU PILASTER
N.T.S.

10 STEEL BEAM TO CMU
N.T.S.

CMU WALL LAP SPLICE SCHEDULE

BAR SIZE	LAP LENGTH	
	BOND BEAM	VERT. REINF.
#4	1' - 8"	2' - 6"
#5	2' - 1"	3' - 2"
#6	2' - 6"	3' - 9"
#7	2' - 11"	4' - 5"

NOTE: DO NOT SPLICE BARS IN BOND BEAMS OVER OPENINGS.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4101 PINNACLE
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

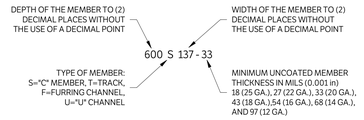
FIRM REGISTRATION NUMBERS:
F-10193910
TBPE F-7451, TBPLS F-10193910

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

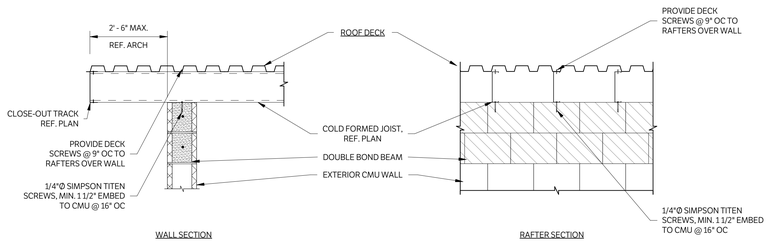
BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

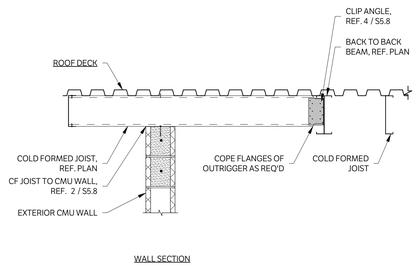
S5.7
CMU WALL DETAILS



1 LIGHT GAUGE LEGEND
N.T.S.

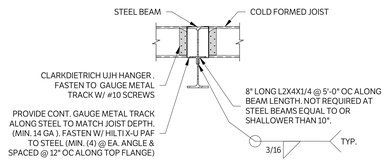


2 LIGHT GAUGE RAFTER TO EXTERIOR CMU WALL
N.T.S.



3 LIGHT GAUGE RAFTER TO EXTERIOR CMU WALL
N.T.S.

NOTE:
1. WHERE FRAMING INTO BOX BEAM, PROVIDE #10 SCREWS TO BOX BEAM AT TOP AND FACE PER MANUF
2. PROVIDE MAXIMUM AMOUNT OF SCREWS ALLOWED, UNLESS NOTED OTHERWISE.
3. DECKING NOT SHOWN FOR CLARITY IN DETAIL BELOW.



4 COLD FORMED JOIST TO STEEL BEAM (HANGER CONNECTION)
N.T.S.

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214.528.8704
WWW.BRWARCH.COM

CORPORATE OFFICE
4 JOHN STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com

FIRM REGISTRATION NUMBERS:
TBPE F-7451, TBPLS F-10193910

DATE 10.24.24
DRAWN BY BGL
CHECKED BY EJR
BRW PROJECT NUMBER 23-0693

BRENHAM FIRE STATION NO. 2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

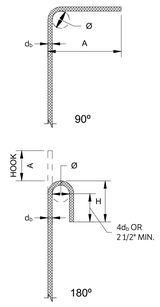
NO.	REVISION	DATE

S5.8

COLD FORMED METAL

STANDARD DOWEL HOOK DIMENSIONS ALL GRADES OF STEEL				
BAR SIZE	Ø	90º	180º	
		A	A	H
#3	2 1/4"	6"	5"	4"
#4	3"	8"	6"	4 1/2"
#5	3 3/4"	10"	7"	5"
#6	4 1/2"	12"	8"	6"
#7	5 1/4"	14"	10"	7"
#8	6"	16"	11"	8"

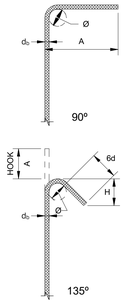
NOTE: Ø = FINISHED INSIDE BEND



1 STANDARD DOWEL HOOKS
N.T.S.

STIRRUP/TIE HOOK DIMENSIONS ALL GRADES OF STEEL				
BAR SIZE	Ø	90º	135º	
		A	A	H
#3	1 1/2"	4"	4 1/4"	3"
#4	2"	4 1/2"	4 1/2"	3"
#5	2 1/2"	6"	5 1/2"	3 3/4"
#6	4 1/2"	12"	8"	4 1/2"
#7	5 1/4"	14"	9"	5 1/4"
#8	6"	16"	10 1/2"	6"

NOTE: Ø = FINISHED INSIDE BEND



2 STIRRUP/TIE HOOKS
N.T.S.

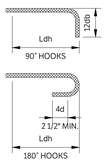
NOTE: TYPE S2 MAY BE SUBSTITUTED FOR S1 AT THE CONTRACTOR'S DISCRETION.

3 STIRRUP TYPES
N.T.S.

NOTES: "S" = CLEAR BAR SPACING TO BE USED FOR DETERMINATION OF TENSION SPLICE LENGTH CATEGORY

4 STAGGERED SPLICES DETAIL
N.T.S.

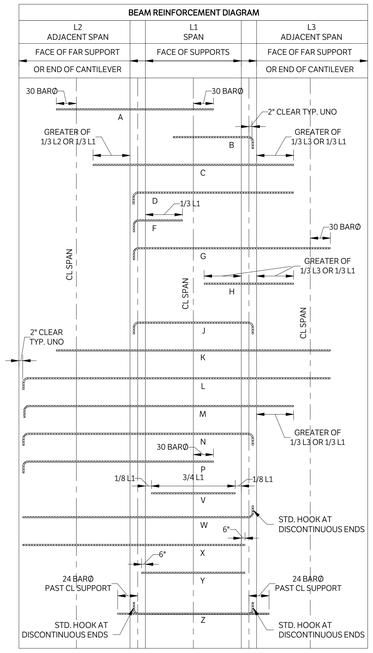
DEVELOPMENT LENGTHS OF STANDARD HOOKS IN TENSION GRADE 60 REINF., NORMALWEIGHT CONCRETE						
BAR SIZE	f'c = 3000 PSI		f'c = 4000 PSI		f'c = 5000 PSI	
	Ldh	0.7 Ldh	Ldh	0.7 Ldh	Ldh	0.7 Ldh
#3	9	7	8	6	7	6
#4	11	8	10	7	9	7
#5	14	10	12	9	11	8
#6	17	12	15	11	13	10
#7	20	14	17	12	15	11
#8	22	16	19	14	17	12
#9	25	18	22	16	20	14
#10	28	20	25	18	22	16
#11	31	22	27	19	24	17
#14	38	-	33	-	29	-
#18	50	-	43	-	39	-



NOTES:
1. Ldh = DEVELOPMENT LENGTH OF STANDARD HOOKS IN TENSION (INCHES).
2. Ldh = Lhb UNLESS CONDITIONS OF NOTE 3 ARE SATISFIED.
3. Ldh = 0.7Lhb FOR #11 BARS AND SMALLER WHEN SIDE COVER (NORMAL TO PLANE OF HOOK) IS NOT LESS THAN 2 1/2 INCHES AND FOR 90° HOOKS COVER ON BAR EXTENSION BEYOND HOOK IS NOT LESS THAN 2 INCHES.
4. HOOKS ARE NOT CONSIDERED EFFECTIVE FOR DEVELOPING BARS IN COMPRESSION.
5. Ldh SHALL BE MULTIPLIED BY 1.2 FOR EPOXY-COATED HOOKED REINF. BARS.

5 DEVELOPMENT LENGTHS OF STANDARD HOOKS IN TENSION
N.T.S.

BEAM REINFORCEMENT DIAGRAM



6 TYPICAL BAR BENDING DIAGRAM
N.T.S.

SLAB TENSION DEVELOPMENT AND LAP SPLICE LENGTHS GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE							
BAR SIZE	LAP CLASS	f'c = 3000 PSI		f'c = 4000 PSI		f'c = 5000 PSI	
		BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS
#3	A	12	13	12	12	12	12
	B	16	17	16	16	16	16
#4	A	17	22	15	19	13	17
	B	23	29	20	25	17	23
#5	A	25	32	21	28	19	25
	B	33	42	28	37	25	33
#6	A	33	43	29	37	26	34
	B	43	56	38	49	34	45
#7	A	53	69	46	60	42	54
	B	69	90	60	78	55	71
#8	A	66	86	57	74	51	67
	B	86	112	75	97	67	88
#9	A	80	104	69	90	62	81
	B	104	136	90	117	81	106
#10	A	96	125	83	108	75	97
	B	125	163	108	141	98	127
#11	A	113	146	98	127	87	114
	B	147	190	128	166	114	149

NOTES:
1. ALL SPLICE LENGTHS ARE IN INCHES.
2. SPLICE TYPE CLASS "A" MAY BE USED WHERE 50% OR LESS OF THE BARS IN ANY GIVEN SECTION ARE SPLICED; OTHERWISE, SPLICE TYPE CLASS "B" SHALL BE USED.
3. FOR NONCONTACT SPLICES IN FLEXURAL MEMBERS, THE TRANSVERSE ON CENTER SPACING OF SPLICED BARS SHALL NOT EXCEED THE LESSER OF 1/5 THE REQUIRED LAP SPLICE LENGTH OR 6".
4. THIS TABLE SHALL BE USED FOR SLABS ONLY. REFER TO OTHER DEVELOPMENT LENGTH TABLES FOR OTHER MEMBERS.
5. THE TENSION DEVELOPMENT LENGTH (Ld) IS EQUAL TO THE SCHEDULED "CLASS A" LAP SPLICE LENGTH.
6. A BOTTOM BAR IS DEFINED AS ANY BAR THAT DOES NOT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
7. OTHER BARS INCLUDE TOP BARS AND ALL OTHER BARS THAT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR. FOR TOP REINFORCEMENT IN SLABS THAT ARE 12" THICK OR LESS, TABULATED SPLICE LENGTHS FOR BOTTOM BARS SHALL BE USED.
8. FOR EPOXY-COATED BARS, MULTIPLY THE TABULATED SPLICE LENGTHS OF BOTTOM BARS BY 1.5 AND THE TABULATED SPLICE LENGTHS OF OTHER BARS BY 1.3.
9. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR BUT MAY NOT BE LESS THAN THE "CLASS A" SPLICE LENGTH OF THE LARGER BAR.

7 SLAB TENSION DEVELOPMENT AND LAP SPLICE LENGTHS
N.T.S.

BEAM AND GIRDER TENSION DEVELOPMENT AND LAP SPLICE LENGTHS GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE							
BAR SIZE	LAP CLASS	f'c = 3000 PSI		f'c = 4000 PSI		f'c = 5000 PSI	
		BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS
#3	A	12	13	12	12	12	12
	B	16	17	16	16	16	16
#4	A	16	20	14	18	12	16
	B	21	26	19	24	16	21
#5	A	23	29	20	25	18	23
	B	30	38	26	33	24	30
#6	A	31	40	27	35	24	31
	B	41	52	36	46	32	41
#7	A	46	60	40	52	36	46
	B	60	78	52	68	47	60
#8	A	60	78	52	67	46	60
	B	78	102	68	88	60	78
#9	A	64	84	56	72	50	65
	B	84	110	73	94	65	85
#10	A	72	93	62	81	56	72
	B	94	121	81	106	73	94
#11	A	85	110	74	96	66	86
	B	111	143	97	125	86	112

NOTES:
1. ALL SPLICE LENGTHS ARE IN INCHES.
2. SPLICE TYPE CLASS "A" MAY BE USED WHERE 50% OR LESS OF THE BARS IN ANY GIVEN SECTION ARE SPLICED; OTHERWISE, SPLICE TYPE CLASS "B" SHALL BE USED.
3. FOR NONCONTACT SPLICES IN FLEXURAL MEMBERS, THE TRANSVERSE ON CENTER SPACING OF SPLICED BARS SHALL NOT EXCEED THE LESSER OF 1/5 THE REQUIRED LAP SPLICE LENGTH OR 6".
4. THIS TABLE SHALL BE USED FOR BEAMS AND GIRDERS ONLY. REFER TO OTHER DEVELOPMENT LENGTH TABLES FOR OTHER MEMBERS.
5. THE TENSION DEVELOPMENT LENGTH (Ld) IS EQUAL TO THE SCHEDULED "CLASS A" LAP SPLICE LENGTH.
6. A BOTTOM BAR IS DEFINED AS ANY BAR THAT DOES NOT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
7. OTHER BARS INCLUDE TOP BARS, FACE BARS, AND ALL OTHER BARS THAT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
8. FOR EPOXY-COATED BARS, MULTIPLY THE TABULATED SPLICE LENGTHS OF BOTTOM BARS BY 1.5 AND THE TABULATED SPLICE LENGTHS OF OTHER BARS BY 1.3.
9. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR BUT MAY NOT BE LESS THAN THE "CLASS A" SPLICE LENGTH OF THE LARGER BAR.

8 BEAM TENSION DEVELOPMENT AND SPLICE LENGTHS
N.T.S.

SLAB SCHEDULE

TYPE	DEPTH	PRIMARY REINF.		T&S REINF. TOP & BOTTOM	REMARKS
		TOP	BOTTOM		
S1	6"	#4 @ 12" OC	#4 @ 12" OC	#4 @18" OC	PLACE T&S REINF. PERP. TO SLAB SPAN (TOP & BOTTOM)
S2	12"	#6 @ 12" OC	#6 @ 12" OC	#4 @18" OC	PLACE T&S REINF. PERP. TO SLAB SPAN (TOP & BOTTOM)

SCHEDULE - FOUNDATION BEAMS

Mark	BEAM	LONGITUDINAL REINFORCEMENT				STIRRUPS		BEAM REMARKS
	WIDTHXDEPTH	TOP REINF. LEFT END	BOT. REINF. CENTER	TOP REINF. CENTER	TOP REINF. RIGHT	STIRRUP SIZE	STIRRUP TYPE	STIRRUP SPACING	
B1	30X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B2	30X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B3	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B4	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B5	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B6	24X24		(4)#5Z			#3	S2	1@2.REM.@9"OC	
B7	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B7	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B8	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B9	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B10	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B11	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B12	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B13	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B14	24X24		(4)#6Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B15	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B16	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B17	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B18	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B19	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B20	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B21	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B22	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B23	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B24	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B25	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B26	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B27	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B28	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B29	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B30	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B31	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B32	24X24	(4)#5A	(4)#6Z			#3	S2	1@2.REM.@9"OC	
B33	24X24		(4)#6Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B34	24X24	(6)#8G	(7)#7Z			#3	S2	1@2.REM.@9"OC	
B35	24X24	(6)#8A	(7)#7Z			#3	S2	1@2.REM.@9"OC	
B36	24X24	(7)#7A	(7)#7Z			#3	S2	1@2.REM.@9"OC	
B37	24X24	(7)#7A	(7)#7Z			#3	S2	1@2.REM.@9"OC	
B38	24X24	(7)#7A	(7)#7Z			#3	S2	1@2.REM.@9"OC	
B39	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B40	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B41	24X24	(7)#8G	(6)#8Z			#3	S2	1@2.REM.@9"OC	
B42	24X24	(7)#8A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B43	24X24	(4)#7A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B44	24X24	(4)#7A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B45	24X24		(4)#7Z		(4)#7G	#3	S2	1@2.REM.@9"OC	
B46	24X24	(7)#8G	(6)#8Z			#3	S2	1@2.REM.@9"OC	
B47	24X24	(7)#8A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B48	24X24	(4)#7A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B49	24X24	(4)#7A	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B50	24X24		(4)#7Z		(4)#7G	#3	S2	1@2.REM.@9"OC	
B51	24X24	(7)#7G	(6)#7Z			#3	S2	1@2.REM.@9"OC	
B52	24X24	(7)#7A	(6)#7Z			#3	S2	1@2.REM.@9"OC	
B53	24X24	(6)#7A	(6)#7Z			#3	S2	1@2.REM.@9"OC	
B54	24X24	(6)#7A	(6)#7Z			#3	S2	1@2.REM.@9"OC	
B55	24X24	(7)#7A	(6)#7Z			#3	S2	1@2.REM.@9"OC	
B56	24X24		(4)#7Z		(4)#7G	#3	S2	1@2.REM.@9"OC	
B57	24X24	(5)#7G	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B58	24X24	(4)#7Z	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B59	24X24	(4)#7Z	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B60	24X24	(4)#7Z	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B61	24X24	(5)#7G	(4)#7Z			#3	S2	1@2.REM.@9"OC	
B62	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B63	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B64	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B65	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B66	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B67	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B68	24X24	(5)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B69	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B70	24X24		(4)#5Z		(5)#5G	#3	S2	1@2.REM.@9"OC	
B71	24X24		(4)#7Z	(4)#7J		#3	S2	1@2.REM.@9"OC	
B72	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B73	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B74	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B75	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B76	24X24	(3)#5A	(5)#5Z			#3	S2	1@2.REM.@9"OC	
B77	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B78	24X24		(4)#5Z	(4)#5J		#3	S2	1@2.REM.@9"OC	
B79	24X24		(4)#5Z	(4)#5J		#3	S2	1@2.REM.@9"OC	
B80	24X24	(4)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B81	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B82	24X24	(3)#5G	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B83	24X24	(3)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B84	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B85	24X24		(4)#5Z		(4)#5G	#3	S2	1@2.REM.@9"OC	
B86	24X24		(4)#5Z	(4)#5J		#3	S2	1@2.REM.@9"OC	
B88	24X24	(4)#5A	(4)#5Z			#3	S2	1@2.REM.@9"OC	
B89	24X24		(4)#5Z		(5)#5G	#3	S2	1@2.REM.@9"OC	
B90	24X24		(4)#7Z	(4)#7J		#3	S2	1@2.REM.@9"OC	

BROWN REYNOLDS WATFORD ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TX 75204
214.528.8704
WWW.BRWARCH.COM

STATE OF TEXAS
10 31 2024
EVAN J. ROE
141174
LICENSED PROFESSIONAL ENGINEER

CORPORATE OFFICE
4101 TEXAS STREET
BRYAN, TEXAS 77803
1.877.GESSNER (437.7637)
www.gessnerengineering.com
FIRM REGISTRATION NUMBERS:
F-001439, TBPE F-7461, TBPLS F-10193910

GESSNER ENGINEERING

DATE	10.24.24
DRAWN BY	BGL
CHECKED BY	EJR
BRW PROJECT NUMBER	23-0693

BRENHAM FIRE STATION NO. 2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

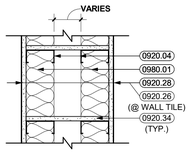
NO.	REVISION	DATE

S6.0
SCHEDULE

D SERIES

NONCOMBUSTIBLE

FIRE RATING AVAILABLE WITH UL ASSEMBLY U420 WHERE NOTED.



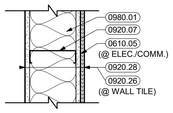
PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
D1	3 5/8" AT 16" O.C.	1' - 2"	TO DECK	N/A	3 1/2" FGL	BACKER BOARD + TILE AT CERAMIC TILE SIDE

B SERIES

NONCOMBUSTIBLE

FIRE RATING AVAILABLE WITH UL ASSEMBLY U465 WHERE NOTED.



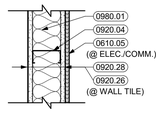
PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
B1	6" AT 16" O.C.	7 1/4"	TO DECK	N/A	3 1/2" FGL	
B2	6" AT 16" O.C.	7 3/4"	TO DECK	N/A	N/A	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL ROOM SIDE; GYP LAYER TO 9'-6"
B3	6" AT 16" O.C.	7 3/4"	TO DECK	N/A	3 1/2" FGL	BACKER BOARD + TILE AT CERAMIC TILE SIDE
B4	6" AT 16" O.C.	8 1/4"	TO DECK	N/A	3 1/2" FGL	BACKER BOARD + TILE BOTH SIDES

A SERIES

NONCOMBUSTIBLE

FIRE RATING AVAILABLE WITH UL ASSEMBLY U465 WHERE NOTED.

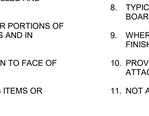


PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
A1	3 5/8" AT 16" O.C.	4 7/8"	TO DECK	N/A	3 1/2" FGL	
A2	3 5/8" AT 16" O.C.	4 7/8"	6" ABOVE CEILING	1/2 HOUR	N/A	
A3	3 5/8" AT 16" O.C.	4 7/8"	TO DECK	N/A	3 1/2" FGL	
A4	3 5/8" AT 16" O.C.	5 1/2"	TO DECK	N/A	N/A	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL/COMM ROOM SIDE
A5	3 5/8" AT 16" O.C.	5 1/2"	6" ABOVE CEILING	N/A	N/A	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL/COMM ROOM SIDE
A6	3 5/8" AT 16" O.C.	5 7/8"	TO DECK	N/A	3 1/2" FGL	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL/COMM ROOM SIDE; BACKER BOARD + TILE AT CERAMIC TILE SIDE
A7	3 5/8" AT 16" O.C.	5 1/2"	TO DECK	N/A	3 1/2" FGL	BACKER BOARD + TILE AT CERAMIC TILE SIDE
A8	3 5/8" AT 16" O.C.	6"	6" ABOVE CEILING	N/A	N/A	BACKER BOARD + TILE BOTH SIDES

G SERIES

NONCOMBUSTIBLE



PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
G1	7/8" AT 16" O.C.	1 1/2"	6" ABOVE CEILING	N/A	N/A	

NOTES:
1. EXTEND GYPSUM BOARD 6" ABOVE ACOUSTICAL CEILING TILE OR STOP AT GYPSUM BOARD CEILING UNLESS NOTED OTHERWISE (ACOUSTICAL INSULATION REQUIREMENTS DO NOT APPLY UNLESS INDICATED ABOVE)

F SERIES

NONCOMBUSTIBLE

PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
F1	3 5/8" AT 16" O.C.	4 1/4"	T6" ABOVE CEILING	N/A	N/A	
F2	3 5/8" AT 16" O.C.	4 1/4"	TO DECK	N/A	3 1/2" FGL	
F3	3 5/8" AT 16" O.C.	4 3/4"	TO DECK	N/A	N/A	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL/COMM ROOM SIDE
F4	3 5/8" AT 16" O.C.	4 3/4"	6" ABOVE CEILING	N/A	N/A	BACKER BOARD + TILE AT CERAMIC TILE SIDE
F5	6" AT 16" O.C.	6 5/8"	TO DECK	N/A	3 1/2" FGL	
F6	6" AT 16" O.C.	7 1/8"	TO DECK	N/A	3 1/2" FGL	PLYWOOD LAYER TO 8'-0" AT ELECTRICAL ROOM SIDE; GYP LAYER TO 9'-6"
F7	6" AT 16" O.C.	7 1/8"	6" ABOVE CEILING	N/A	N/A	BACKER BOARD + TILE AT CERAMIC TILE SIDE

NOTES:
1. EXTEND GYPSUM BOARD 6" ABOVE ACOUSTICAL CEILING TILE OR STOP AT GYPSUM BOARD CEILING UNLESS NOTED OTHERWISE (ACOUSTICAL INSULATION REQUIREMENTS DO NOT APPLY UNLESS INDICATED ABOVE).

E SERIES

NONCOMBUSTIBLE

FIRE RATING AVAILABLE WITH UL ASSEMBLY U937 AND U906 WHERE NOTED.

PLAN VIEW

PTN TYPE	STUD	PART WIDTH	PART HEIGHT	FIRE RATING	INSUL	NOTES
E1	8" NOM. CMU	7 5/8"	TO DECK	1/2 HOUR	PERLITE	
E2	8" NOM. CMU	7 5/8"	TO DECK	N/A	PERLITE	
E3	8" NOM. CMU	7 5/8"	TO ONE COURSE ABOVE CEILING	N/A	N/A	
E4	6" NOM. CMU	9 1/8"	TO ONE COURSE ABOVE CEILING	N/A	N/A	7/8" FURRING + GYP LAYER ONE SIDE
E5	6" NOM. CMU	7 1/8"	TO DECK	1/2 HOUR	PERLITE	7/8" FURRING + GYP LAYER ONE SIDE
E6	6" NOM. CMU	7 5/8"	TO DECK	1/2 HOUR	PERLITE	7/8" FURRING + GYP LAYER; PLYWOOD LAYER TO 8'-0" AT COMM ROOM SIDE
E7	6" NOM. CMU	7 5/8"	TO DECK	1/2 HOUR	PERLITE	7/8" FURRING + BACKERBOARD & TILE AT CERAMICE TILE SIDE
E8	4" NOM. CMU	3 5/8"	TO HT. SHOWN	N/A	N/A	

PARTITION TYPES

NOT TO SCALE

GENERAL NOTES:

1. PARTITIONS SHALL BE TYPE "A1" UNLESS OTHERWISE NOTED.
2. ALL ELEMENTS OF ACOUSTICALLY RATED PARTITIONS SHALL EXTEND TO ROOF OR FLOOR DECK ABOVE AND ALL JOINTS AND PENETRATIONS OF ACOUSTICALLY RATED PARTITIONS SHALL BE FILLED AND SEALED.
3. PENETRATIONS IN RATED PARTITIONS AND CONNECTIONS OF THE PARTITIONS TO OTHER PORTIONS OF THE WORK SHALL BE IN ACCORDANCE WITH MANUFACTURERS' RECOMMENDED DETAILS AND IN COMPLIANCE WITH APPLICABLE TESTING AGENCY REQUIREMENTS.
4. WHERE A CLEAR DIMENSION OR OPENING IS REQUIRED OR NOTED, MEASURE DIMENSION TO FACE OF PARTITION FINISH
5. INSTALL BLOCKING OR BACKER MATERIAL FOR ATTACHMENT/MOUNTING OF WALL HUNG ITEMS OR EQUIPMENT DESCRIBED IN THE DOCUMENTS.
6. PROVIDE CEMENTITIOUS BACKER BOARD AT AREAS THAT ARE SCHEDULED TO RECEIVE CERAMIC TILE FINISH AND AT AREAS SO REQUIRED BY CODE.
7. INSTALLATION OF GYPSUM BOARD, BACKER BOARD AND BASE BOARD SHALL CONFORM TO REQUIREMENTS FOR FIRE RATINGS AND ACOUSTICAL RATINGS.
8. TYPICAL FLOOR PLAN DIMENSIONS OF PARTITIONS ARE TO THE NOMINAL FINISH FACE OF GYPSUM BOARD.
9. WHERE PARTITIONS AND/OR FURRING MEET, MAINTAIN A FLUSH SURFACE ON THE SIDE WHERE THE FINISH IS STRAIGHT OR CONTINUOUS UNLESS OTHERWISE NOTED.
10. PROVIDE STUD BRACING AT 4' - 0" O.C. STAGGERED IN ALTERNATING DIRECTIONS. BRACING SHALL ATTACH TO STUDS 1' - 0" MAX. ABOVE CEILING.
11. NOT ALL TYPES LISTED ABOVE MAY BE REQUIRED IN THE PROJECT.

KEYNOTES

0360.03	FILL WITH GROUT
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.13	6" CONCRETE MASONRY UNITS
0420.14	8" CONCRETE MASONRY UNITS
0610.05	1/2" EXTERIOR GRADE PLYWOOD
0720.14	GRANULAR INSULATING FILL IN CMU BLOCKS
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.26	5/8" CEMENTITIOUS BACKER BOARD
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.34	GYPSUM BOARD GUSSETS AT 16" O.C. VERTICALLY
0980.01	3 1/2" FIBERGLASS SOUND ATTENUATION BATT INSULATION

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

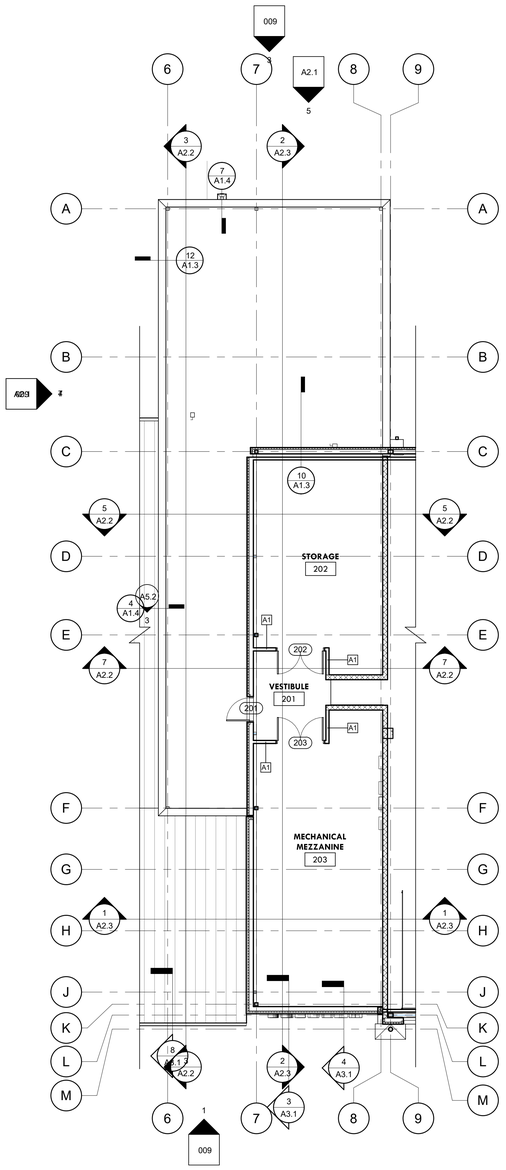
DATE 10/24/2024
DRAWN BY CP, SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

A1.0

PARTITION TYPES



2 SECOND FLOOR PLAN

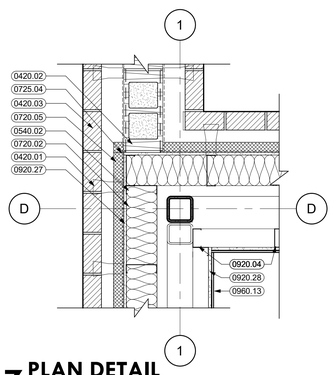
1/8" = 1'-0"

TRUE NORTH PLAN NORTH

1 FIRST FLOOR PLAN

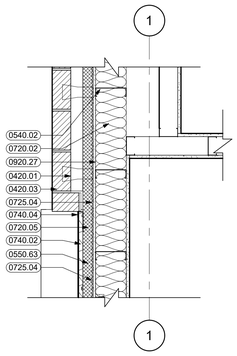
1/8" = 1'-0"

TRUE NORTH PLAN NORTH



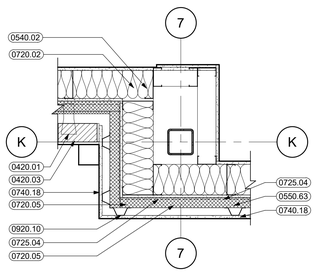
7 PLAN DETAIL

1" = 1'-0"



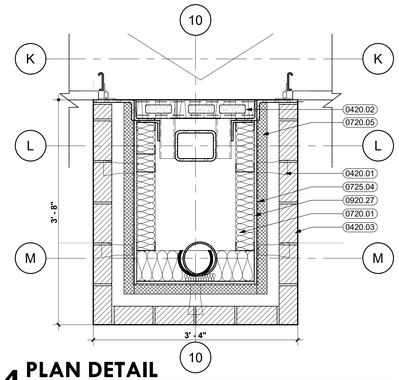
6 PLAN DETAIL

1" = 1'-0"



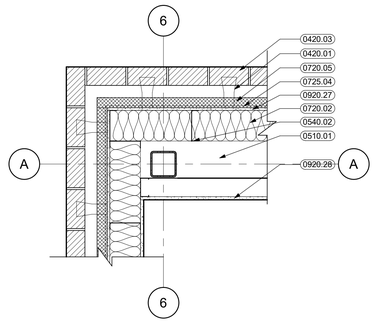
5 PLAN DETAIL

1" = 1'-0"



4 PLAN DETAIL

1" = 1'-0"



3 PLAN DETAIL

1" = 1'-0"

KEYNOTES

0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0510.01	STEEL STRUCTURE (RE: STRUCTURAL)
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0720.01	3 1/2" BATT INSULATION
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0960.13	4" RESILIENT BASE

REGISTERED ARCHITECT RAFAEL HOLLIDAY 23834 STATE OF TEXAS
10/24/2024

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 150
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY SF, LG, LT
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

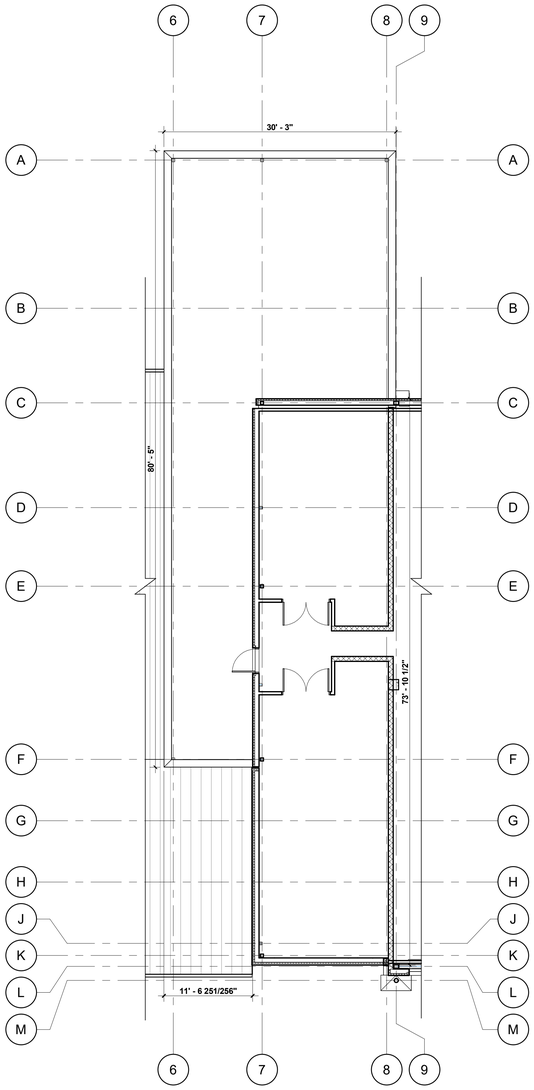
BRENHAM FIRE STATION #2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

A1.1

FLOOR PLANS

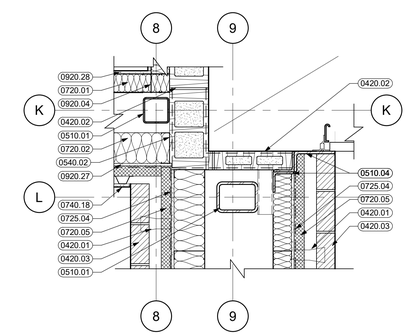


KEYNOTES

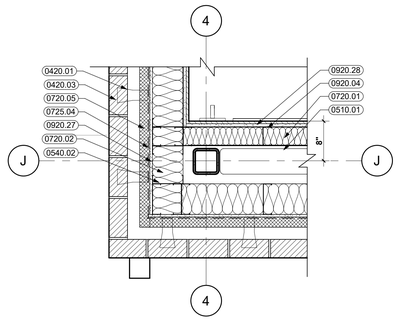
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0510.01	STEEL STRUCTURE (RE: STRUCTURAL)
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0720.01	3 1/2" BATT INSULATION
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0840.01	ALUMINUM STOREFRONT
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0930.01	CERAMIC TILE
1010.18	RAISED LETTERS AND SYMBOLS

2 SECOND FLOOR DIMENSION PLAN
1/8" = 1'-0"

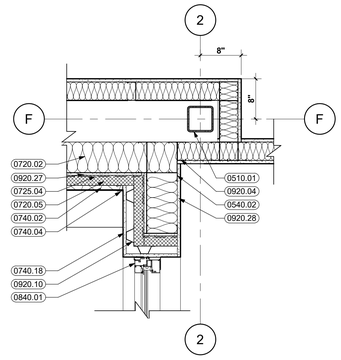
1 FIRST FLOOR DIMENSION PLAN
1/8" = 1'-0"



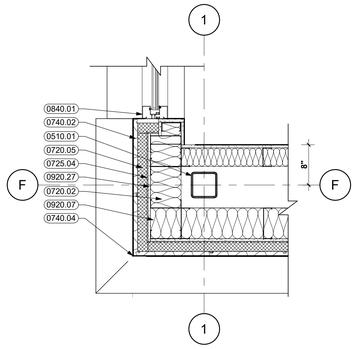
8 PLAN DETAIL
1" = 1'-0"



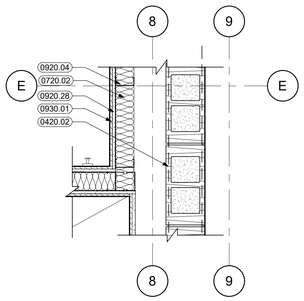
7 PLAN DETAIL
1" = 1'-0"



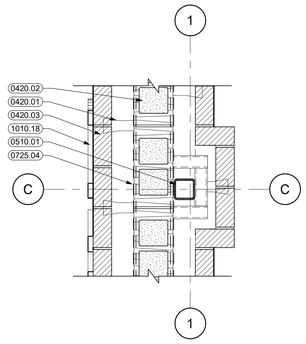
6 PLAN DETAIL
1" = 1'-0"



5 PLAN DETAIL
1" = 1'-0"



4 PLAN DETAIL
1" = 1'-0"



3 PLAN DETAIL
1" = 1'-0"

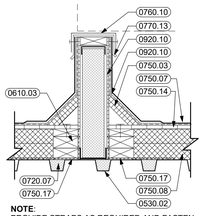
BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY SF, LG, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

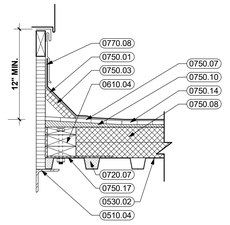
NO.	REVISION	DATE

A1.2
DIMENSION FLOOR PLANS

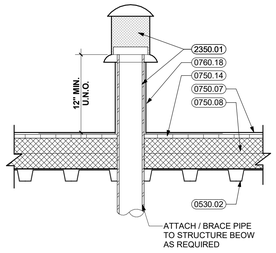


NOTE:
PROVIDE STRAPS AS REQUIRED AND FASTEN AT VERTICAL SURFACE. NO PENETRATIONS ALLOWED THROUGH TOP SIDE OF FLASHING CAP WILL BE ALLOWED.

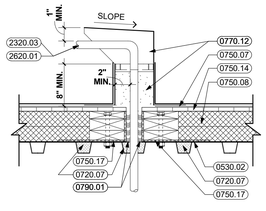
3 EQUIPMENT SUPPORT
1 1/2" = 1'-0"



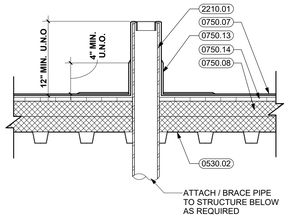
2 EQUIPMENT CURB
1 1/2" = 1'-0"



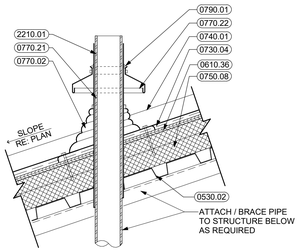
5 HOODED VENT
1 1/2" = 1'-0"



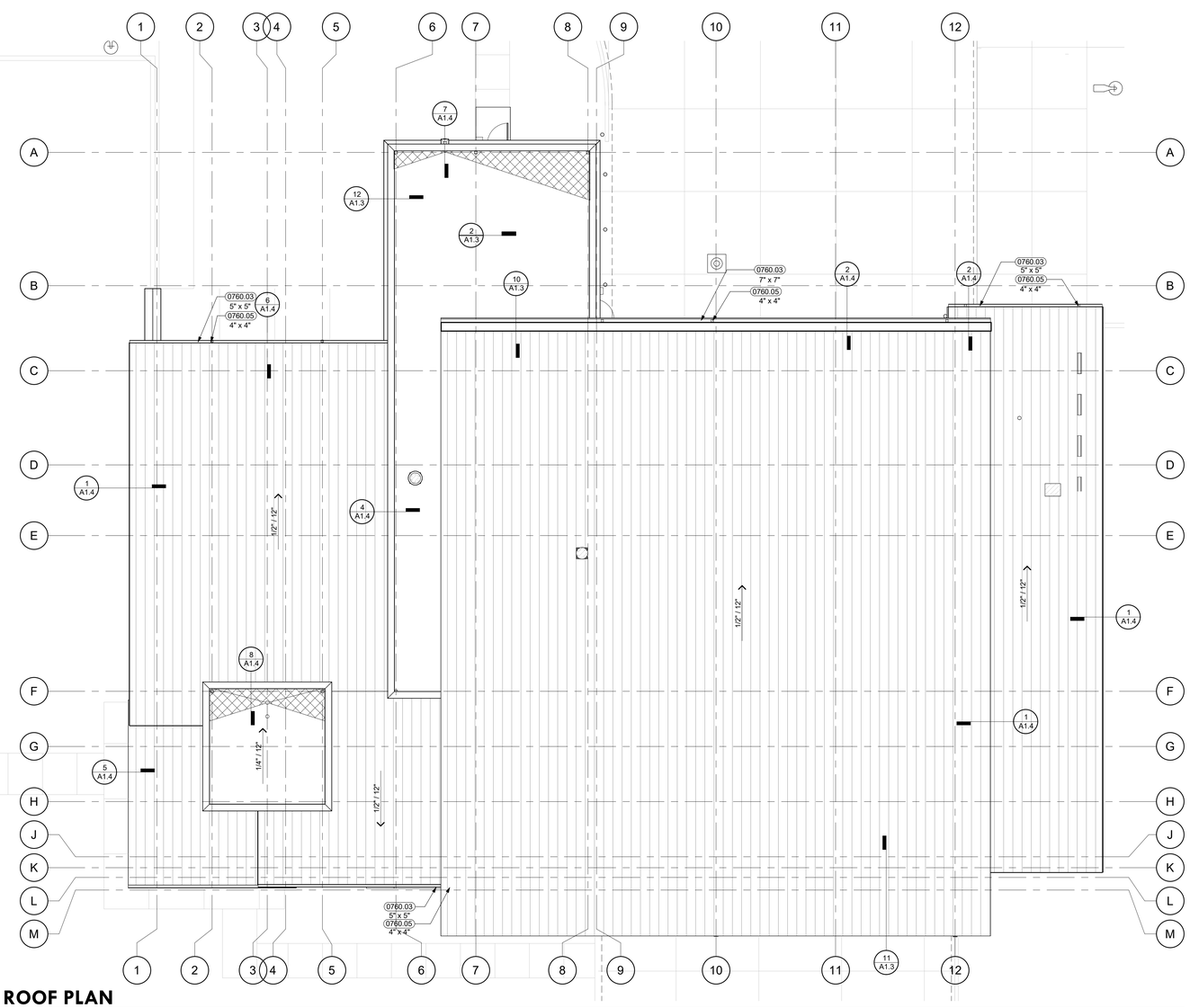
4 HOODED PAN
1 1/2" = 1'-0"



7 PLUMBING VENT
1 1/2" = 1'-0"

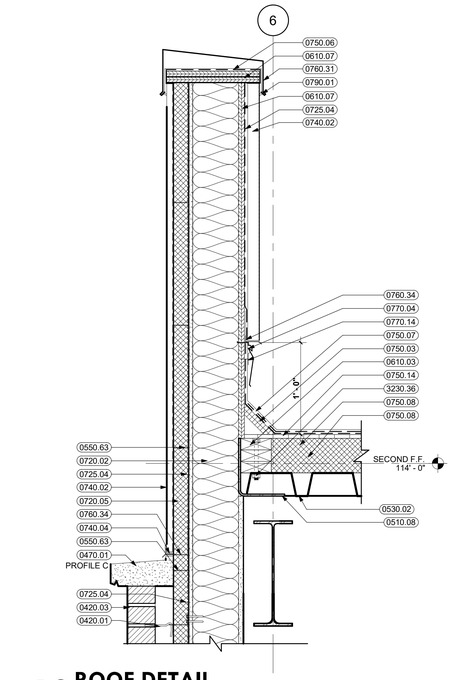


6 PLUMBING VENT
1 1/2" = 1'-0"

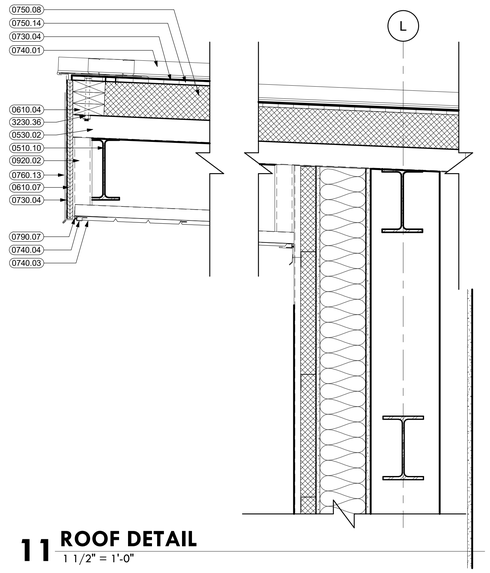


TRUE NORTH PLAN NORTH

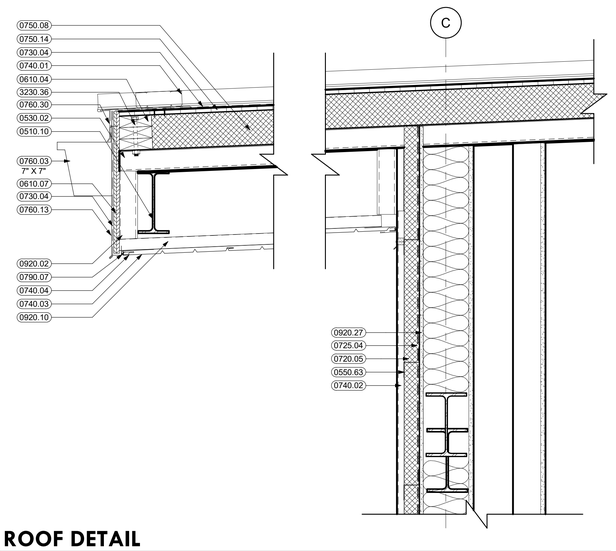
1 ROOF PLAN
1/8" = 1'-0"



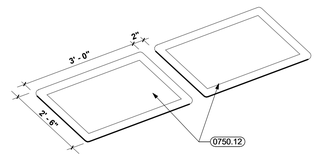
12 ROOF DETAIL
1 1/2" = 1'-0"



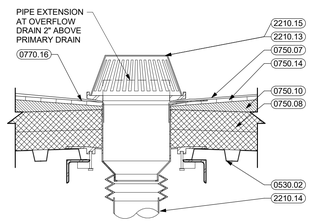
11 ROOF DETAIL
1 1/2" = 1'-0"



10 ROOF DETAIL
1 1/2" = 1'-0"



8 WALK PAD
1 1/2" = 1'-0"



9 ROOF / OVERFLOW DRAIN
1 1/2" = 1'-0"

KEYNOTES

0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.03	FACE BRICK
0470.01	CAST STONE
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0510.08	STEEL BENT PLATE (RE: STRUCTURAL)
0510.10	STEEL BEAM (RE: STRUCTURAL)
0530.02	METAL ROOF DECK (RE: STRUCTURAL)
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0610.03	2X WOOD BLOCKING
0610.04	2X PRESSURE TREATED WOOD BLOCKING
0610.07	3/4" EXTERIOR GRADE PLYWOOD
0610.36	INSULATED ROOF NAIL BASE PANEL
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0720.07	SPRAY FOAM INSULATION
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0730.04	SELF-ADHERING, HIGH-TEMPERATURE ROOFING SHEET UNDERLAYMENT
0740.01	PREFINISHED METAL ROOF PANEL SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0750.01	ROOFING BASE FLASHING SYSTEM
0750.03	4" CANT STRIP
0750.06	WRAP HIGH TEMPERATURE SELF-SEALING UNDERLAYMENT MEMBRANE TO OUTSIDE FACE OF BLOCKING
0750.07	MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM
0750.08	TWO (2) LAYERS OF 2.2" RIGID ROOF INSULATION (R-25)
0750.10	TAPERED ROOF INSULATION
0750.12	WALKWAY PAD
0750.13	LIQUID ROOF FLASHING SYSTEM
0750.14	1/2" ROOF COVER BOARD
0750.17	HEAT-WELDED LAP
0760.03	PREFINISHED METAL GUTTER
0760.05	PREFINISHED METAL DOWNSPOUT WITH FABRICATED TRANSITION TO DOWNSPOUT BOOT
0760.10	GALVANIZED STRAP
0760.13	PREFINISHED METAL FASCIA
0760.18	METAL PIPE JACK FLASHING
0760.30	PREFINISHED EAVE TRIM
0760.31	PREFINISHED METAL COPING SYSTEM
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0770.02	PIPE BOOT
0770.04	PREFINISHED METAL REGLET WITH SEALANT AND COUNTERFLASHING
0770.08	EQUIPMENT CURB WITH GALVANIZED COUNTERFLASHING
0770.12	24 GAUGE HOODED PAN. FILL WITH 1" POURABLE SEALANT OVER ROOFING GRANULES
0770.13	24 GAUGE GALVANIZED CAP. MITER, RIVET AND SOLDER ENDS WATERTIGHT. ANCHOR 12" O.C. (ONE MIN. PER SIDE)
0770.14	PRESSURE BAR WITH MECHANICAL FASTENERS
0770.16	4 LB. LEAD FLASHING, SET IN PLASTIC CEMENT AND EXTEND 2'-0" FROM DRAIN
0770.21	STAINLESS STEEL CLAMP
0770.22	PIPE UMBRELLA WITH SEALANT
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0790.07	SET IN BED OF SEALANT
0920.02	2 1/2" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
2210.01	PLUMBING VENT
2210.13	ROOF DRAIN
2210.14	ROOF DRAIN PIPING
2210.15	OVERFLOW ROOF DRAIN
2320.03	REFRIGERANT PIPING
2350.01	METAL FLUE WITH BASE AND COLLAR
2620.01	CONDUIT
3230.36	THROUGH-BOLT

Registered Architect Ryan Holliday 6837 STATE OF TEXAS
10/24/2024

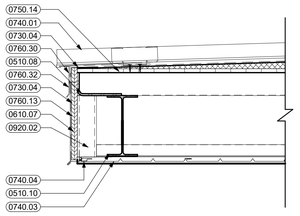
BRWARCHITECTS
175 CENTURY SQUARE DRIVE SUITE 200
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

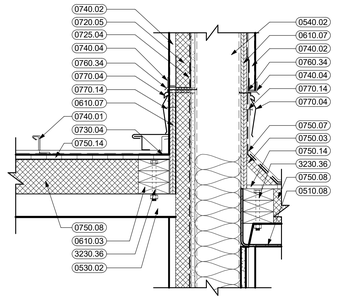
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

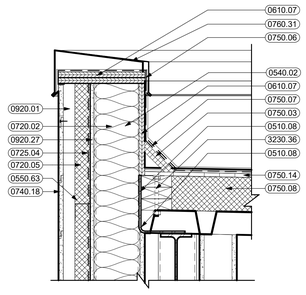
A1.3
ROOF PLAN AND DETAILS



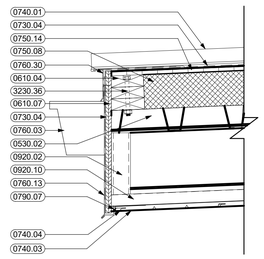
5 ROOF DETAIL
1 1/2" = 1'-0"



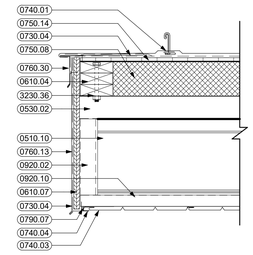
4 ROOF DETAIL
1 1/2" = 1'-0"



3 ROOF DETAIL
1 1/2" = 1'-0"



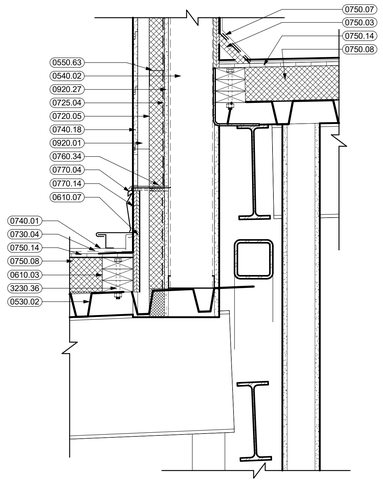
2 ROOF DETAIL
1 1/2" = 1'-0"



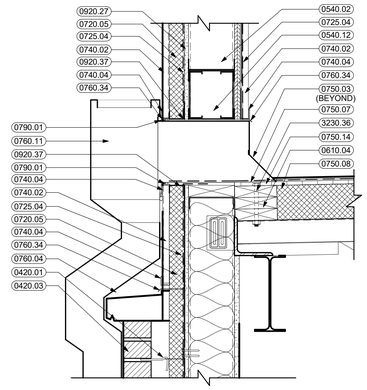
1 ROOF DETAIL
1 1/2" = 1'-0"

KEYNOTES

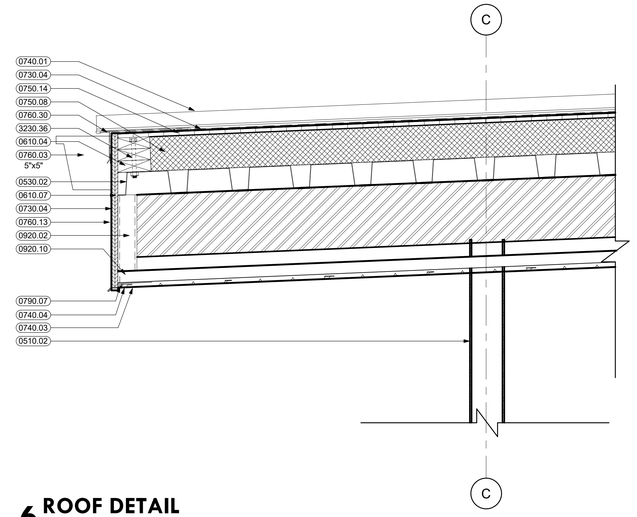
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.03	FACE BRICK
0510.02	STEEL COLUMN (RE: STRUCTURAL)
0510.08	STEEL BENT PLATE (RE: STRUCTURAL)
0510.10	STEEL BEAM (RE: STRUCTURAL)
0530.02	METAL ROOF DECK (RE: STRUCTURAL)
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0540.12	COLD-FORMED METAL HEADER
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0610.03	2X WOOD BLOCKING
0610.04	2X PRESSURE TREATED WOOD BLOCKING
0610.07	3/4" EXTERIOR GRADE PLYWOOD
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0730.04	SELF-ADHERING, HIGH-TEMPERATURE ROOFING SHEET UNDERLAYMENT
0740.01	PREFINISHED METAL ROOF PANEL SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0750.03	4" CANT STRIP
0750.06	WRAP HIGH TEMPERATURE SELF-SEALING UNDERLAYMENT MEMBRANE TO OUTSIDE FACE OF BLOCKING
0750.07	MODIFIED BITUMEN MEMBRANE ROOFING SYSTEM
0750.08	TWO (2) LAYERS OF 2.2" RIGID ROOF INSULATION (R-25)
0750.14	1/2" ROOF COVER BOARD
0760.03	PREFINISHED METAL GUTTER
0760.04	PREFINISHED METAL DOWNSPOUT
0760.11	PREFINISHED METAL CONDUCTOR HEAD (14" W X 12" H X 6" D)
0760.13	PREFINISHED METAL FASCIA
0760.30	PREFINISHED EAVE TRIM
0760.31	PREFINISHED METAL COPING SYSTEM
0760.32	CONTINUOUS CLEAT
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0770.04	PREFINISHED METAL REGLET WITH SEALANT AND COUNTERFLASHING
0770.14	PRESSURE BAR WITH MECHANICAL FASTENERS
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0790.07	SET IN BED OF SEALANT
0920.01	1 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.02	2 1/2" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.37	2" J-SHAPE TRACK
3230.36	THROUGH-BOLT



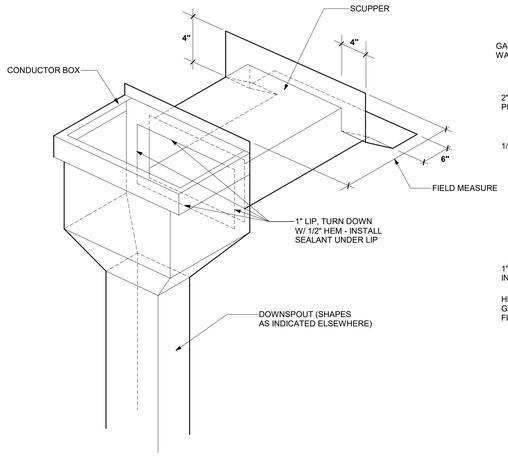
8 ROOF DETAIL
1 1/2" = 1'-0"



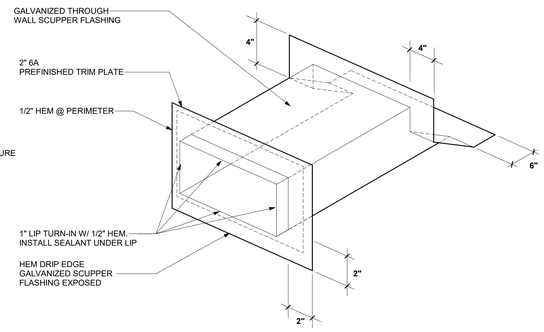
7 LEADER BOX
1 1/2" = 1'-0"

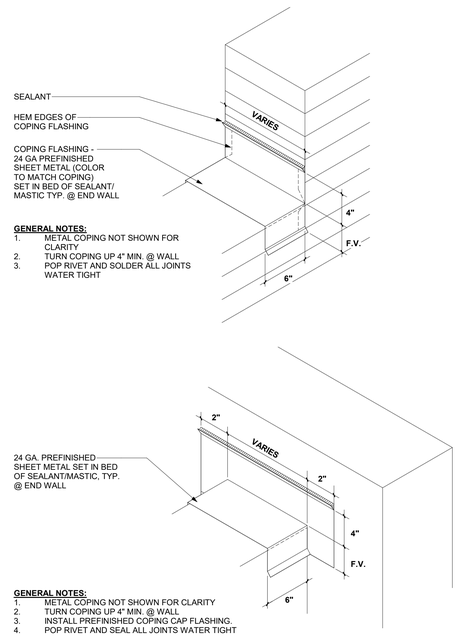


6 ROOF DETAIL
1 1/2" = 1'-0"



11 SCUPPER AND DOWNSPOUT
1 1/2" = 1'-0"





10 PARAPET COPING AND RISE WALL
1 1/2" = 1'-0"

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

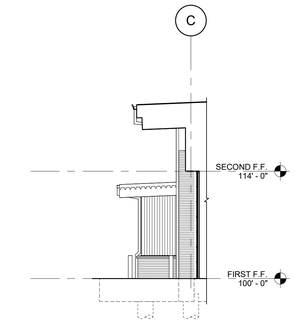
DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

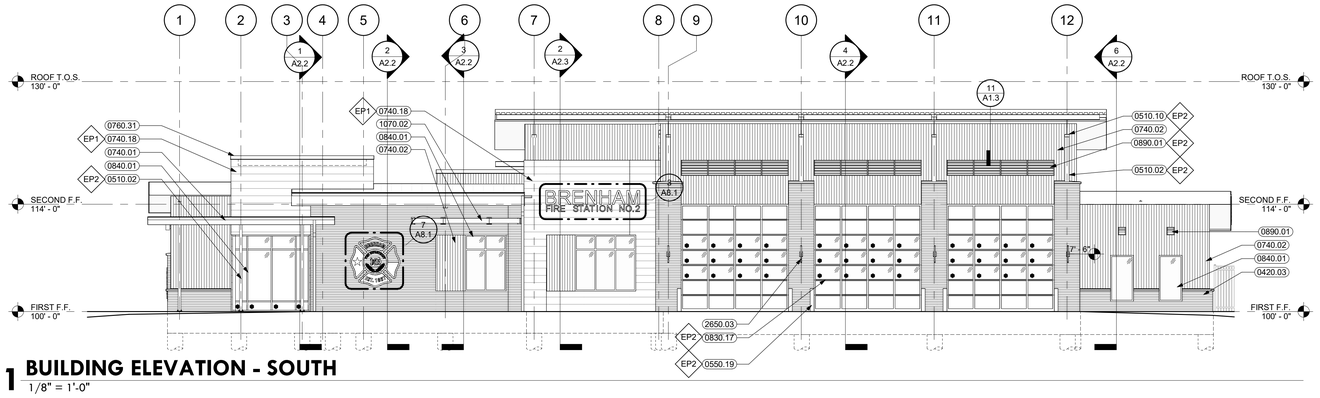
NO.	REVISION	DATE

A1.4

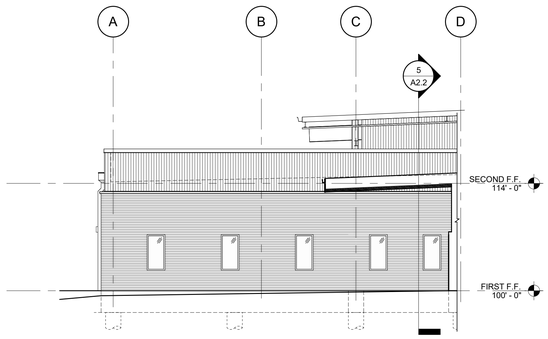
ROOF DETAILS



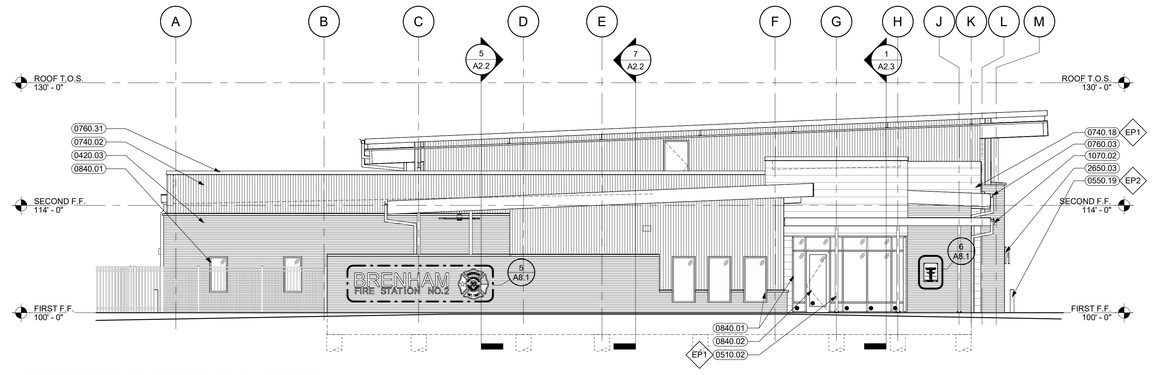
2 BUILDING ELEVATION - WEST
1/8" = 1'-0"



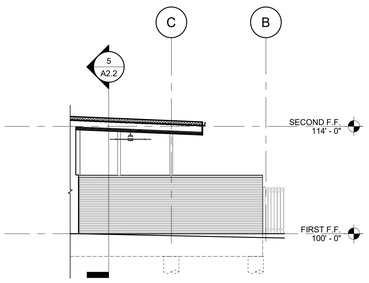
1 BUILDING ELEVATION - SOUTH
1/8" = 1'-0"



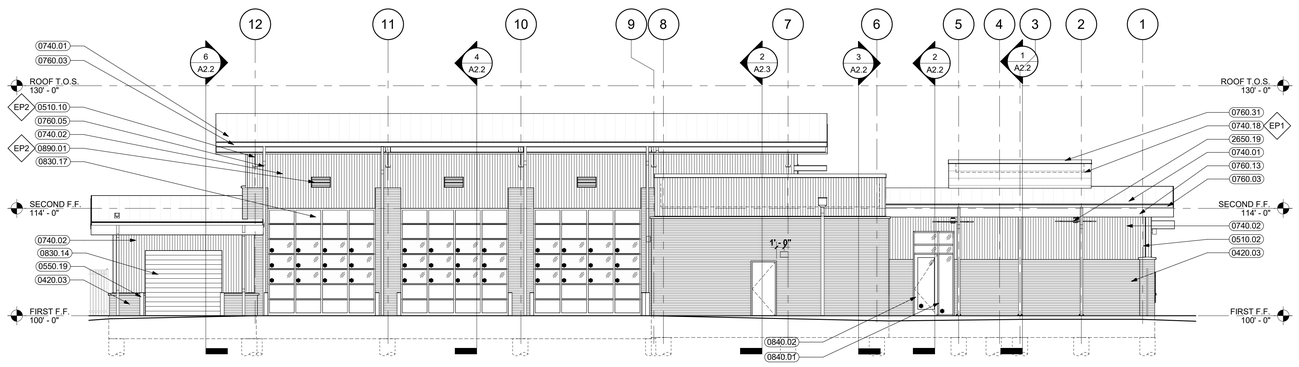
4 BUILDING ELEVATION - WEST (PARTIAL)
1/8" = 1'-0"



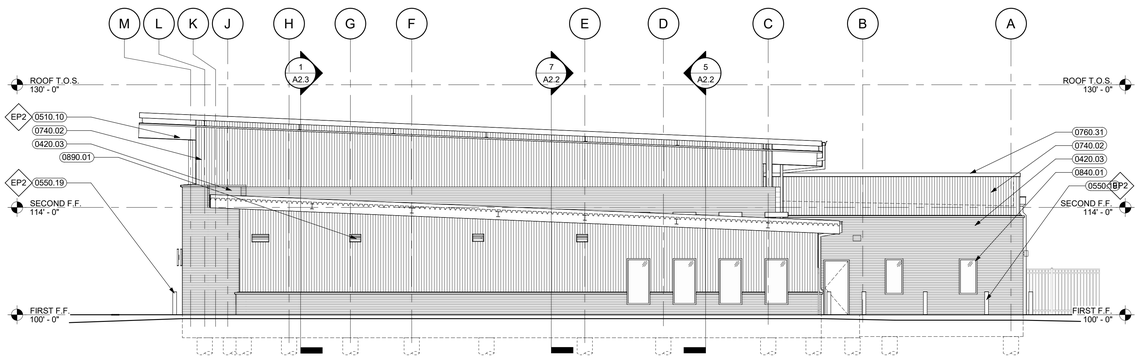
3 BUILDING ELEVATION - WEST
1/8" = 1'-0"



6 BUILDING ELEVATION - EAST (PARTIAL)
1/8" = 1'-0"



5 BUILDING ELEVATION - NORTH
1/8" = 1'-0"



7 BUILDING ELEVATION - EAST
1/8" = 1'-0"

KEYNOTES

0420.03	FACE BRICK
0510.02	STEEL COLUMN (RE: STRUCTURAL)
0510.10	STEEL BEAM (RE: STRUCTURAL)
0550.19	6" STEEL PIPE BOLLARD. FILL WITH CONCRETE (GALVANIZED AT EXTERIOR LOCATIONS)
0740.01	PREFINISHED METAL ROOF PANEL SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0760.03	PREFINISHED METAL GUTTER
0760.05	PREFINISHED METAL DOWNSPOUT WITH FABRICATED TRANSITION TO DOWNSPOUT BOOT
0760.13	PREFINISHED METAL FASCIA
0760.31	PREFINISHED METAL COPING SYSTEM
0830.14	OVERHEAD COILING DOOR
0830.17	UPWARD ACTING SECTIONAL DOOR
0840.01	ALUMINUM STOREFRONT
0840.02	ALUMINUM STOREFRONT DOOR
0890.01	PREFINISHED FIXED ALUMINUM LOUVER (WITH BIRD SCREEN)
1070.02	PRE-MANUFACTURED EXTERIOR SUN CONTROL DEVICES
2650.03	SURFACE-MOUNTED LIGHT FIXTURE
2650.19	CEILING FAN

MATERIAL LEGEND

PATTERN	DESCRIPTION
	BRICK VENEER INTERSTATE BRICK BLEND: 34% MOUNTAIN RED, 33% PARK ROSE, 33% IRONSTONE
	CORRUGATED METAL PANEL BERRIDGE HR-16 CHARCOAL GREY
	CEMENTITIOUS SIDING JAMES HARDIE ARTISIN SERIES
	CONCEALED FASTENER METAL SOFFIT BERRIDGE VEE PANEL HONEY WALNUT
	WINDOW MULLIONS KAWNEER- PERMANODIC ANODIZED FINISH BLACK NO. 29
	APPARATUS BAY DOORS RAL 3003 RUBY RED
EP1	**EXTERIOR PAINT FOR SIDING** SHERWIN WILLIAMS SW 0055
EP2	**EXTERIOR PAINT FOR METALS** SHERWIN WILLIAMS SW 7069

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024
DRAWN BY LG, SF, LT, SP
CHECKED BY JD, RH, MW
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

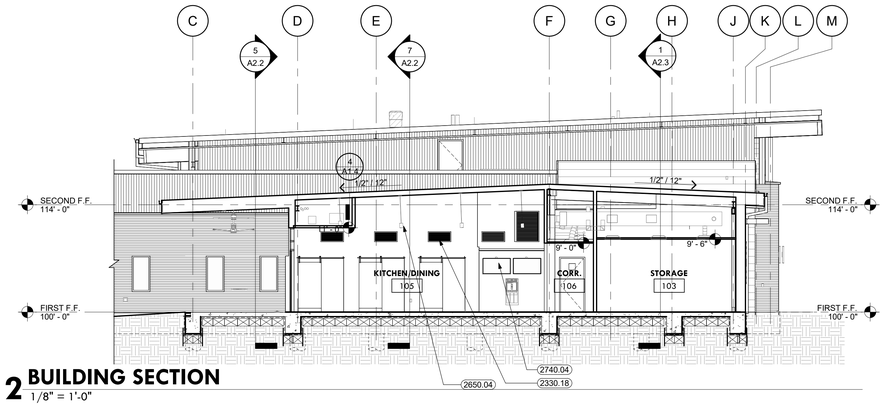
NO.	REVISION	DATE

A2.1

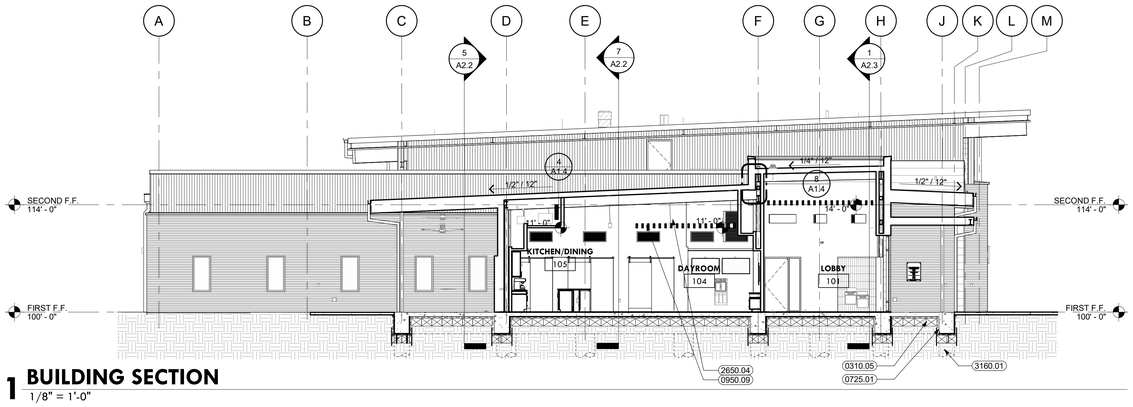
EXTERIOR ELEVATIONS

KEYNOTES

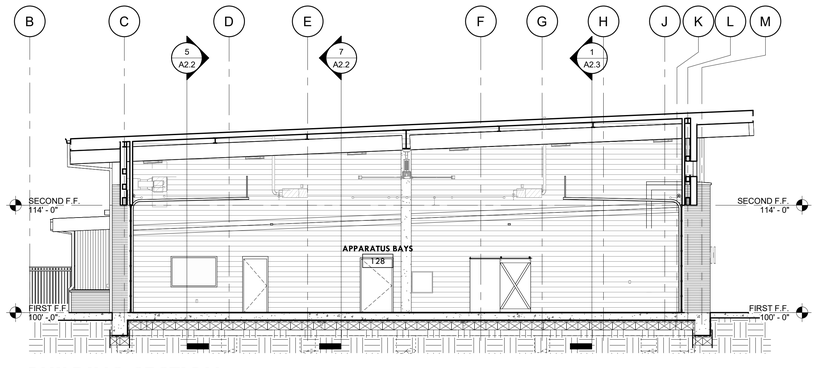
0310.05	VOID FORMS
0725.01	UNDERSLAB VAPOR BARRIER
0950.09	SUSPENDED ACOUSTICAL BAFFLE CEILING SYSTEM
2330.18	RETURN AIR GRILLE
2650.04	SUSPENDED LIGHT FIXTURE
2740.04	TELEVISION OR MONITOR
3160.01	CONCRETE PIER (RE: STRUCTURAL)



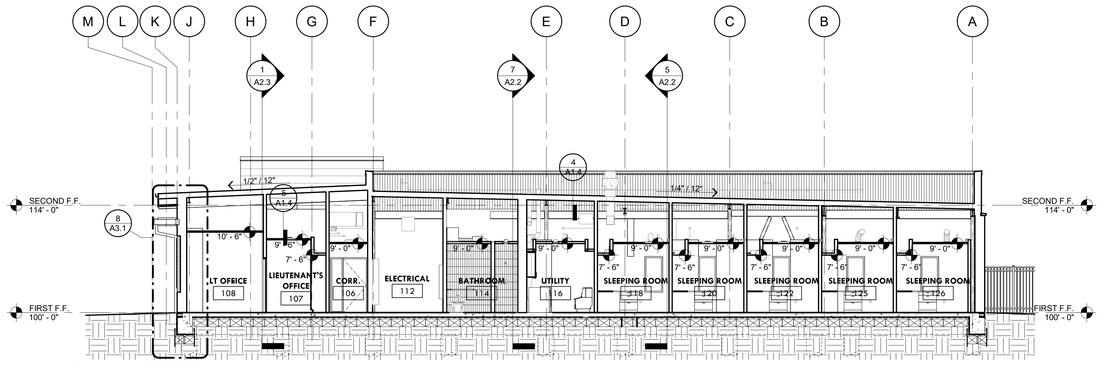
2 BUILDING SECTION
1/8" = 1'-0"



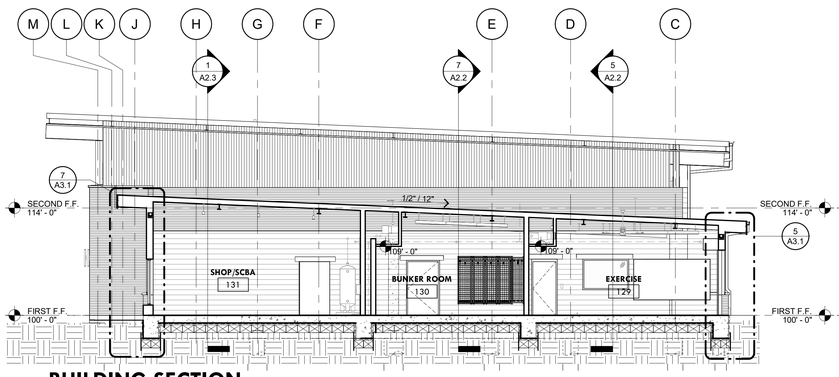
1 BUILDING SECTION
1/8" = 1'-0"



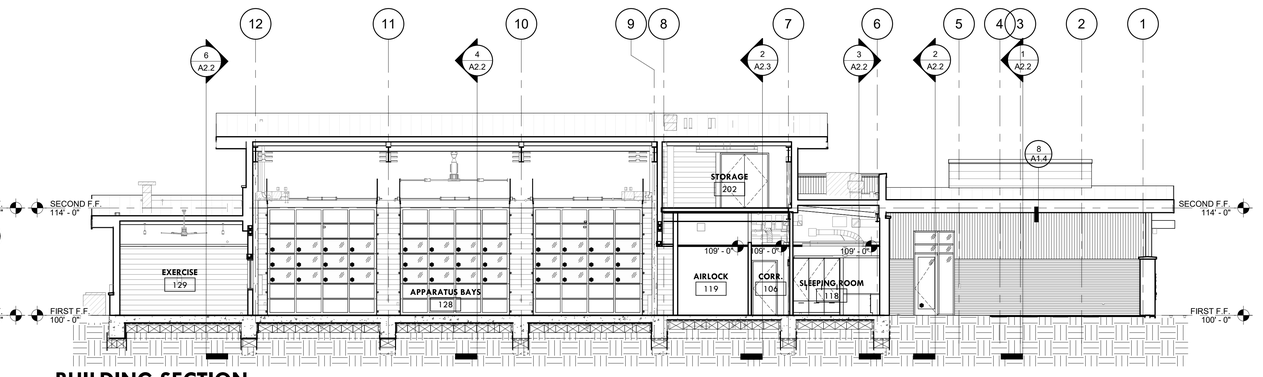
4 BUILDING SECTION
1/8" = 1'-0"



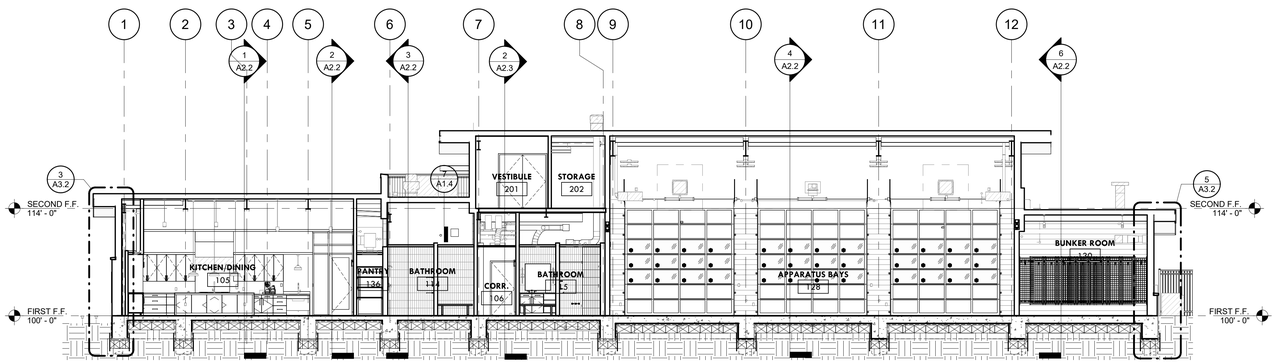
3 BUILDING SECTION
1/8" = 1'-0"



6 BUILDING SECTION
1/8" = 1'-0"



5 BUILDING SECTION
1/8" = 1'-0"



7 BUILDING SECTION
1/8" = 1'-0"

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	LG, SF, LT, SP
CHECKED BY	JD, RH, MW
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

A2.2
BUILDING SECTIONS

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 350
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	LG, SF, LT, SP
CHECKED BY	JD, RH, MW
BRW PROJECT NUMBER	2231020.00

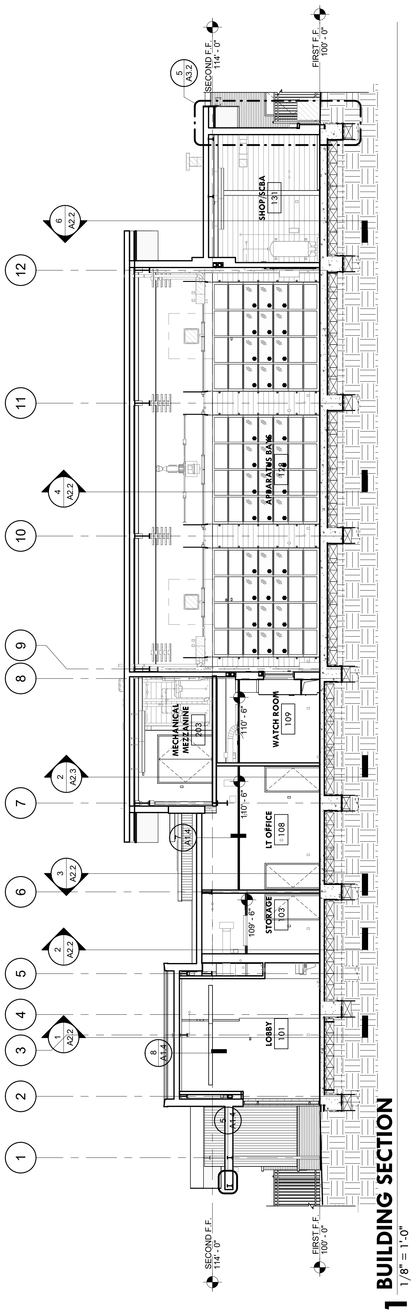
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

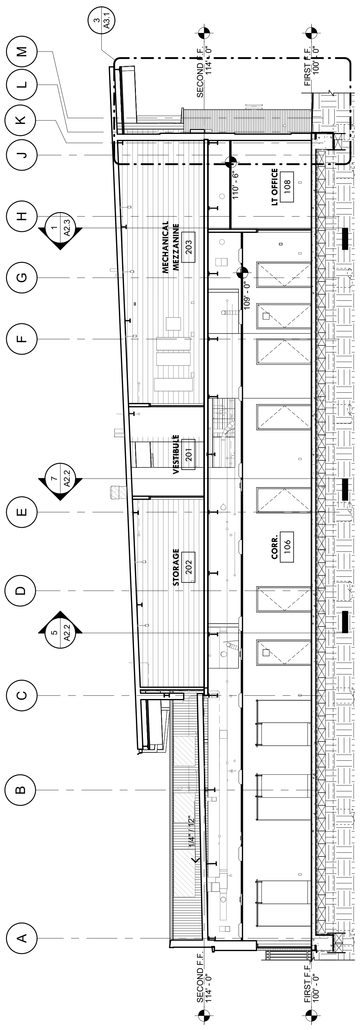
A2.3
BUILDING SECTIONS

10/24/2024

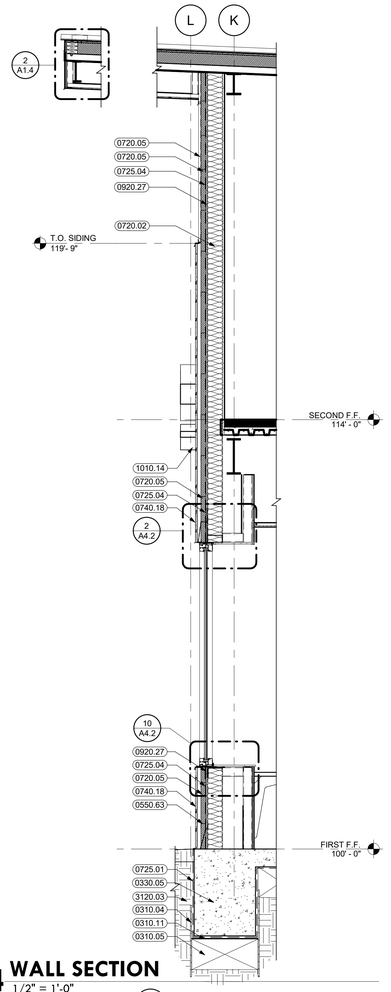
KEYNOTES



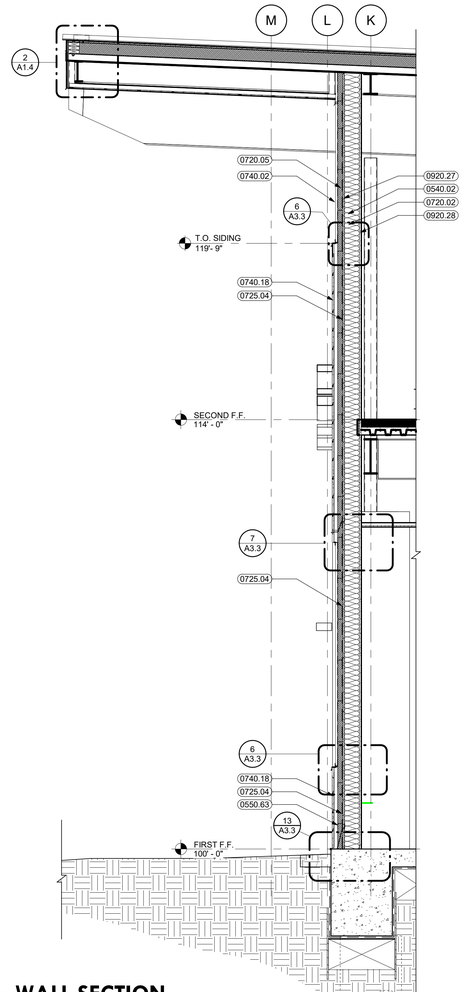
1 BUILDING SECTION
1/8" = 1'-0"



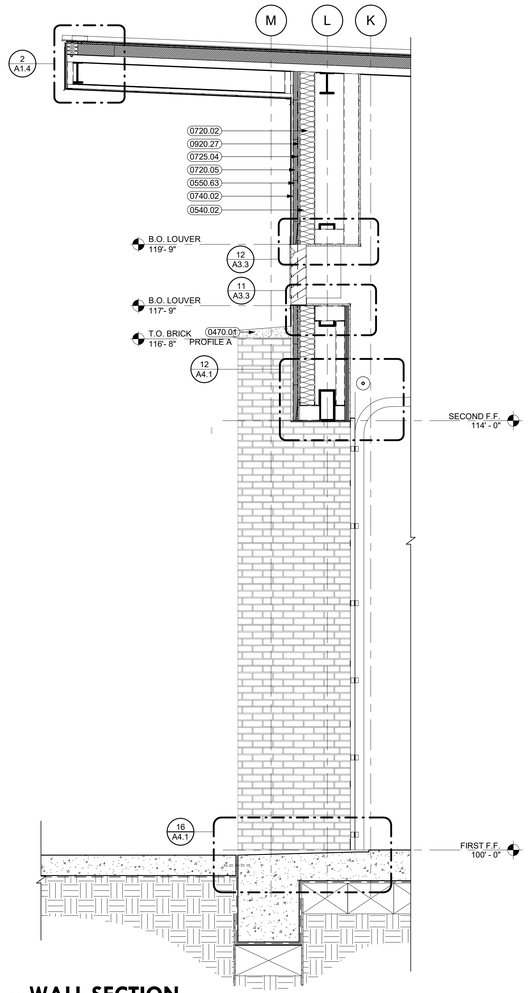
2 BUILDING SECTION
1/8" = 1'-0"



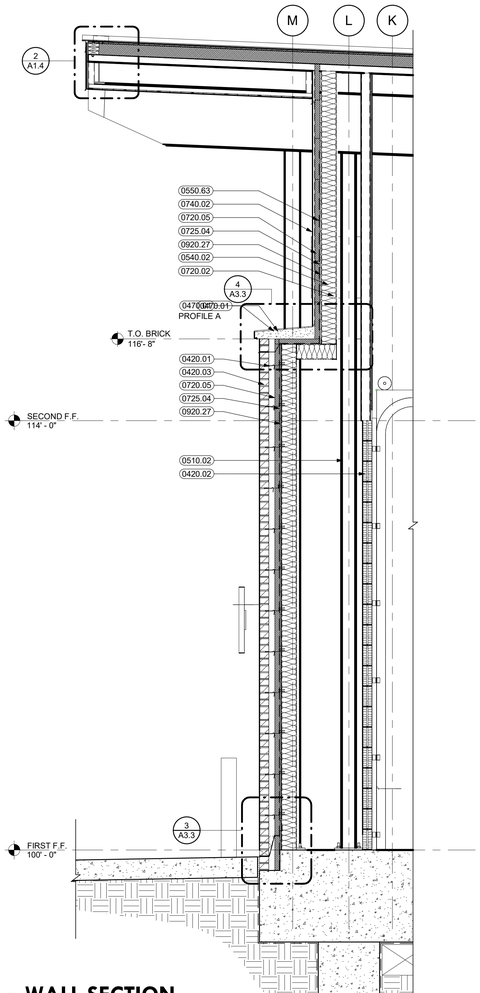
4 WALL SECTION
1/2" = 1'-0"



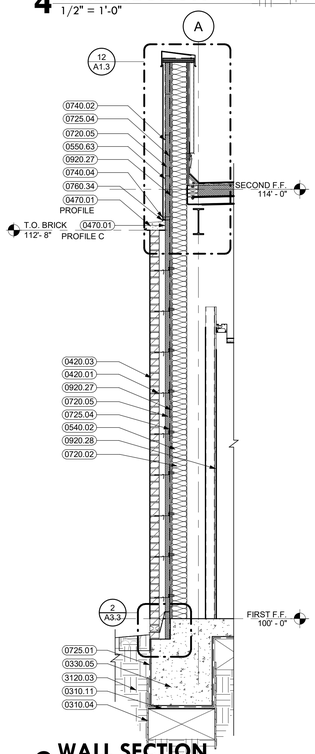
3 WALL SECTION
1/2" = 1'-0"



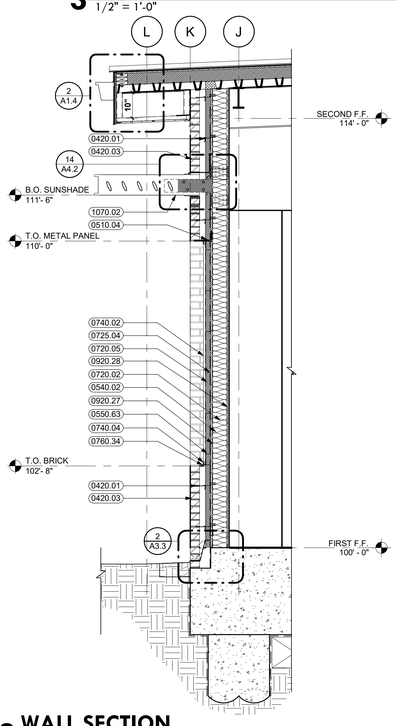
2 WALL SECTION
1/2" = 1'-0"



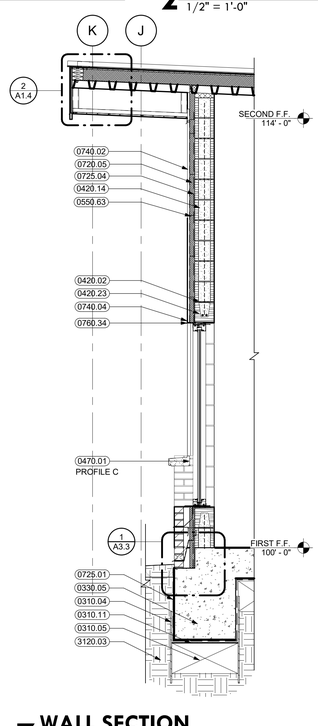
1 WALL SECTION
1/2" = 1'-0"



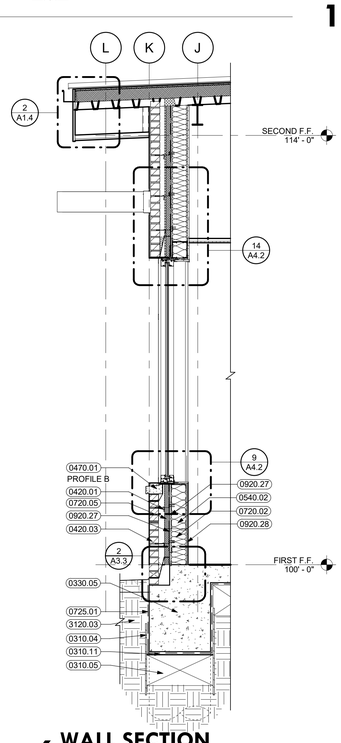
9 WALL SECTION
1/2" = 1'-0"



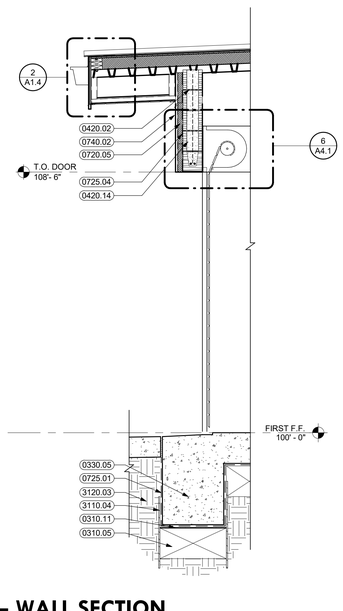
8 WALL SECTION
1/2" = 1'-0"



7 WALL SECTION
1/2" = 1'-0"



6 WALL SECTION
1/2" = 1'-0"



5 WALL SECTION
1/2" = 1'-0"

KEYNOTES

0310.04	SOIL RETENTION PANELS
0310.05	VOID FORMS
0310.11	EXPANSION JOINT PREMOLDED EXPANSION FILLER
0330.05	CONCRETE GRADE BEAM
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0470.01	CAST STONE
0510.02	STEEL COLUMN (RE: STRUCTURAL)
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.01	UNDERSLAB VAPOR BARRIER
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
1010.14	DIMENSIONAL SIGN LETTERS
1070.02	PRE-MANUFACTURED EXTERIOR SUN CONTROL DEVICES
3110.04	PROTECT EXISTING TREE OR TREES
3120.03	COMPACTED SUBGRADE

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

REGISTERED ARCHITECT RALPH W. HOLLIDAY 18834 STATE OF TEXAS
10/24/2024

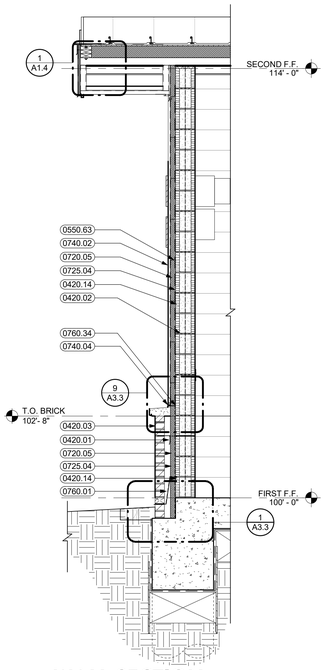
DATE 10/24/2024
DRAWN BY PRIMARY DRAWER, PA/PC
CHECKED BY PM/DIR, ARCH. OF RECORD
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

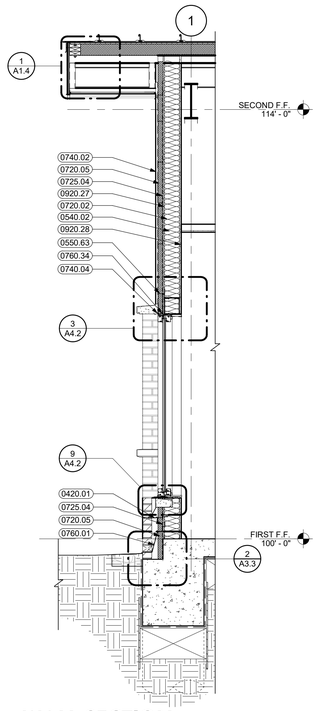
NO.	REVISION	DATE

A3.1

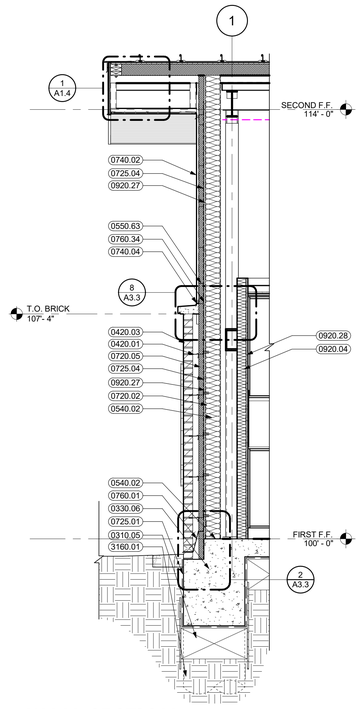
WALL SECTIONS



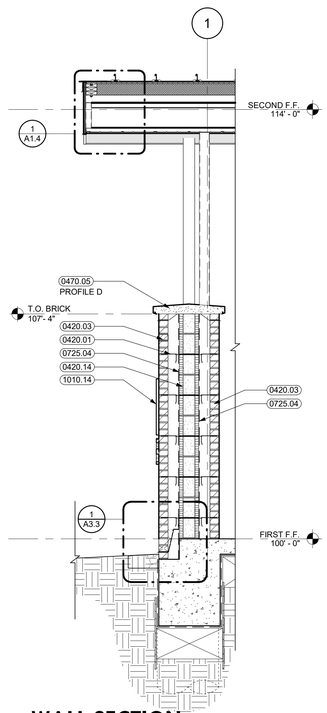
5 WALL SECTION
1/2" = 1'-0"



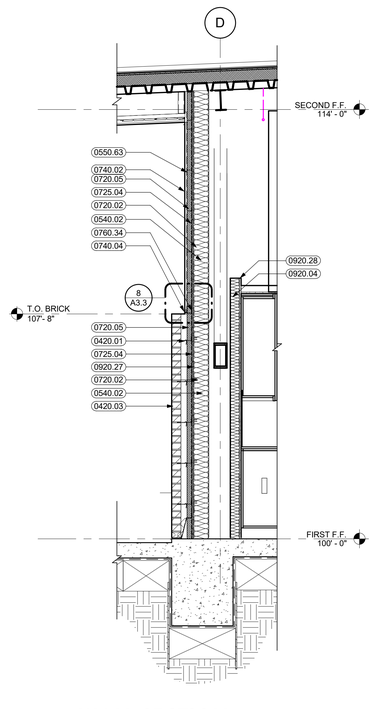
4 WALL SECTION
1/2" = 1'-0"



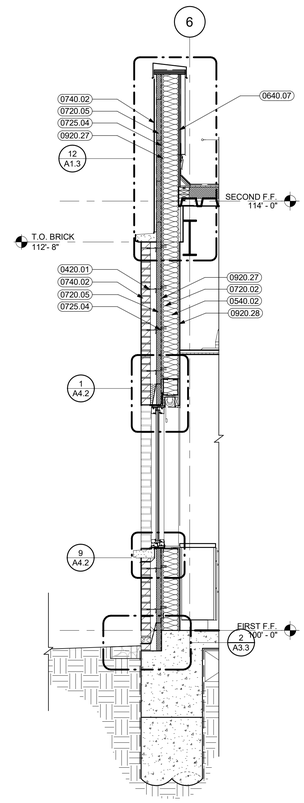
3 WALL SECTION
1/2" = 1'-0"



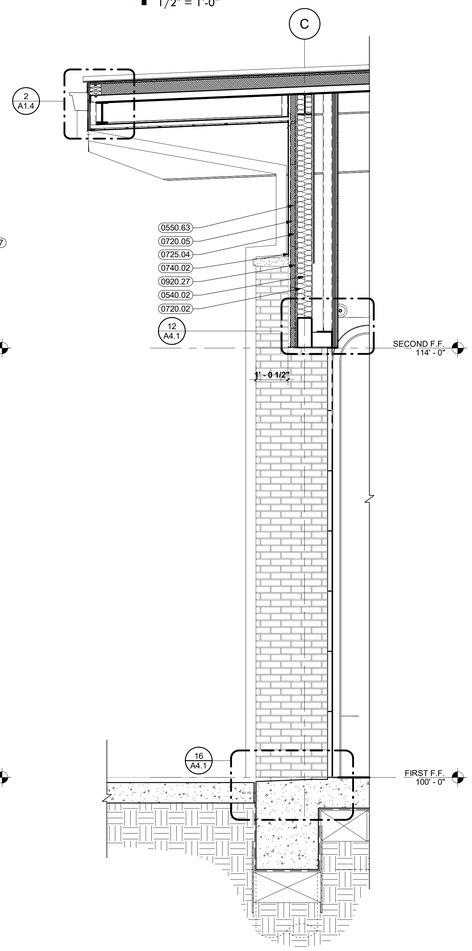
2 WALL SECTION
1/2" = 1'-0"



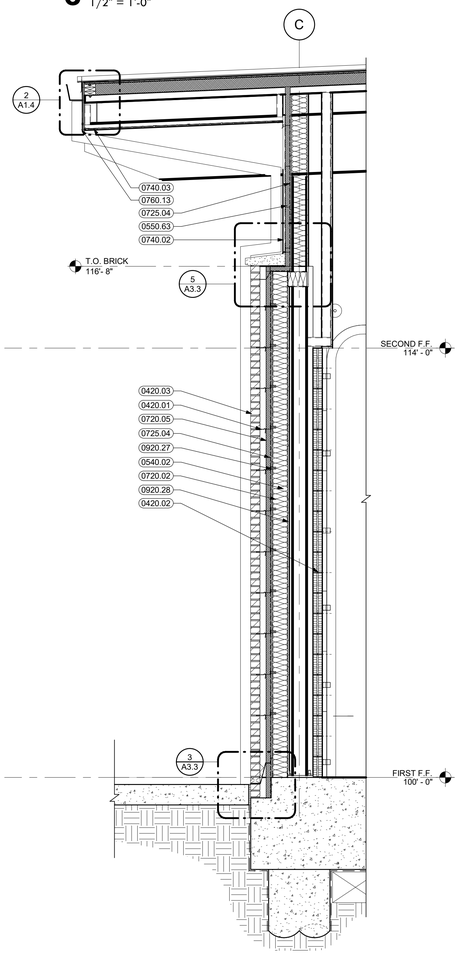
1 WALL SECTION
1/2" = 1'-0"



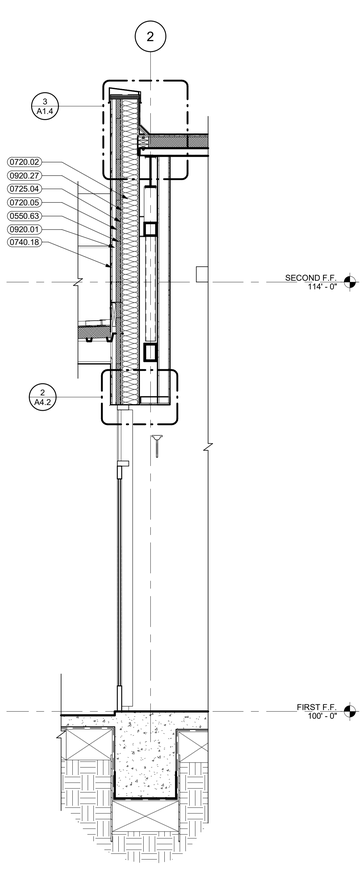
10 WALL SECTION
1/2" = 1'-0"



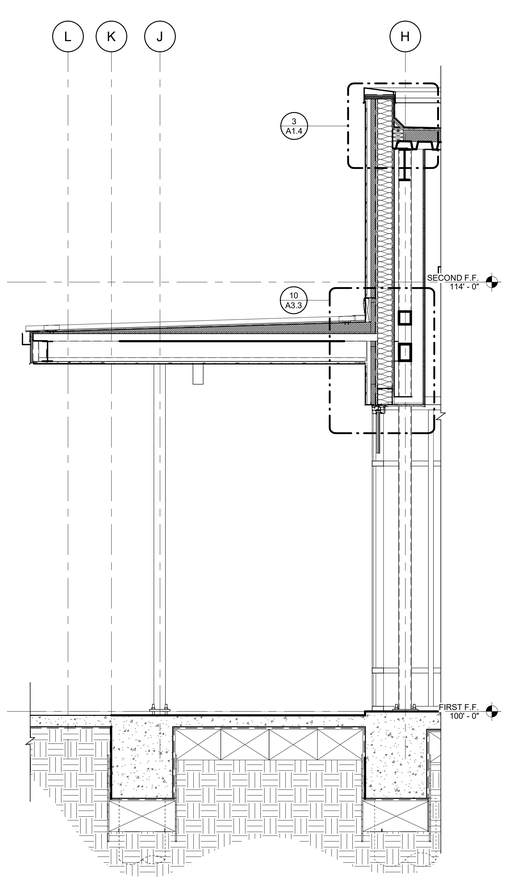
9 WALL SECTION
1/2" = 1'-0"



8 WALL SECTION
1/2" = 1'-0"



7 WALL SECTION
1/2" = 1'-0"



6 WALL SECTION
1/2" = 1'-0"

KEYNOTES

0310.05	VOID FORMS
0330.06	CONCRETE GRADE BEAM ON VOID FORMS
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.14	8" CONCRETE MASONRY UNITS
0470.05	CAST STONE SILL WITH DRIP
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0640.07	3/4" PLYWOOD
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.01	UNDERSLAB VAPOR BARRIER
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0760.01	THROUGH-WALL FLASHING WITH WEEPS AT 2'-0" O.C. AND MORTAR NET
0760.13	PREFINISHED METAL FASCIA
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0920.01	1 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
1010.14	DIMENSIONAL SIGN LETTERS
3160.01	CONCRETE PIER (RE: STRUCTURAL)

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR. ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

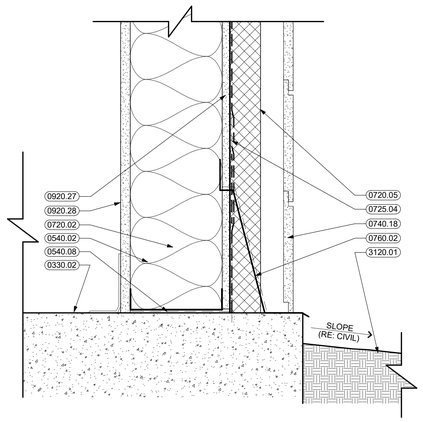
NO.	REVISION	DATE

A3.2

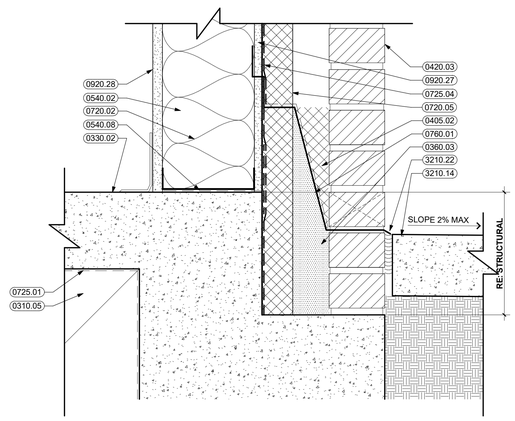
WALL SECTIONS

KEYNOTES

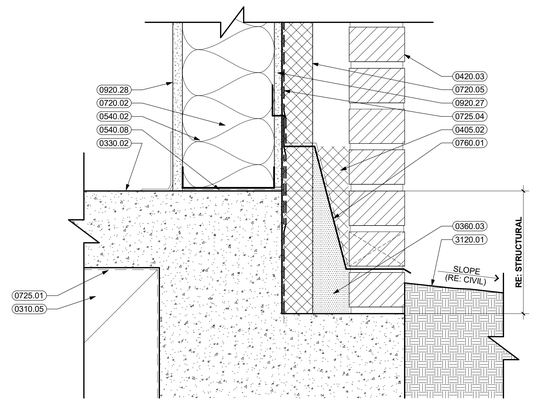
0310.05	VOID FORMS
0330.02	CONCRETE SLAB
0360.03	FILL WITH GROUT
0405.02	MORTAR NET
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.14	8" CONCRETE MASONRY UNITS
0470.01	CAST STONE
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0540.08	SILL GASKET
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.01	UNDERSLAB VAPOR BARRIER
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0725.05	SELF-ADHERING DETAIL TRANSITION MEMBRANE
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.03	PREFINISHED METAL SOFFIT PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0760.01	THROUGH-WALL FLASHING WITH WEEPS AT 2'-0" O.C. AND MORTAR NET
0760.02	THROUGH-WALL FLASHING (WITH WEEPS AT 2'-0" O.C. AS REQUIRED)
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0760.35	PREFINISHED METAL THROUGH WALL FLASHING WITH HEMMED DRIP EDGE
0760.40	TERMINATION BAR AND PREFINISHED FLASHING CAP
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0790.07	SET IN BED OF SEALANT
0830.02	WALL ACCESS PANEL
0890.01	PREFINISHED FIXED ALUMINUM LOUVER (WITH BIRD SCREEN)
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.35	CORNER BEAD, TYPICAL
0920.37	2" J-SHAPE TRACK
3120.01	GRADE
3210.14	CONCRETE PAVING (RE: CIVIL)
3210.22	PAVING EXPANSION JOINT - FILL WITH JOINT SEALER 1/4" BELOW SURFACE



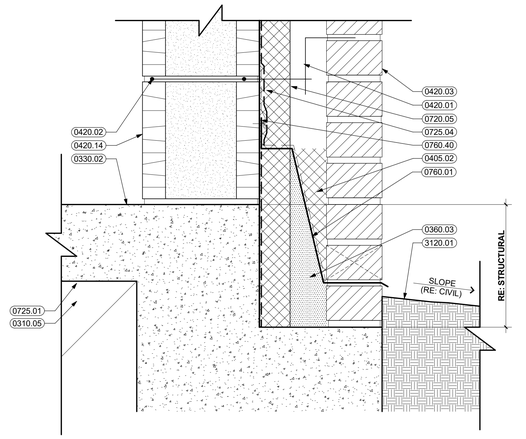
13 SECTION DETAIL
3" = 1'-0"



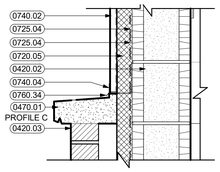
3 SECTION DETAIL
3" = 1'-0"



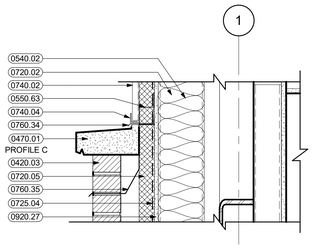
2 SECTION DETAIL
3" = 1'-0"



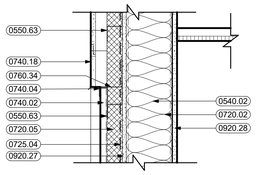
1 SECTION DETAIL
3" = 1'-0"



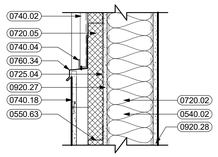
9 SECTION DETAIL
1 1/2" = 1'-0"



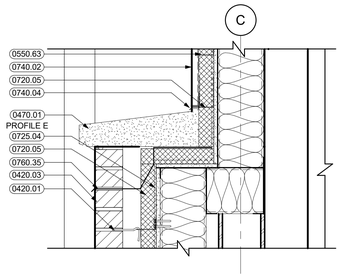
8 SECTION DETAIL
1 1/2" = 1'-0"



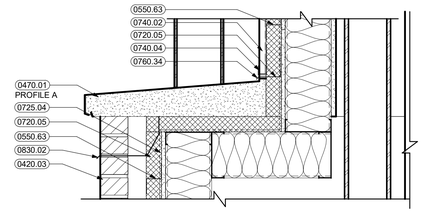
7 SECTION DETAIL
1 1/2" = 1'-0"



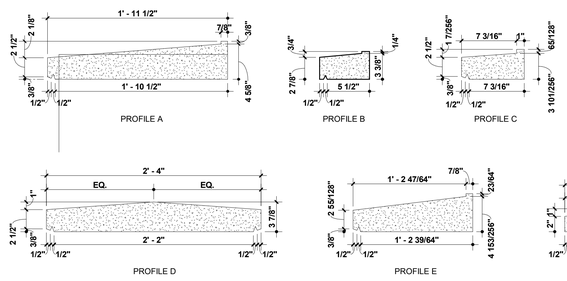
6 SECTION DETAIL
1 1/2" = 1'-0"



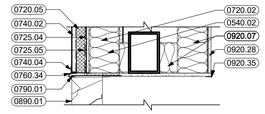
5 SECTION DETAIL
1 1/2" = 1'-0"



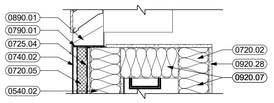
4 SECTION DETAIL
1 1/2" = 1'-0"



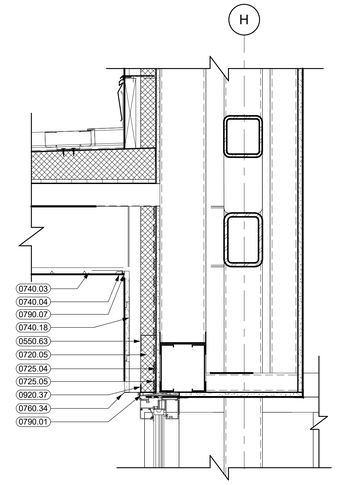
CAST STONE PROFILES



12 AIR TERMINAL CONNECTION
1" = 1'-0"



11 AIR TERMINAL CONNECTION
1" = 1'-0"



10 SECTION DETAIL
1 1/2" = 1'-0"

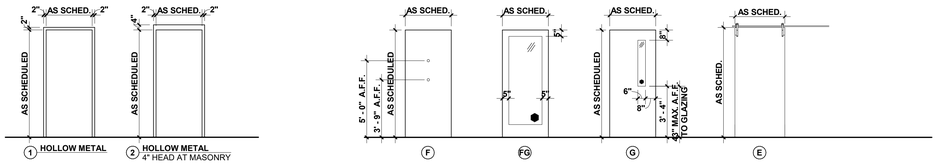
BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR, ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

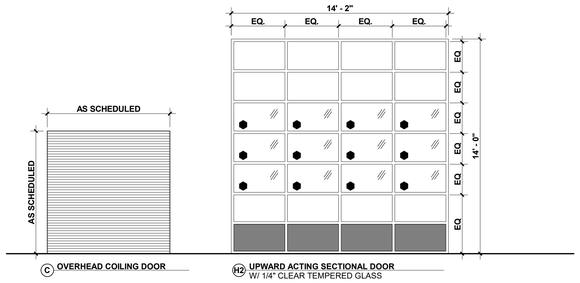
NO.	REVISION	DATE

A3.3
SECTION DETAILS



NOTE: NOT ALL TYPES LISTED ABOVE MAY BE REQUIRED IN THE PROJECT

DOOR FRAME TYPES



NOTE: NOT ALL TYPES LISTED ABOVE MAY BE REQUIRED IN THE PROJECT

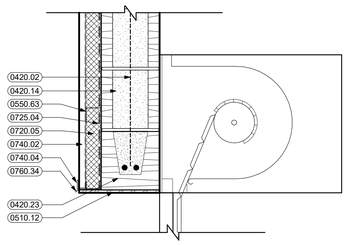
DOOR TYPES

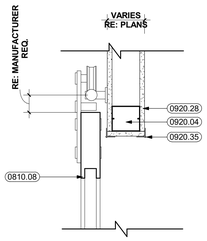
DOOR SCHEDULE

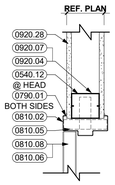
DOOR NO.	DESCRIPTION	SIZE	DOOR MTL.	DOOR TYPE	FRAME MTL.	FRAME TYPE	DETAIL REFERENCE HEAD	DETAIL REFERENCE JAMB	DETAIL REFERENCE SILL	HDWR. SET	FIRE RATING	REMARKS	TO ROOM:
FIRST F.F.													
101A	SINGLE	3' - 0" X 8' - 0" X 1 3/4"	AL/GL	FG	AL		14/A4.1		16/A4.1	C715A	-	CARD READER	LOBBY
101B	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	FG	AL					C711		CARD READER	LOBBY
102	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	341	-		PUBLIC RR
103	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	503	-		STORAGE
105A	SINGLE	3' - 0" X 8' - 0" X 1 3/4"	AL/GL	FG	AL		14/A4.1	8/A4.1	16/A4.1	C715A	-	CARD READER	KITCHEN/DINING
105B	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1	-	903			KITCHEN/DINING
105C	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1	-	903			KITCHEN/DINING
105D	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1	-	903			KITCHEN/DINING
106	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	1	2/A4.1	9/A4.1	13/A4.1	C715	-	CARD READER	CORR.
108	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	103	-		LT OFFICE
109	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	103	-		WATCH ROOM
110A	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	G	HM	1	4/A4.1	4/A4.1	-	731			AIRLOCK
110B	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	G	HM	2	3/A4.1	9/A4.1	-	C715		CARD READER	APPARATUS BAYS
111	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	C201	-	CARD READER	COMM
112	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	C201	-	CARD READER	ELECTRICAL
113	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	503	-		JANITOR
114	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	341	-		BATHROOM
115	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	341	-		BATHROOM
116	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	503	-		UTILITY
117	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-	341	-		BATHROOM
118	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			CORR.
119A	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	G	HM	1	14/A4.1	14/A4.1		731			AIRLOCK
119B	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	G	HM	2	3/A4.1	9/A4.1		C715		CARD READER	APPARATUS BAYS
120	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			CORR.
121	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			SLEEPING ROOM
122	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			CORR.
123	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	1	2/A4.1	9/A4.1	13/A4.1	205	-		RISER ROOM
124	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			SLEEPING ROOM
125	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			CORR.
126	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			CORR.
127	SLIDING	3' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-	16/A4.1	17/A4.1		903			SLEEPING ROOM
128A	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
128B	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
128C	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
128D	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
128E	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
128F	OVERHEAD ROLLING	14' - 2" X 14' - 1" X 1 3/4"	-	H2	-	-	10/A4.1	15/A1.1	15/A4.1	001			APPARATUS BAYS
129A	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	2	3/A4.1	9/A4.1		401G	-		EXERCISE
129B	OVERHEAD COILING DOOR	10' - 0" X 8' - 6" X 1 3/4"	-	C	-	-	17/A4.1			001			
129F	SINGLE	3' - 0" X 7' - 0" X 1 3/4"	WD	F	HM	1	14/A4.1	14/A4.1	-		-		LIEUTENANT'S OFFICE
130	SINGLE	4' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	2	3/A4.1	9/A4.1		C207GW		CARD READER	BUNKER ROOM
131	SLIDING	4' - 0" X 7' - 0" X 2 1/4"	WD	E	-	-				903			APPARATUS BAYS
301	PAIR OF 3'-0" DOORS	6' - 0" X 7' - 0" X 1 3/4"	HM	F	HM					214			
SECOND F.F.													
201	SINGLE	3' - 0" X 6' - 4" X 1 3/4"	HM	U	HM	1				205			VESTIBULE
202	PAIR OF 3'-0" DOORS	6' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	1				510			VESTIBULE
203	PAIR OF 3'-0" DOORS	6' - 0" X 7' - 0" X 1 3/4"	HM	F	HM	1				210			VESTIBULE

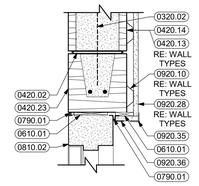
KEYNOTES

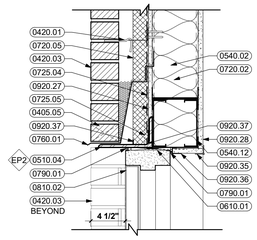
0310.10	CONCRETE EXPANSION JOINT, FILL WITH SEALANT TO WITHIN 1/4" OF SURFACE
0320.01	DOWEL INTO CONCRETE SLAB
0320.02	STEEL REINFORCING (RE: CIVIL)
0330.02	CONCRETE SLAB
0330.05	CONCRETE GRADE BEAM
0405.05	MASONRY VENEER WEEP / VENT
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.13	6" CONCRETE MASONRY UNITS
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0510.10	STEEL BEAM (RE: STRUCTURAL)
0510.12	STEEL PLATE (RE: STRUCTURAL)
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0540.12	COLD-FORMED METAL HEADER
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0610.01	SHIM AS REQUIRED
0610.07	3/4" EXTERIOR GRADE PLYWOOD
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.01	UNDERSLAB VAPOR BARRIER
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0725.05	SELF-ADHERING DETAIL TRANSITION MEMBRANE
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0760.01	THROUGH-WALL FLASHING WITH WEEPS AT 2'-0" O.C. AND MORTAR NET
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0760.37	CONTINUOUS STEEL STRAP ATTACHED TO EACH STUD
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0810.02	HOLLOW METAL FRAME
0810.05	JAMB ANCHOR (3 PER JAMB)
0810.06	HOLLOW METAL DOOR
0810.08	SOLID CORE WOOD DOOR
0830.17	UPWARD ACTING SECTIONAL DOOR
0830.26	SOUND CONTROL DOOR ASSEMBLY
0840.02	ALUMINUM STOREFRONT DOOR
0870.01	METAL THRESHOLD. SET IN BED OF SEALANT
0880.03	GLASS TYPE MG#1C (MONOLITHIC CLEAR, FULLY TEMPERED)
0880.08	GLASS TYPE MG#4 (MONOLITHIC, TINTED, FULLY TEMPERED)
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.35	CORNER BEAD, TYPICAL
0920.36	J-MOULD, TYPICAL
0920.37	2" J-SHAPE TRACK
0980.01	3 1/2" FIBERGLASS SOUND ATTENUATION BATT INSULATION
3210.14	CONCRETE PAVING (RE: CIVIL)
3210.22	PAVING EXPANSION JOINT - FILL WITH JOINT SEALER 1/4" BELOW SURFACE

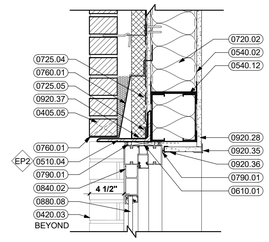




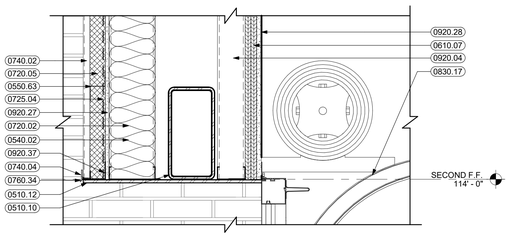








6 DOOR HEAD
1 1/2" = 1'-0"



5 DOOR HEAD
1 1/2" = 1'-0"

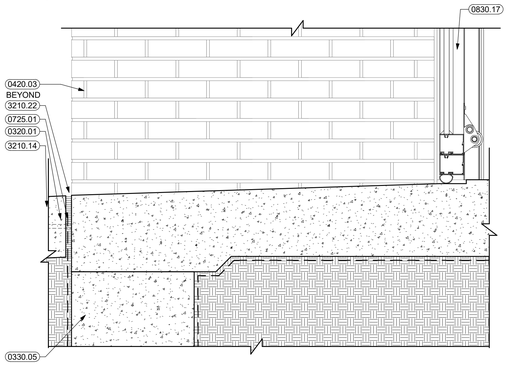
4 DOOR HEAD/JAMB
1 1/2" = 1'-0"

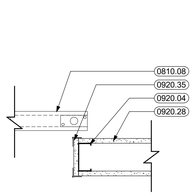
3 DOOR HEAD
1 1/2" = 1'-0"

2 DOOR HEAD
1 1/2" = 1'-0"

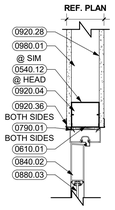
1 DOOR HEAD
1 1/2" = 1'-0"

12 DOOR HEAD
1 1/2" = 1'-0"

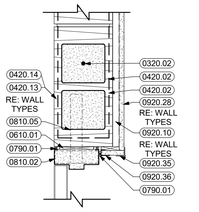




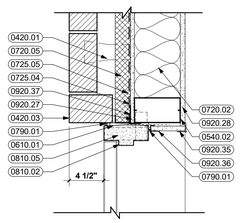
11 DOOR JAMB
1 1/2" = 1'-0"



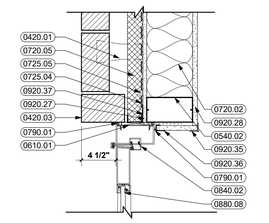
10 DOOR HEAD/JAMB
1 1/2" = 1'-0"



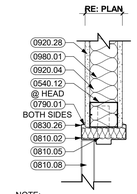
9 DOOR JAMB
1 1/2" = 1'-0"



8 DOOR JAMB
1 1/2" = 1'-0"

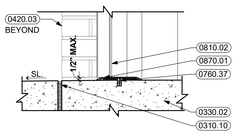


7 DOOR JAMB
1 1/2" = 1'-0"

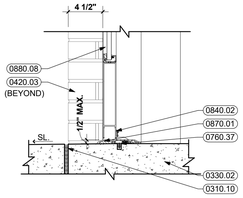


NOTE:
COORDINATE HARDWARE WITH DOOR SEALS WITH SOUND INSULATION SEALS TO BE CONTINUOUS. DO NOT CUT SEALS FOR ANY REASON.

15 DOOR HEAD/JAMB
1 1/2" = 1'-0"



14 DOOR SILL
1 1/2" = 1'-0"



13 DOOR SILL
1 1/2" = 1'-0"

16 DOOR SILL
1 1/2" = 1'-0"

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

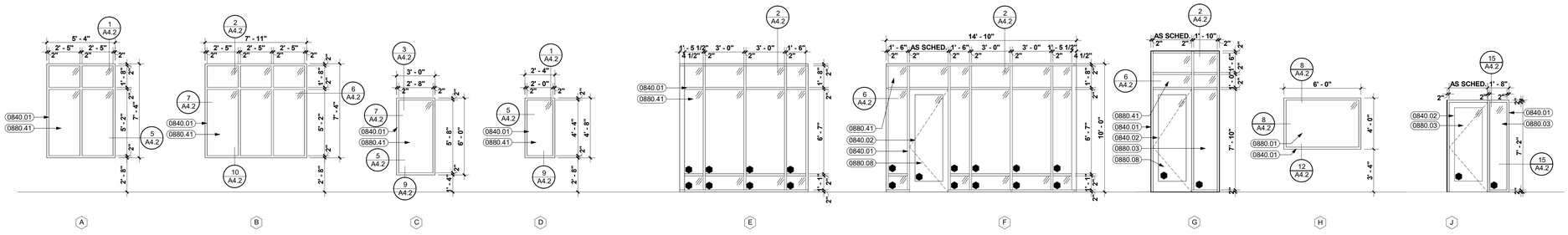
DATE 10/24/2024
DRAWN BY PRIMARY DRAWER, PA/PC
CHECKED BY PM/DIR, ARCH. OF RECORD
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

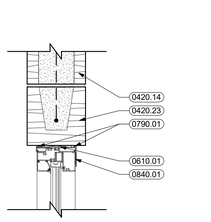
NO.	REVISION	DATE

A4.1

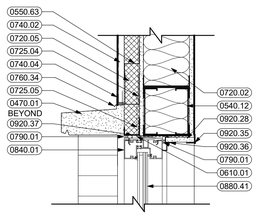
DOOR SCHEDULE AND DOOR TYPES



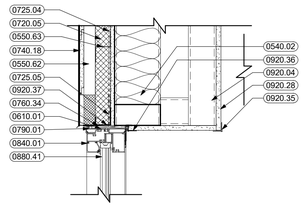
WINDOW TYPES



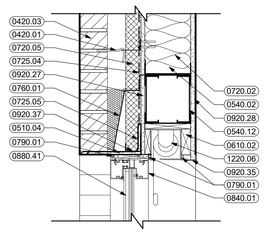
4 WINDOW HEAD
1 1/2" = 1'-0"



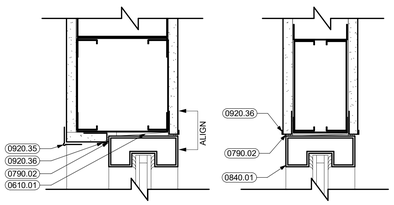
3 WINDOW HEAD
1 1/2" = 1'-0"



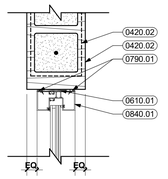
2 WINDOW HEAD
1 1/2" = 1'-0"



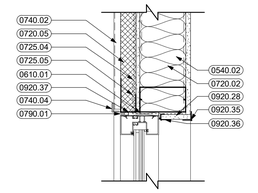
1 WINDOW HEAD
1 1/2" = 1'-0"



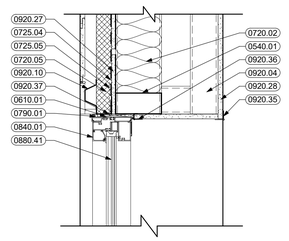
13 WINDOW HEAD / SILL DETAIL
3" = 1'-0"



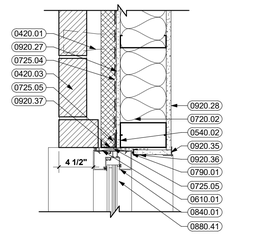
8 WINDOW JAMB
1 1/2" = 1'-0"



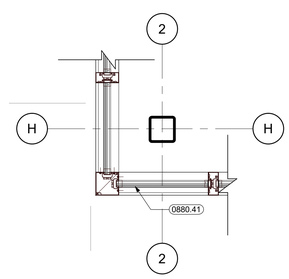
7 WINDOW JAMB
1 1/2" = 1'-0"



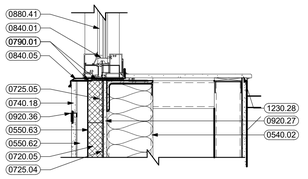
6 WINDOW JAMB
1 1/2" = 1'-0"



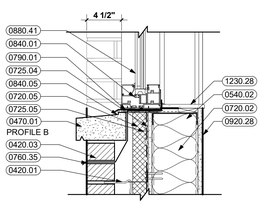
5 WINDOW JAMB
1 1/2" = 1'-0"



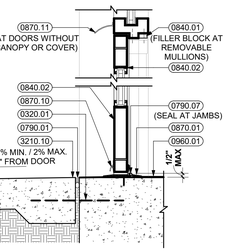
11 WINDOW JAMB
1" = 1'-0"



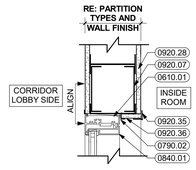
10 WINDOW SILL
1 1/2" = 1'-0"



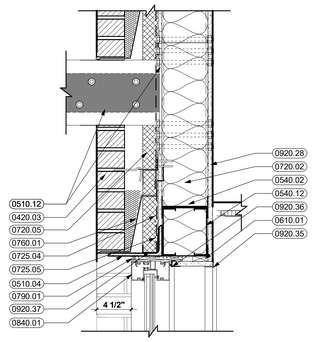
9 WINDOW SILL
1 1/2" = 1'-0"



16 STOREFRONT DETAIL
1 1/2" = 1'-0"



15 INT. WINDOW HEAD
1 1/2" = 1'-0"



14 WINDOW HEAD
1 1/2" = 1'-0"

GLAZING LEGEND

PATTERN	DESCRIPTION
	CLEAR GLAZING
	TEMPERED GLAZING
	LAMINATED GLAZING
	PATTERNED GLAZING
	SPANDREL GLAZING

KEYNOTES

0320.01	DOWEL INTO CONCRETE SLAB
0420.01	ADJUSTABLE MASONRY WALL TIES AT 16" O.C.E.W.
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.03	FACE BRICK
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0470.01	CAST STONE
0510.04	STEEL ANGLE (RE: STRUCTURAL)
0510.12	STEEL PLATE (RE: STRUCTURAL)
0540.01	COLD-FORMED METAL FRAMING
0540.02	6" METAL STUDS (C.F.M.F.) AT 16" O.C. MAXIMUM
0540.12	COLD-FORMED METAL HEADER
0550.62	1.5" VERTICAL FURRING CHANNEL @ 16" O.C.
0550.63	2" HORIZONTAL Z-CHANNEL @ 16" O.C.
0610.01	SHIM AS REQUIRED
0610.02	1X WOOD BLOCKING
0720.02	6 1/4" BATT INSULATION
0720.05	2" CONTINUOUS INSULATION
0725.04	FLUID-APPLIED MEMBRANE AIR BARRIER SYSTEM
0725.05	SELF-ADHERING DETAIL TRANSITION MEMBRANE
0740.02	PREFINISHED METAL WALL PANEL SYSTEM
0740.04	PREFINISHED METAL PANEL TRIM
0740.18	FIBER REINFORCED CEMENTITIOUS WALL PANEL
0760.01	THROUGH-WALL FLASHING WITH WEEPS AT 2'-0" O.C. AND MORTAR NET
0760.34	PREFORMED PREFINISHED METAL FLASHING WITH ALL SEAMS WELDED WATERTIGHT
0760.35	PREFINISHED METAL THROUGH WALL FLASHING WITH HEMMED DRIP EDGE
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0790.02	CAULKING
0790.07	SET IN BED OF SEALANT
0840.01	ALUMINUM STOREFRONT
0840.02	ALUMINUM STOREFRONT DOOR
0840.05	CONTINUOUS ALUMINUM SILL PAN FLASHING WITH BACK AND END DAMS
0870.01	METAL THRESHOLD. SET IN BED OF SEALANT
0870.10	DOOR BOTTOM WITH DRIP SKIRT
0870.11	DRIP CAP
0880.01	GLASS TYPE MG#1A (MONOLITHIC CLEAR, ANNEALED)
0880.03	GLASS TYPE MG#1C (MONOLITHIC CLEAR, FULLY TEMPERED)
0880.08	GLASS TYPE MG#4 (MONOLITHIC, TINTED, FULLY TEMPERED)
0880.41	GLASS TYPE IG#7 (INSULATED TINTED, LOW-E)
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.10	7/8" FURRING CHANNELS AT 16" O.C.
0920.27	1/2" EXTERIOR GYPSUM SHEATHING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.35	CORNER BEAD, TYPICAL
0920.36	J-MOULD, TYPICAL
0920.37	2" J-SHAPE TRACK
0960.01	FLOORING AS SCHEDULED
1220.06	MANUAL WINDOW SHADE
1230.28	QUARTZ WINDOW SILL
3210.10	CONCRETE CURB RAMP PER CITY REQUIREMENTS

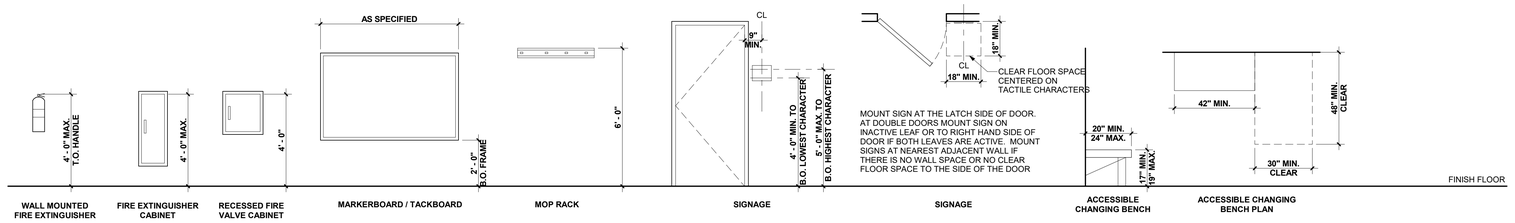
BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

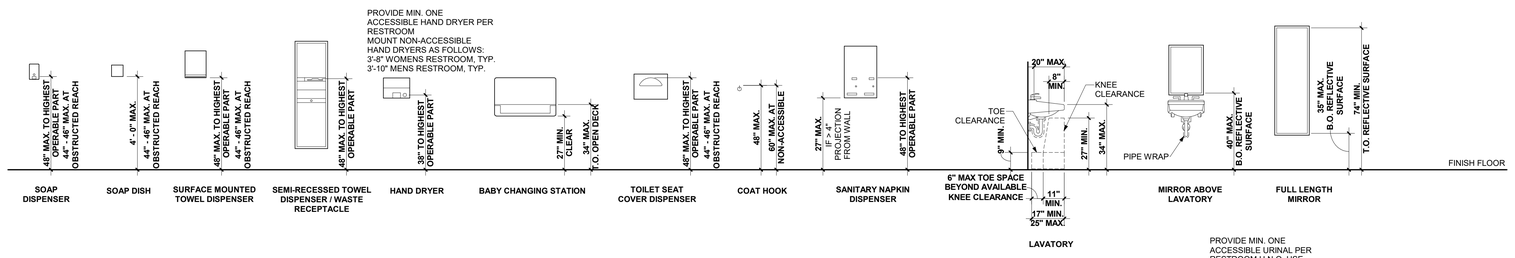
DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR, ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

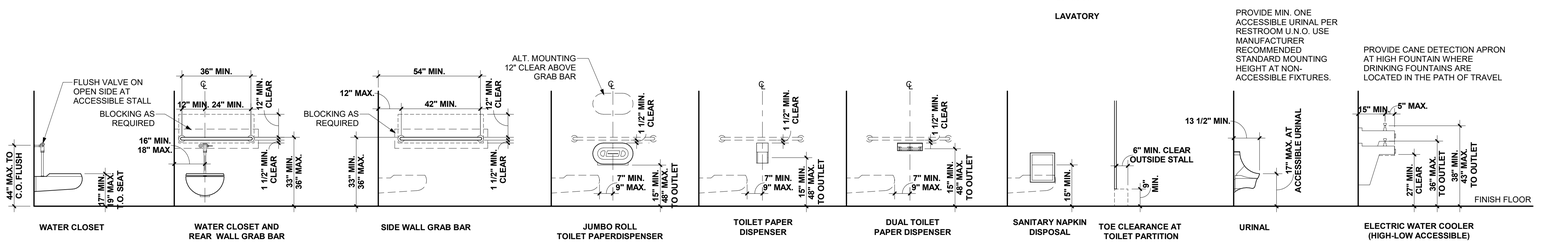
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

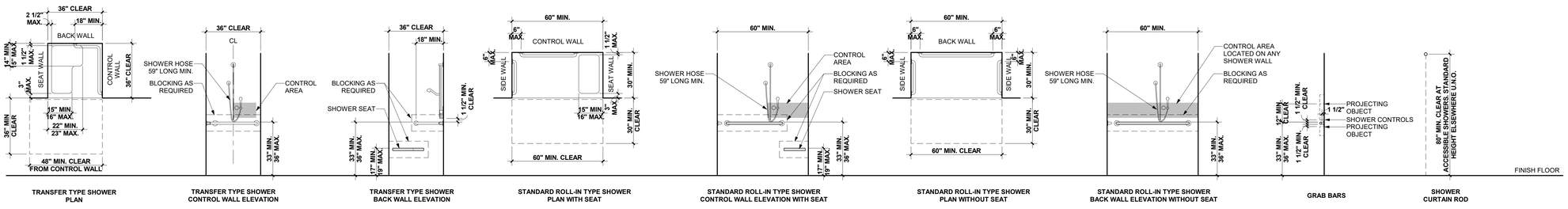
NO.	REVISION	DATE

A4.2
STOREFRONT AND CURTAINWALL TYPES





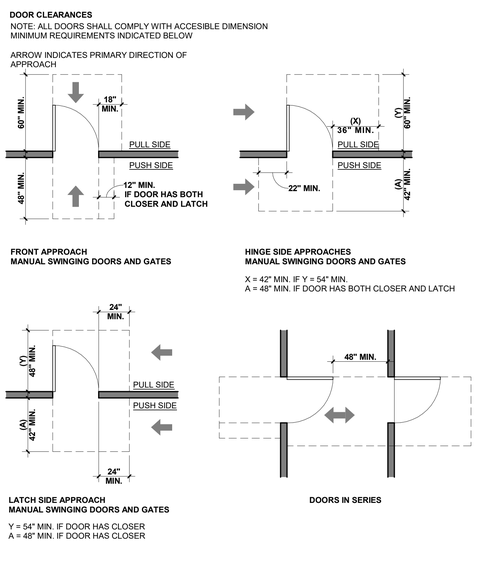


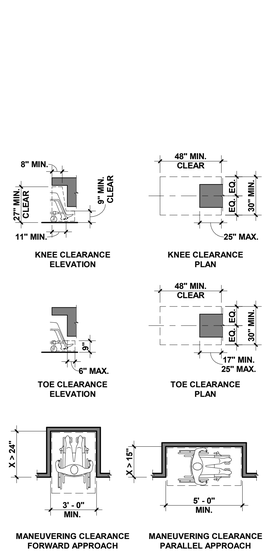


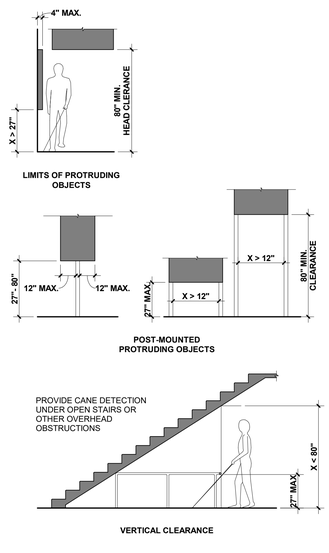
1 TYPICAL ACCESSIBLE MOUNTING HEIGHTS

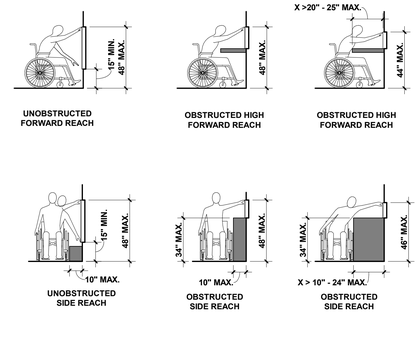
N.T.S.

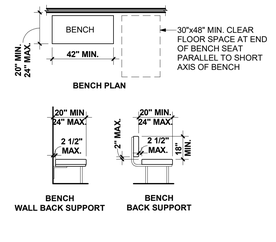
NOTE: NOT ALL CONDITIONS ABOVE MAY BE REQUIRED IN THE PROJECT











2 TYPICAL ACCESSIBILTY REQUIREMENTS

N.T.S.

NOTE: NOT ALL CONDITIONS ABOVE MAY BE REQUIRED IN THE PROJECT

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 150
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

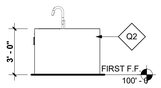
REGISTERED ARCHITECT RAYNE HOLLIDAY 6837 STATE OF TEXAS
10/24/2024

DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR, ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

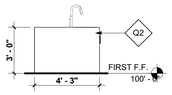
NO.	REVISION	DATE

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

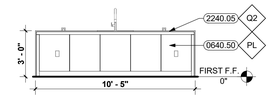
A5.0
TYPICAL ACCESSIBILITY DETAILS



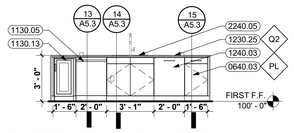
6 INTERIOR ELEVATION
1/4" = 1'-0"



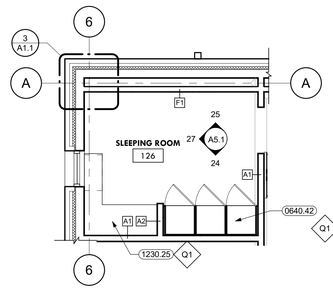
7 INTERIOR ELEVATION
1/4" = 1'-0"



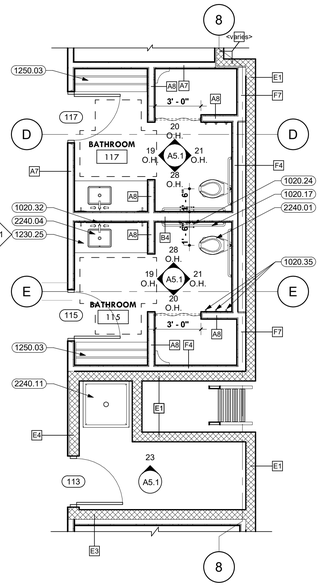
8 INTERIOR ELEVATION
1/4" = 1'-0"



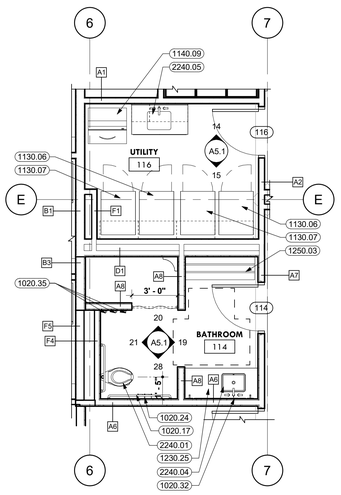
9 INTERIOR ELEVATION
1/4" = 1'-0"



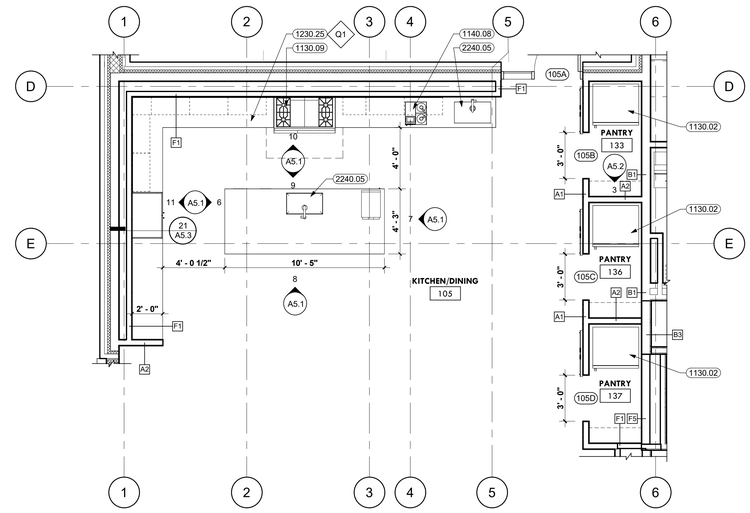
5 ENLARGED PLAN
1/4" = 1'-0"



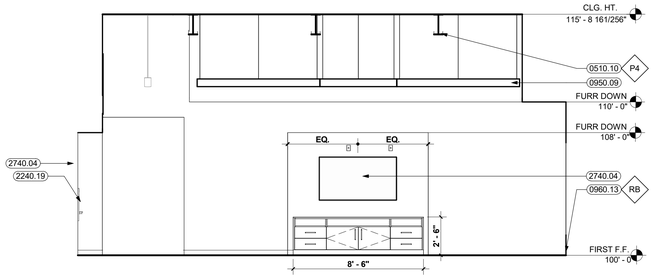
4 ENLARGED PLAN
1/4" = 1'-0"



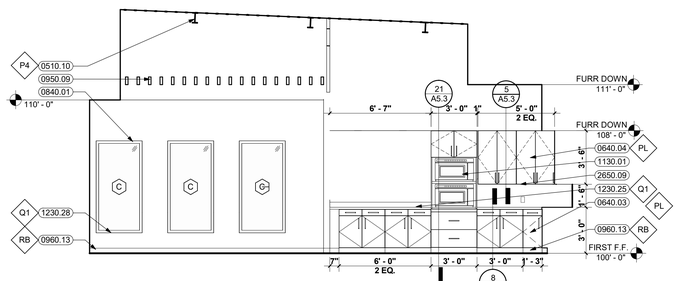
3 ENLARGED PLAN
1/4" = 1'-0"



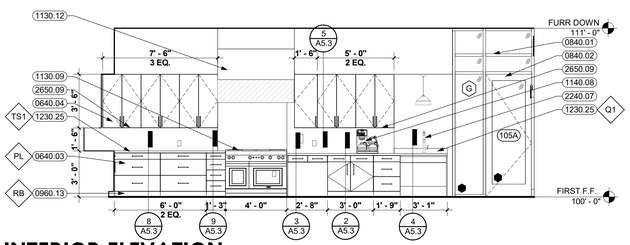
1 ENLARGED PLAN
1/4" = 1'-0"



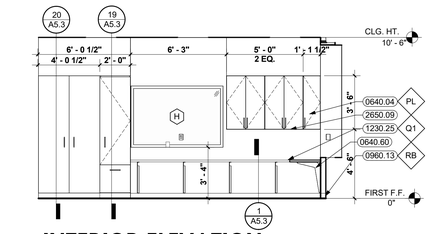
12 INTERIOR ELEVATION
1/4" = 1'-0"



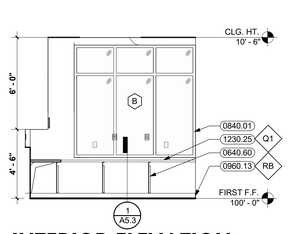
11 INTERIOR ELEVATION
1/4" = 1'-0"



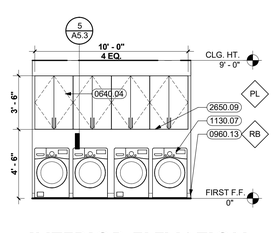
10 INTERIOR ELEVATION
1/4" = 1'-0"



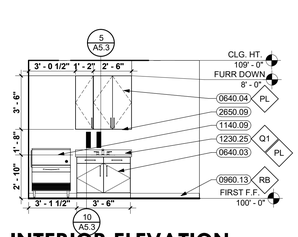
17 INTERIOR ELEVATION
1/4" = 1'-0"



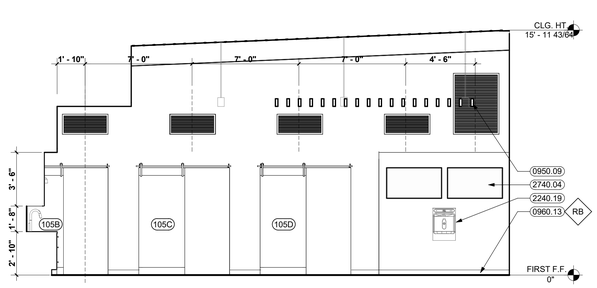
16 INTERIOR ELEVATION
1/4" = 1'-0"



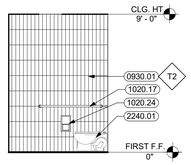
15 INTERIOR ELEVATION
1/4" = 1'-0"



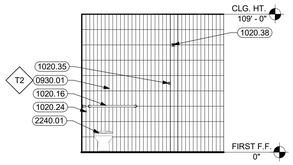
14 INTERIOR ELEVATION
1/4" = 1'-0"



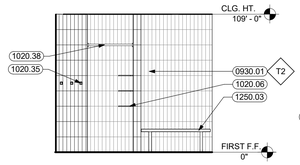
13 INTERIOR ELEVATION
1/4" = 1'-0"



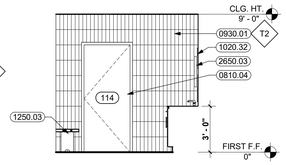
22 INTERIOR ELEVATION
1/4" = 1'-0"



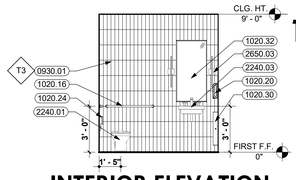
21 INTERIOR ELEVATION
1/4" = 1'-0"



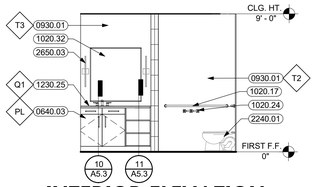
20 INTERIOR ELEVATION
1/4" = 1'-0"



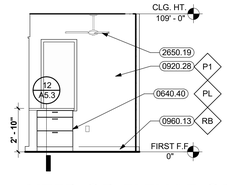
19 INTERIOR ELEVATION
1/4" = 1'-0"



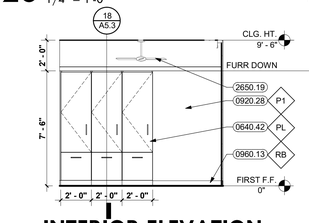
18 INTERIOR ELEVATION
1/4" = 1'-0"



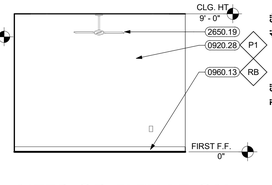
28 INTERIOR ELEVATION
1/4" = 1'-0"



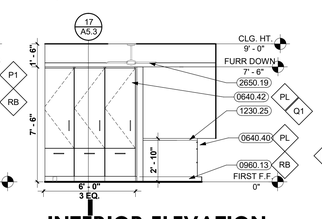
27 INTERIOR ELEVATION
1/4" = 1'-0"



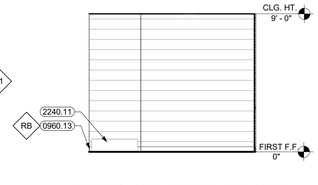
26 INTERIOR ELEVATION
1/4" = 1'-0"



25 INTERIOR ELEVATION
1/4" = 1'-0"



24 INTERIOR ELEVATION
1/4" = 1'-0"



23 INTERIOR ELEVATION
1/4" = 1'-0"

KEYNOTES

0510.10	STEEL BEAM (RE: STRUCTURAL)
0640.03	PLASTIC LAMINATE CLAD BASE CABINETS WITH ADJUSTABLE SHELVES
0640.04	PLASTIC LAMINATE CLAD WALL CABINETS WITH ADJUSTABLE SHELVES
0640.40	PLASTIC LAMINATE CLAD DESK
0640.42	PLASTIC LAMINATE CLAD WARDROBE
0640.50	PLASTIC LAMINATE CLAD END PANEL
0640.60	1/4" RUBBER MAT AT PULL OUT TRASH / RECYCLING DRAWER
0810.04	HOLLOW METAL DOOR AND FRAME
0840.01	ALUMINUM STOREFRONT
0840.02	ALUMINUM STOREFRONT DOOR
0920.28	5/8" GYPSUM BOARD (TYPE X)
0930.01	CERAMIC TILE
0950.09	SUSPENDED ACOUSTICAL BAFFLE CEILING SYSTEM
0960.13	4" RESILIENT BASE
1020.06	WALL MOUNTED SHOWER SHELF
1020.16	STAINLESS STEEL 1 1/2" DIAMETER GRAB BAR (36" LONG)
1020.17	STAINLESS STEEL 1 1/2" DIAMETER GRAB BAR (42" LONG)
1020.20	SOAP DISPENSER (SURFACE-MOUNTED)
1020.24	STAINLESS STEEL SURFACE MOUNTED TOILET PAPER DISPENSER
1020.30	STAINLESS STEEL SEMI-RECESSED PAPER TOWEL DISPENSER / TRASH RECEPTACLE
1020.32	STAINLESS STEEL FRAMED MIRROR
1020.35	ROBE / TOWEL HOOK
1020.38	STAINLESS STEEL SHOWER CURTAIN ROD WITH VINYL CURTAIN AND HOOKS
1130.01	MICROWAVE
1130.02	REFRIGERATOR
1130.05	DISHWASHER
1130.06	WASHING MACHINE
1130.07	CLOTHES DRYER
1130.09	GAS RANGE
1130.12	RANGE HOOD
1130.13	UNDER-COUNTER ICE MAKER
1140.08	COMMERCIAL COFFEE MAKER
1140.09	ICE MACHINE
1230.25	QUARTZ SURFACE COUNTERTOP WITH SPLASH AS SHOWN
1230.28	QUARTZ WINDOW SILL
1240.03	TRASH OR RECYCLING RECEPTACLE
1250.03	BENCH
2240.01	WATER CLOSET. ORIENT FLUSH VALVE TOWARDS ACCESSIBLE SPACE AT ACCESSIBLE STALLS / RESTROOMS
2240.03	WALL-HUNG LAVATORY WITH CARRIER
2240.04	PORCELAIN LAVATORY
2240.05	STAINLESS STEEL UNDERMOUNT SINK
2240.07	SINK FITTINGS
2240.11	MOP SINK
2240.19	WATER FOUNTAIN
2650.03	SURFACE-MOUNTED LIGHT FIXTURE
2650.09	UNDER / OVER CABINET LIGHT
2650.19	CEILING FAN
2740.04	TELEVISION OR MONITOR

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 200
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

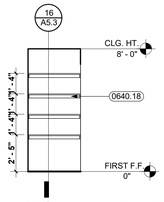
DATE 10/24/2024
DRAWN BY PRIMARY DRAWER, PA/PC
CHECKED BY PM/DIR. ARCH. OF RECORD
BRW PROJECT NUMBER 223102.00

NO.	REVISION	DATE

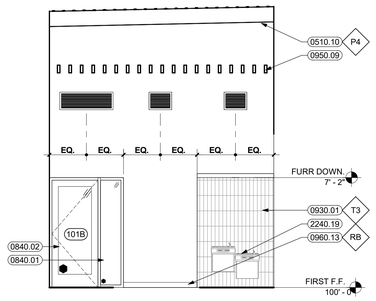
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

A5.1

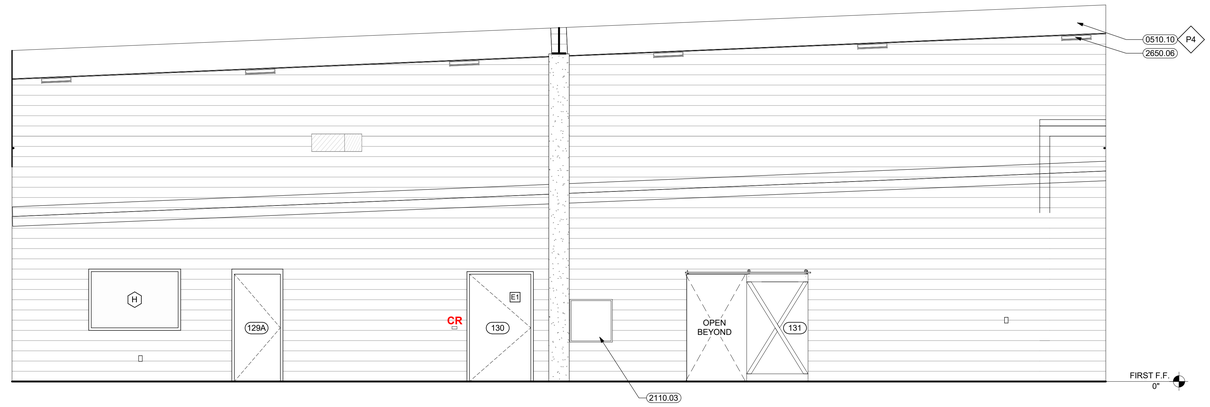
ENLARGED PLANS AND INTERIOR ELEVATIONS



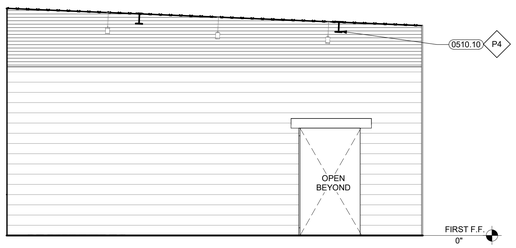
3 INTERIOR ELEVATION
1/4" = 1'-0"



2 INTERIOR ELEVATION
1/4" = 1'-0"

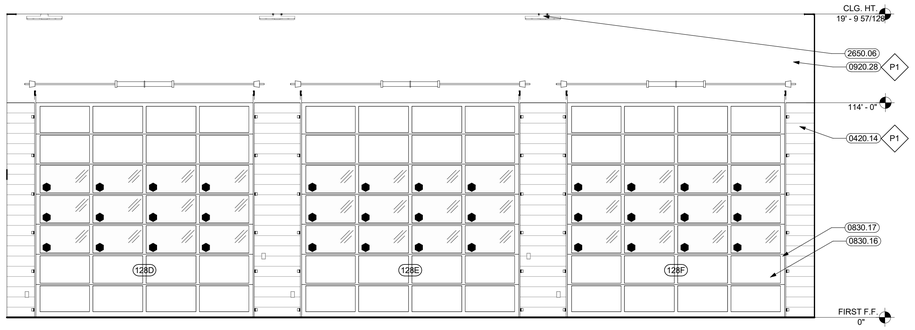


1 INTERIOR ELEVATION
1/4" = 1'-0"

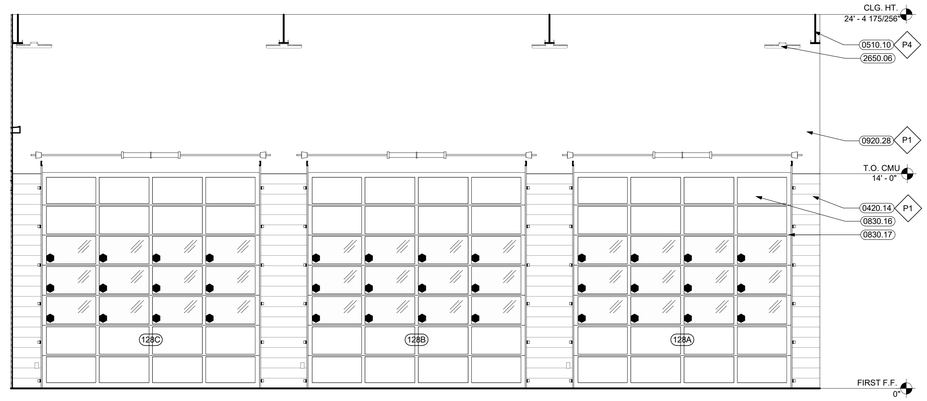


5 INTERIOR ELEVATION
1/4" = 1'-0"

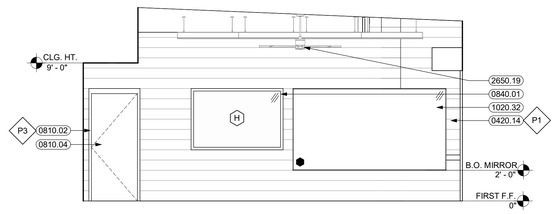
4 INTERIOR ELEVATION
1/4" = 1'-0"



7 INTERIOR ELEVATION
1/4" = 1'-0"



6 INTERIOR ELEVATION
1/4" = 1'-0"



8 INTERIOR ELEVATION
1/4" = 1'-0"

KEYNOTES

0420.14	8" CONCRETE MASONRY UNITS
0510.10	STEEL BEAM (RE: STRUCTURAL)
0550.33	METAL LADDER
0640.18	ADJUSTABLE SHELVING
0810.02	HOLLOW METAL FRAME
0810.04	HOLLOW METAL DOOR AND FRAME
0830.16	SECTIONAL DOOR PREFINISHED METAL INFILL PANEL
0830.17	UPWARD ACTING SECTIONAL DOOR
0840.01	ALUMINUM STOREFRONT
0840.02	ALUMINUM STOREFRONT DOOR
0920.28	5/8" GYPSUM BOARD (TYPE X)
0930.01	CERAMIC TILE
0950.09	SUSPENDED ACOUSTICAL BAFFLE CEILING SYSTEM
0960.13	4" RESILIENT BASE
1020.32	STAINLESS STEEL FRAMED MIRROR
2110.03	FIRE HOSE VALVE IN SEMI-RECESSED CABINET
2240.19	WATER FOUNTAIN
2650.06	HIGH-BAY LIGHT FIXTURE
2650.19	CEILING FAN

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 150
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR. ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

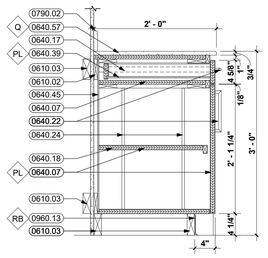
BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

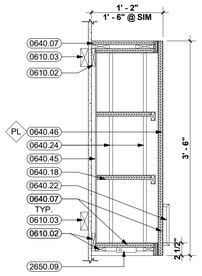
A5.2
INTERIOR ELEVATIONS

KEYNOTES

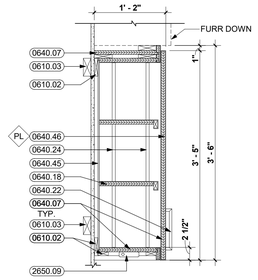
0610.02	1X WOOD BLOCKING
0610.03	2X WOOD BLOCKING
0610.09	2 X 4 WOOD STUDS AT 16" O.C.
0640.07	3/4" PLYWOOD
0640.15	CABINET CAM LOCK
0640.17	DRAWER GLIDE
0640.18	ADJUSTABLE SHELVING
0640.21	WIRE GROMMET
0640.22	CABINET PULLS
0640.24	ADJUSTABLE METAL SHELF STANDARDS. PROVIDE BLOCKING IN WALL AS REQUIRED
0640.38	1/2" PLASTIC LAMINATE CLAD PLYWOOD
0640.39	3/4" PLASTIC LAMINATE CLAD PLYWOOD DRAWER WITH 1/4" HARDWOOD BOTTOM
0640.44	3/4" PLASTIC LAMINATE CLAD PLYWOOD REMOVABLE ACCESS PANEL
0640.45	1/4" HARDWOOD CABINET BACK
0640.46	3/4" PLASTIC LAMINATE CLAD PLYWOOD CABINET DOOR
0640.48	HEAVY DUTY COAT ROD
0640.50	PLASTIC LAMINATE CLAD END PANEL
0640.55	1/4" PLASTIC LAMINATE CLAD CABINET BACK
0640.57	3/4" HARDWOOD VENEER PLYWOOD TOE KICK
0640.59	CONCEALED COUNTERTOP BRACKET WITH IN-WALL CONFIGURATION HARDWARE. PROVIDE BLOCKING IN WALL AS REQUIRED
0640.65	METAL WORK SURFACE SUPPORT
0790.02	CAULKING
0920.28	5/8" GYPSUM BOARD (TYPE X)
0960.03	METAL TRANSITION TRIM
0960.13	4" RESILIENT BASE
1020.34	VINYL-COATED PIPING WRAP
1130.01	MICROWAVE
1130.05	DISHWASHER
1130.11	FOOD DISPOSAL
1250.11	MURPHY BED
2240.04	PORCELAIN LAVATORY
2240.05	STAINLESS STEEL UNDERMOUNT SINK
2620.04	ELECTRICAL OUTLET
2650.09	UNDER / OVER CABINET LIGHT



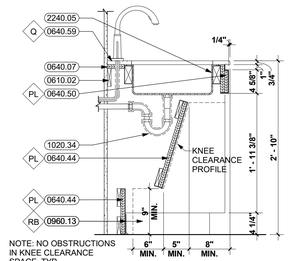
7 MILLWORK DETAIL
1" = 1'-0"



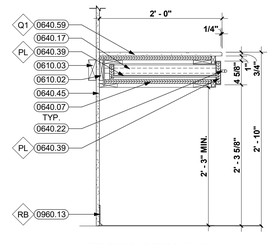
6 MILLWORK DETAIL
1" = 1'-0"



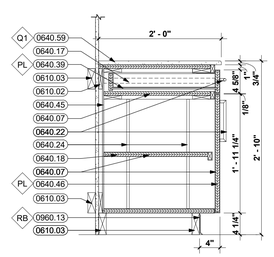
5 MILLWORK DETAIL
1" = 1'-0"



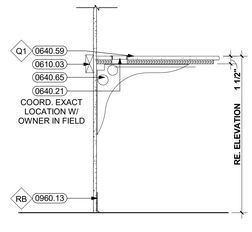
4 MILLWORK DETAIL
1" = 1'-0"



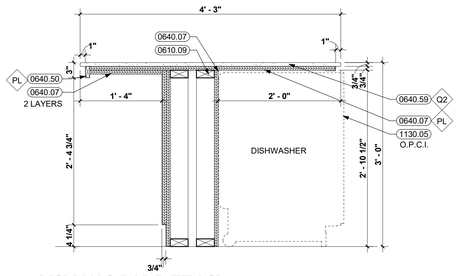
3 MILLWORK DETAIL
1" = 1'-0"



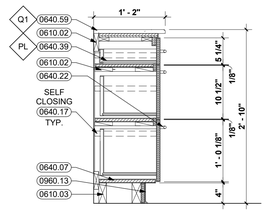
2 MILLWORK DETAIL
1" = 1'-0"



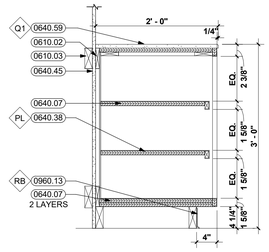
1 MILLWORK DETAIL
1" = 1'-0"



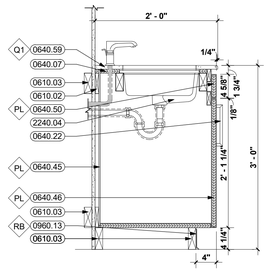
13 MILLWORK DETAIL
1" = 1'-0"



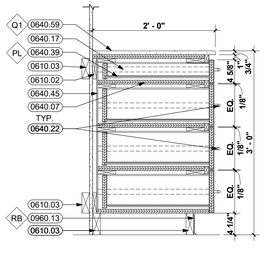
12 MILLWORK DETAIL
1" = 1'-0"



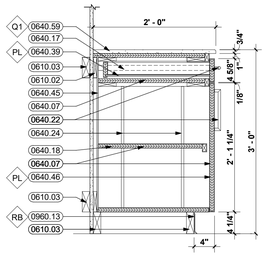
11 MILLWORK DETAIL
1" = 1'-0"



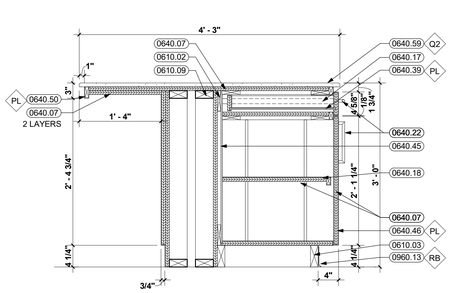
10 MILLWORK DETAIL
1" = 1'-0"



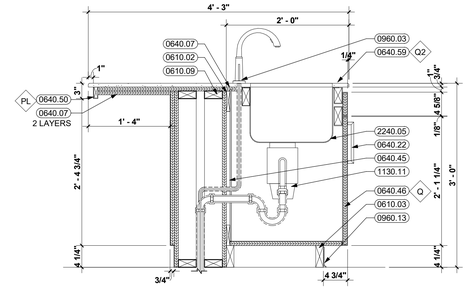
9 MILLWORK DETAIL
1" = 1'-0"



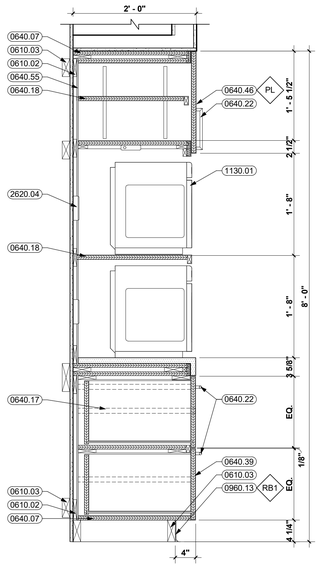
8 MILLWORK DETAIL
1" = 1'-0"



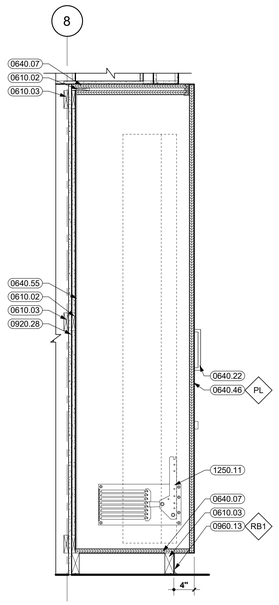
15 MILLWORK DETAIL
1" = 1'-0"



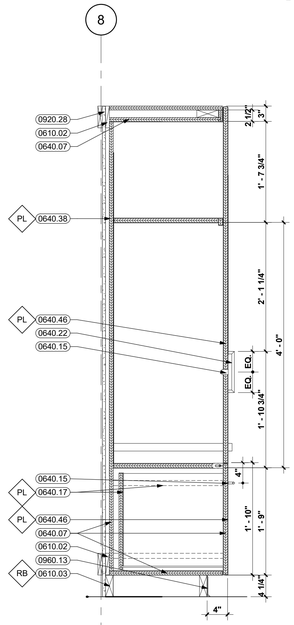
14 MILLWORK DETAIL
1" = 1'-0"



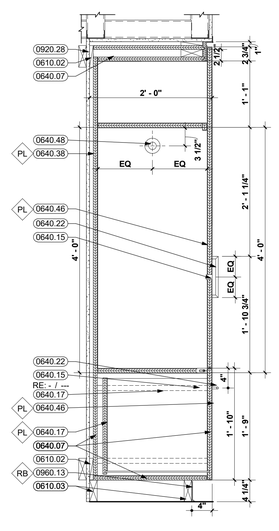
21 MILLWORK DETAIL
1" = 1'-0"



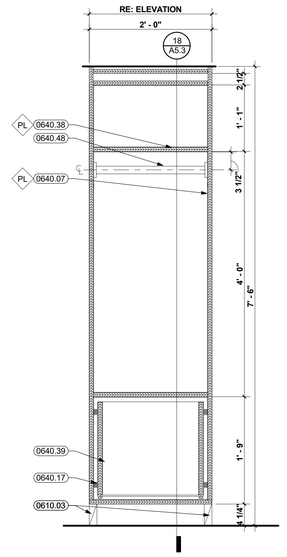
20 MILLWORK DETAIL
1" = 1'-0"



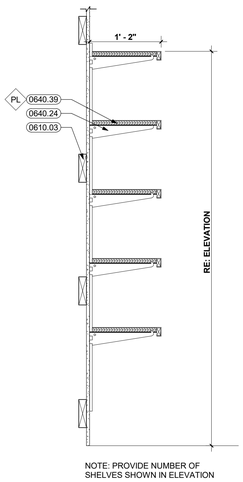
19 MILLWORK DETAIL
1" = 1'-0"



18 MILLWORK DETAIL
1" = 1'-0"



17 MILLWORK DETAIL
1" = 1'-0"



NOTE: PROVIDE NUMBER OF SHELVES SHOWN IN ELEVATION

16 MILLWORK DETAIL
1" = 1'-0"

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	PRIMARY DRAWER, PA/PC
CHECKED BY	PM/DIR. ARCH. OF RECORD
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

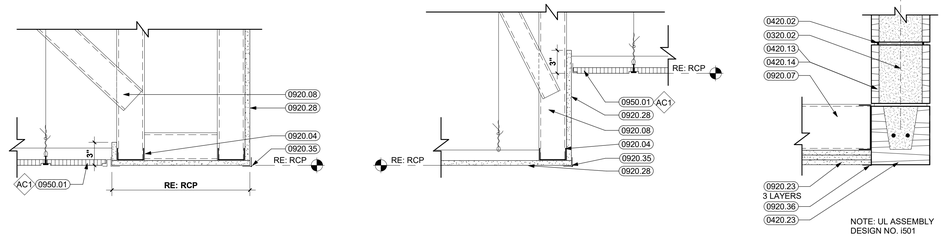
NO.	REVISION	DATE

A5.3

MILLWORK SECTIONS

2 SECOND FLOOR REFLECTED CEILING PLAN
1/8" = 1'-0"

1 FIRST FLOOR REFLECTED CEILING PLAN
1/8" = 1'-0"



KEYNOTES

0320.02	STEEL REINFORCING (RE: CIVIL)
0420.02	CONCRETE MASONRY UNIT HORIZONTAL REINFORCING
0420.13	6" CONCRETE MASONRY UNITS
0420.14	8" CONCRETE MASONRY UNITS
0420.23	CONCRETE MASONRY BOND BEAM
0830.02	WALL ACCESS PANEL
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.07	6" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.08	STUD BRACE AT 4'-0" O.C. MAX.
0920.23	5/8" MOLD AND MOISTURE RESISTANT GYPSUM BOARD
0920.28	5/8" GYPSUM BOARD (TYPE X)
0920.35	CORNER BEAD, TYPICAL
0920.36	J-MOULD, TYPICAL
0950.01	SUSPENDED ACOUSTICAL LAY-IN TILE CEILING
1220.06	MANUAL WINDOW SHADE

RCP LEGEND

PATTERN	DESCRIPTION
	CEILINGS
	AC ACOUSTICAL CEILING
	AC1 ACOUSTICAL CEILING TILE 24" X 24" SUSPENDED COLOR: WHITE
	AC2 ACOUSTICAL CEILING TILE 24" X 24" SUSPENDED VINYL-FACED COLOR: WHITE
	AC3 ACOUSTICAL CEILING TILE 24" X 24" SUSPENDED TEGULAR COLOR: WHITE
	AC4 ACOUSTICAL CEILING TILE 24" X 24" SUSPENDED TEGULAR COLOR: WHITE
	AC5 ACOUSTICAL CEILING TILE, 24" X 96" SUSPENDED PLANK COLOR: WHITE
	AC6 ACOUSTICAL BAFFLE PANELS SUSPENDED CEILING PANEL SIZE AS INDICATED IN DRAWINGS
	AC7 WOOD PANEL CEILING SYSTEM STAIN: TO BE SELECTED BY ARCHITECT
	GYPSUM BOARD ON METAL SUPPORT SYSTEM REF: FINISH PLAN FOR FINISH
	CEILING FIXTURES AND EQUIPMENT RE: ELECTRICAL LIGHT FIXTURE SCHEDULE
	ILLUMINATED EXIT SIGN RE: ELECTRICAL
	SUPPLY AIR REGISTER RE: MECHANICAL
	RETURN AIR GRILLE RE: MECHANICAL
	CEILING FAN
	65" CEILING FAN
	RECESSED DOWNLIGHT
	2' X 2' FIXTURE
	2' X 4' FIXTURE
	LINEAR RECESSED FIXTURE
	SUSPENDED CYLINDER DOWNLIGHT
	PENDANT LIGHT FIXTURE
	UNDER-CABINET LIGHTING
	HIGH-BAY LIGHT FIXTURE
	SUSPENDED LIGHT FIXTURE

BRW ARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE	10/24/2024
DRAWN BY	LT, SF, SP
CHECKED BY	JD, RH, MW
BRW PROJECT NUMBER	223102.00

NO.	REVISION	DATE

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

A6.1
REFLECTED CEILING PLANS

KEYNOTES

0330.02	CONCRETE SLAB
0360.02	CEMENT GROUT
0720.12	CONTINUOUS ADHESIVE BASE COAT
0790.01	SEALANT WITH BACKER ROD AS REQUIRED
0920.04	3 5/8" METAL STUDS (20 GAUGE MINIMUM) AT 16" O.C.
0920.05	4" METAL STUDS AT 16" O.C.
0920.23	5/8" MOLD AND MOISTURE RESISTANT GYPSUM BOARD
0920.26	5/8" CEMENTITIOUS BACKER BOARD
0920.28	5/8" GYPSUM BOARD (TYPE X)
0930.01	CERAMIC TILE
0930.07	TILE WATERPROOFING MEMBRANE
0930.10	METAL TILE TRIM
0930.11	LINEAR SLOT DRAIN (PROVIDE 1"-2" WIDER THAN OPEN SIDE OF SHOWER, AND WITH METAL TILE TRANSITIONS AT PERIMETER)
0930.12	PRE-FABRICATED SHOWER TRAY BASE
0960.01	FLOORING AS SCHEDULED
0960.03	METAL TRANSITION TRIM
0960.13	4" RESILIENT BASE
0970.02	WALL FINISH AS SCHEDULED
1020.13	CORNER GUARD
2210.06	FLOOR DRAIN

FINISH LEGEND

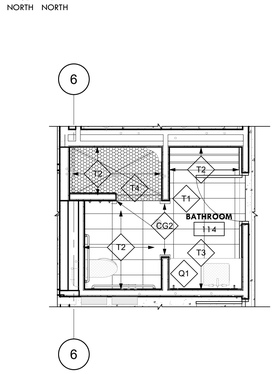
XX XX XX XX
- CEILING FINISH
- WALL FINISH
- BASE FINISH
- FLOOR FINISH

X → ACCENT FINISH KEY

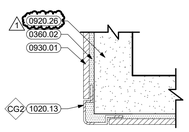
PATTERN	DESCRIPTION
	AC - **ACOUSTICAL CEILING** **AC1:** **ACOUSTICAL CEILING TILE** 24" X 24" SUSPENDED COLOR: WHITE **AC2:** **ACOUSTICAL BAFFLE PANELS** SOUNDPLY CELLA BAFFLES BA-LRL51. SIZE AS INDICATED IN DRAWINGS
	PC - **POLISHED CONCRETE** COLOR: TO BE SELECTED BY ARCHITECT
	SC - **SEALED CONCRETE** CLEAR CONCRETE SEALER
	P- **PAINT** **P1:** **WALLS** SHERWIN WILLIAMS SW7028, "INCREDIBLE WHITE" **P2:** **CEILING AND DECK** SHERWIN WILLIAMS SW7757, "HIGH REFLECTIVE WHITE" **P3** **HOLLOW METAL DOORS AND FRAMES** SHERWIN WILLIAMS SW 7069, "IRON ORE" **P4** **EXPOSED STEEL STRUCTURE AND MISC. METALS** SHERWIN WILLIAMS SW 7069, "IRON ORE"
	PL : **PLASTIC LAMINATE CLAD MILLWORK** WILSONART COLOR: 7965 WALNUT HEIGHTS FINISH:
	Q - **QUARTZ** **Q1:** **QUARTZ COUNTERTOP** WILSONART, QUARTZ COLOR: Q6023 FROZEN **Q2:** **QUARTZ ISLAND COUNTERTOP** WILSONART, QUARTZ COLOR: Q4068 NOVA SERRANA
	RB - **RESILIENT BASE** ROPPE, 4" VINYL WALL BASE COLOR: 695 CALLA LILY
	RF - **RESILIENT ATHLETIC FLOORING** RUBBER FLOORING ROPPE, TUFLEX SPARTUS COLOR: 977 NATURAL
	T - **TILE** **T1:** **BATHROOM FLOOR TILE** PLATFORM SURFACES VENEZIANO 12" X 24" COLOR: CLOUD INSTALLATION PATTERN AS INDICATED IN DRAWINGS
	T2: **WALL TILE** ANATOLIA TERRAMODA 3" X 12" COLOR: STONE
	T3: **WALL TILE ACCENT** ANATOLIA GEOMETRA, MAZE 3" X 12" COLOR: EMERALD
	T4 **FLOOR ACCENT TILE - SHOWER** ANATOLIA SOHO, HEXAGON MOSAIC 2" COLOR: CEMENT CHIC, MATTE GLAZED
	TS - **CERAMIC TILE** **TS1:** **METAL TRANSITION (TILE / PC)** SCHLUTER RENO-RAMP COLOR: ALUMINUM
	WP - **WALL PROTECTION** **CG1:** **CORNER GUARDS** FULL WALL HEIGHT STAINLESS STEEL **CG2:** **CORNER GUARD** - - - -
	WT - **WINDOW TREATMENT** **WT2** **MANUAL ROLLER SHADES** COLOR: TO BE SELECTED BY ARCHITECT

1 FIRST FLOOR FINISH PLAN
1/8" = 1'-0"

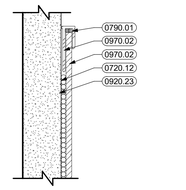
2 SECOND FLOOR FINISH PLAN
1/8" = 1'-0"



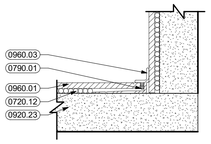
11 ENLARGED PLAN
1/4" = 1'-0"



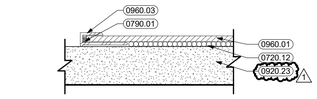
6 TILE TRIM DETAIL
12" = 1'-0"



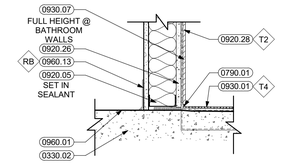
10 FRP TRIM DETAIL
12" = 1'-0"



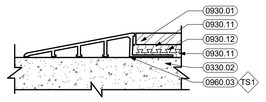
9 FRP TRIM DETAIL
12" = 1'-0"



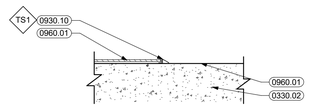
5 FRP TRIM DETAIL
12" = 1'-0"



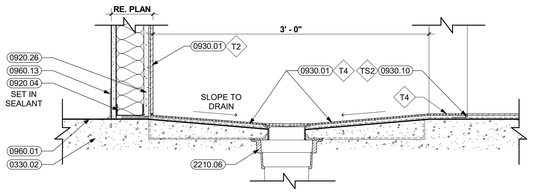
8 TILE DETAIL
1 1/2" = 1'-0"



4 TILE TRANSITION DETAIL
6" = 1'-0"



3 TYP. TRANSITION DETAIL
1 1/2" = 1'-0"



7 TILE DETAIL
1 1/2" = 1'-0"

FINISH NOTES

1. PROVIDE FLOOR LEVELING COMPOUND UNDER FINISH FLOORING AS REQUIRED TO PROVIDE LEVEL AND CONSISTENT SURFACE.
2. PROVIDE CONTROL JOINTS AT CONCRETE SLAB, AS REQUIRED PER SPECIFICATIONS AND AS SHOWN ON FINISH PLAN.
3. PROVIDE TRANSITION STRIPS BETWEEN FINISH MATERIALS AS INDICATED IN TYPICAL DETAILS.
4. LINE OF TRANSITION FROM POLISHED OR COLORED CONCRETE TO SEALED CONCRETE SHALL BE A STRAIGHT SAWCUT JOINT. LOCATE JOINTS AT DOORS SO THAT SEALED CONCRETE IS NOT VISIBLE FROM THE DIAMOND POLISHED CONCRETE SIDE OF DOOR, TYP.
5. WAX NEW AND EXISTING, AS APPLICABLE, RESILIENT FLOORS, WITHIN THE PROJECT AREA, U.N.O. REFERENCE SPECIFICATIONS FOR REQUIRED NUMBER OF COATS.
6. PROTECT FLOOR FINISHES DURING CONSTRUCTION PER SPECIFICATIONS.
7. PROVIDE FRP AT LOCATIONS INDICATED ON FINISH PLAN TO 48" A.F.F., U.N.O.
8. FIELD VERIFY EXISTING CONDITIONS PRIOR TO INSTALLATION OF FINISH MATERIALS. REPAIR, REFINISH, AND PREPARE AS APPLICABLE ALL EXISTING SURFACES TO RECEIVE NEW MATERIALS INCLUDING, BUT NOT LIMITED TO FLOORING, BASE, BUILDING PARTITIONS, FLOOR SLAB, CEILING, AND RELATED ITEMS U.N.O.
9. DO NOT PAINT EXPOSED MASONRY U.N.O.
10. ALL WALLS TO BE P1 U.N.O.
11. ALL GYPSUM BOARD CEILINGS TO BE P2 U.N.O.
12. ALL METAL DECK CEILINGS TO BE P2 U.N.O.
13. ALL MILLWORK CABINETS TO BE PL1 U.N.O.
14. ALL COUNTERTOPS TO BE Q1, EXCEPT FOR KITCHEN ISLAND. KITCHEN ISLAND TO BE Q2.
15. ALL WOOD DOORS TO BE PL U.N.O.

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 150
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

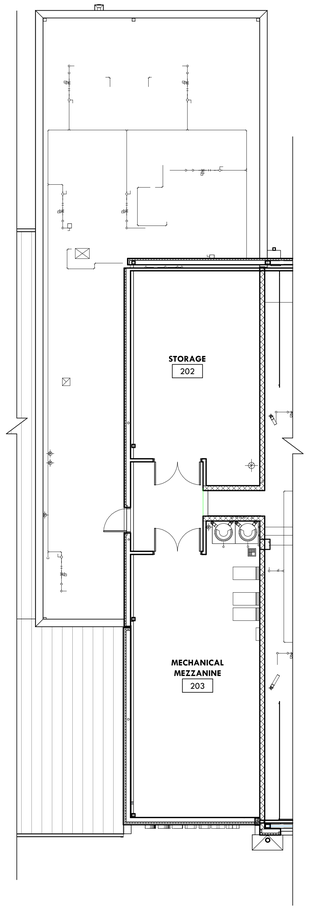
DATE	10/24/2024
DRAWN BY	LG, SF, LT,
CHECKED BY	JD, RH, MW
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE
1	REVISION NO. 01	MM/DD/YY YY

A7.1
FINISH PLANS

KEYNOTES



2 SECOND FLOOR FURNISHING PLAN

TRUE NORTH PLAN NORTH

1/8" = 1'-0"

1 FIRST FLOOR FURNISHING PLAN

TRUE NORTH PLAN NORTH

1/8" = 1'-0"

FURNITURE SCHEDULE

Room: Name	Type Mark	Description	Type Comments	Count
101				
LOBBY	F1	BENCH SEAT	OWNER PROVIDED OWNER INSTALLED	1
104				
DAYROOM	F6	RECLINER	OWNER PROVIDED OWNER INSTALLED	9
DAYROOM	F8	END TABLE (DAYROOM)	OWNER PROVIDED OWNER INSTALLED	5
105				
KITCHEN/DINING	F4	KITCHEN STOOL	OWNER PROVIDED OWNER INSTALLED	3
KITCHEN/DINING	F5	KITCHEN CHAIR	OWNER PROVIDED OWNER INSTALLED	8
KITCHEN/DINING	F9	DINING TABLE	OWNER PROVIDED OWNER INSTALLED	1
107				
LIEUTENANT'S OFFICE		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
108				
LT OFFICE	F2	OFFICE CHAIR	OWNER PROVIDED OWNER INSTALLED	1
LT OFFICE	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	2
LT OFFICE	F7	DESK	OWNER PROVIDED OWNER INSTALLED	1
109				
WATCH ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
WATCH ROOM	F2	OFFICE CHAIR	OWNER PROVIDED OWNER INSTALLED	4
WATCH ROOM	F4	ROLLING STORAGE CABINET	OWNER PROVIDED OWNER INSTALLED	3
118				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
120				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
121				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
122				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
124				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
125				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
126				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1
127				
SLEEPING ROOM		BED (SLEEPING ROOM)	OWNER PROVIDED OWNER INSTALLED	1
SLEEPING ROOM	F3	GUEST CHAIR	OWNER PROVIDED OWNER INSTALLED	1

EQUIPMENT SCHEDULE

TYPE MARK	DESCRIPTION	MANUFACTURER	MODEL	TYPE COMMENTS	COUNT
E1	COFFEE MAKER			OWNER PROVIDED CONTRACTOR INSTALLED	1
E2	SCBA CASCADE SYSTEM				1
E3	SCBA FILL STATION				1
E4	EXTRACTOR		As Specified	OWNER PROVIDED CONTRACTOR INSTALLED	1
E5	FRONT LOAD DRYER				2
E6	FRONT LOAD WASHER				2
E7	SCBA COMPRESSOR			OWNER PROVIDED CONTRACTOR INSTALLED	1
E8	DUMBELL RACK (EXERCISE ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	2
E9	ADJUSTABLE BENCH (EXERCISE ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	1
E10	WEIGHT RACK (EXERCISE ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	1
E11	PRECORE TRM.731			OWNER PROVIDED CONTRACTOR INSTALLED	1
E12	STAIR CLIMBER (EXERCISE ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	1
E13	TELEVISION 70" (TRAINING ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	1
E14	TELEVISION 50" (EXERCISE ROOM)			OWNER PROVIDED CONTRACTOR INSTALLED	2

BRWARCHITECTS
175 CENTURY SQUARE DRIVE
SUITE 100
COLLEGE STATION, TEXAS 77840
979.694.1791
BRWARCH.COM

DATE 10/24/2024

DRAWN BY LG, SF, LT, SP

CHECKED BY JD, RH, MW

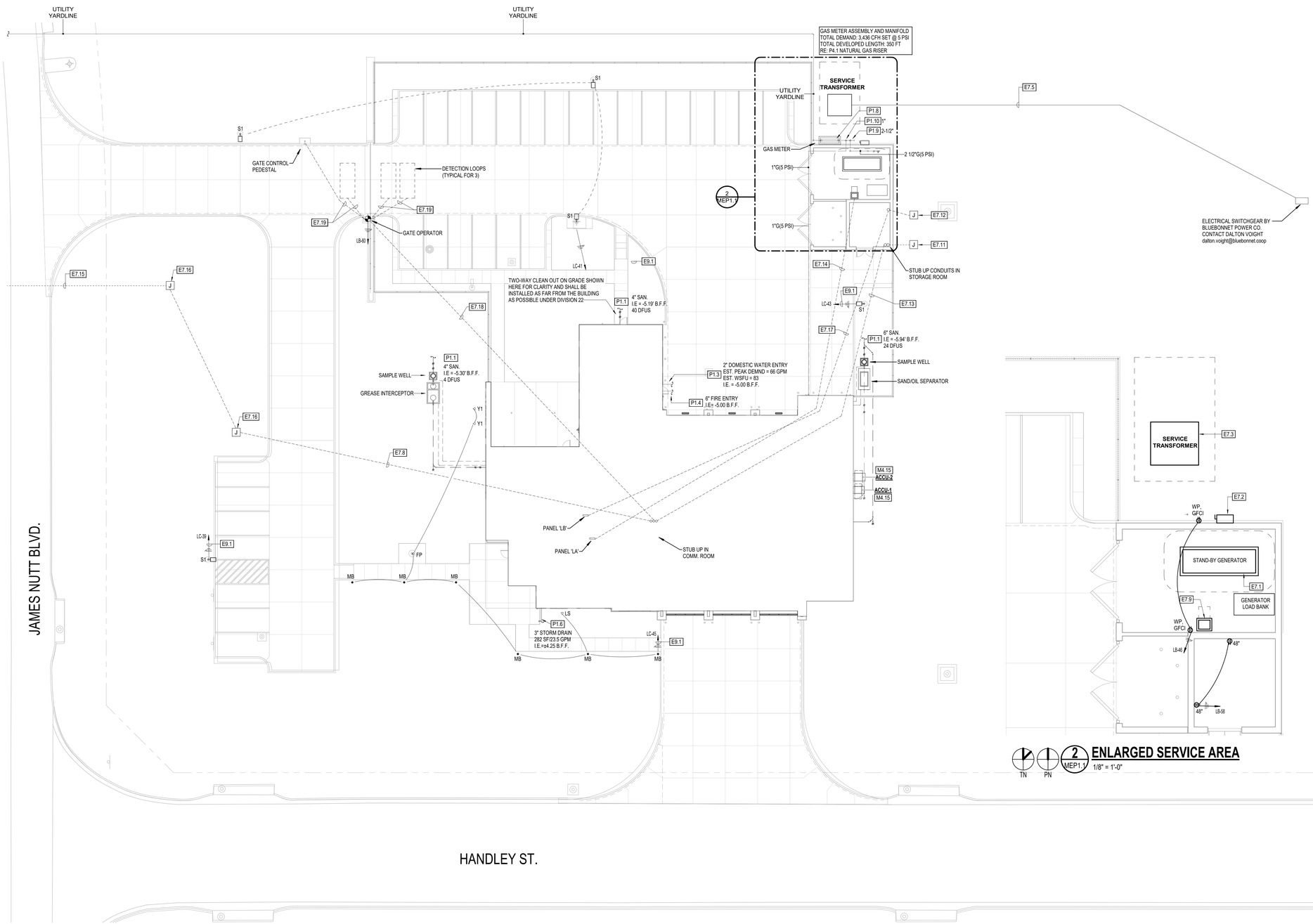
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

A9.1

FURNISHING PLANS (FOR INFORMATION ONLY)



TN PN 2 MEP1.1 **ENLARGED SERVICE AREA**
1/8" = 1'-0"

TN PN 1 MEP1.1 **MEP SITE PLAN**
1/16" = 1'-0"

GENERAL SITE ELECTRICAL NOTES:

A. COORDINATE LOCATION OF ALL UTILITIES WITH CIVIL PLANS AND ALL OTHER TRADES PRIOR TO ROUGH-IN OF ANY UNDERGROUND CONDUIT.

B. SEE DETAIL 7/E6.02 FOR ELECTRICAL PRIMARY DUCT BANK.

C. SEE DETAIL 8/E6.02 FOR ELECTRICAL SECONDARY DUCT BANK.

D. SEE DETAIL 6/E6.02 FOR ALL OTHER UNDERGROUND CONDUIT.

E. CONTRACTOR SHALL PROVIDE BURIED COPPER GROUND LOOP AROUND PERIMETER OF BUILDING. SEE GROUNDING DETAIL AND SPECIFICATIONS. PROVIDE GROUND TEST WELLS NO FURTHER THAN 100' APART.

F. CONTRACTOR SHALL PROVIDE LIGHTNING PROTECTION SYSTEM AROUND PERIMETER OF ROOF. SEE DETAILS AND SPECIFICATIONS.

G. PROVIDE MINIMUM 3'-0" SEPARATION BETWEEN LOW VOLTAGE CABLING CONDUIT AND 120V (OR HIGHER) VOLTAGE CONDUIT. 3'-0" DIMENSION SHALL APPLY IN ALL DIRECTIONS.

H. PROVIDE LONG SWEEP BEND IN ALL UNDERGROUND CONDUIT ELBOWS.

ELECTRICAL KEYED NOTES

E7.1 LOCATION OF GENERATOR. GENERATOR EXHAUST SHALL BE DIRECTED AWAY FROM BUILDING.

E7.2 LOCATION FOR SERVICE ENTRANCE DISCONNECT. SEE ONE-LINE DIAGRAM.

E7.3 LOCATION OF POWER COMPANY PAD MOUNTED TRANSFORMER. PROVIDE CONCRETE PAD PER UTILITY SERVICE STANDARDS. SEE ONE-LINE DIAGRAM.

E7.5 PROPOSED ROUTING OF NEW UNDERGROUND PRIMARY. COORDINATE EXACT ROUTING AND REQUIREMENTS WITH POWER CO. REPRESENTATIVE PRIOR TO ROUGH-IN. SEE DETAIL 7/E6.02

E7.8 PROPOSED ROUTING OF INCOMING TELECOM UTILITY. PROVIDE (2) 2" CONDUITS AND (2) 4" CONDUITS WITH PULLSTRING. COORDINATE EXACT ROUTING WITH TELECOM UTILITY PRIOR TO CONSTRUCTION. SEE DETAIL 6/E6.02

E7.9 AUTOMATIC TRANSFER SWITCH. SEE ONE-LINE DIAGRAM.

E7.11 STUB UP TWO (2) EMPTY 4" CONDUITS WITH PULLSTRING FOR FUTURE RADIO TOWER. ROUTE UNDERGROUND TO COMM. ROOM.

E7.12 STUB UP ONE EMPTY 1 1/2" CONDUIT WITH PULLSTRING FOR FUTURE RADIO TOWER POWER. ROUTE UNDERGROUND TO ELECTRICAL ROOM.

E7.13 TWO (2) EMPTY 4" CONDUITS ROUTED BELOW GRADE.

E7.14 UNDERGROUND FEEDER TO PANEL 'LA'. SEE CONDUIT BURIAL DETAIL.

E7.15 TWO EMPTY 2" CONDUITS WITH PULLSTRING TO EXISTING CITY FIBER BOX ON OPPOSITE SIDE OF JAMES NUTT BLVD. COORDINATE EXACT LOCATION IN FIELD. BORE UNDER STREET FOR CONDUIT ROUTING.

E7.16 PROVIDE IN-GRADE PULLBOX. COORDINATE EXACT LOCATION IN FIELD PRIOR TO ROUGH-IN.

E7.17 EMPTY 1 1/4" CONDUIT FOR FUTURE RADIO TOWER POWER.

E7.18 TWO (2) EMPTY 1" CONDUITS, ONE FOR ACCESS CONTROL, ONE SPARE.

E7.19 EMPTY 1" CONDUIT ROUTED BELOW GRADE.

E9.1 ROUTE CIRCUIT THROUGH RELAY PANEL FOR TIME BASED AND PHOTO-SENSING CONTROLS. PROVIDE #10 WIRE ENTIRE LENGTH OF CIRCUIT.

PLUMBING GENERAL NOTES

A. REFER TO CIVIL DRAWINGS FOR CONTINUATION OF DOMESTIC WATER, FIRE PROTECTION WATER, STORM, AND SANITARY WASTE UTILITIES.

B. REFER TO CIVIL DRAWINGS FOR LOCATION(S) OF WATER METER(S) AND BACKFLOW PREVENTION ON DOMESTIC/FIRE.

C. REFER TO CIVIL DRAWINGS FOR REMOTE PIV (POST INDICATOR VALVE).

D. REFER TO CIVIL DRAWINGS FOR BUILDING FINISHED FLOOR ELEVATION(S).

E. ALL INVERT ELEVATIONS INDICATED ARE RELATIVE TO THE FINISHED FLOOR ELEVATION OF THE BUILDING SLAB AT THEIR RESPECTIVE LOCATIONS, UNLESS SPECIFICALLY NOTED OTHERWISE.

F. INVERT ELEVATIONS LISTED ARE APPROXIMATE. PRIOR TO CONSTRUCTION, COORDINATE FINAL INVERT ELEVATIONS OF GRAVITY OUTFALLS WITH SITE UTILITY CONTRACTOR. MAKE ADJUSTMENTS AS REQUIRED TO ENSURE PROPER CONNECTIONS TO AVAILABLE SITE UTILITIES.

G. ROLL-DOWN AS NECESSARY AND PROVIDE PIPE, FITTINGS, AND ADAPTERS AS REQUIRED TO MAKE PROPER CONNECTIONS TO SITE UTILITY LINES.

H. NO PLUMBING PIPING SHALL BE ROUTED OVER MDF/IDF/DATA CLOSETS, ELECTRICAL ROOMS, OR ANY SUCH EQUIPMENT.

I. UNLESS SPECIFICALLY NOTED OTHERWISE, THE BUILDING SHALL BE FULLY FIRE SPRINKLERED IN COMPLIANCE WITH NFPA 13, STATE DEPARTMENT OF INSURANCE (STATE FIRE MARSHAL) REQUIREMENTS, AND ALL APPLICABLE LOCAL CODES.

J. THE FIRE SPRINKLER CONTRACTOR SHALL COORDINATE SPRINKLER HEAD INSTALLATION AND EXTEND BRANCH LINES DOWN TO PENETRATE THROUGH ANY "CLOUD"CEILINGS, IF PRESENT. REFER TO ARCHITECTURAL REFLECTED CEILING PLANS FOR CLARIFICATION.

PLUMBING KEYED NOTES

P1.1 SANITARY BUILDING DRAIN, SIZE AS NOTED. REFER TO CIVIL UTILITY DRAWINGS FOR CONTINUATION BEYOND 5' OF THE BUILDING LINE.

P1.3 DOMESTIC WATER SERVICE, SIZE AND PEAK FLOW RATE AS NOTED.

P1.4 FIRE PROTECTION WATER SERVICE, SIZE AS NOTED.

P1.6 STORM, SIZE AND DEPTH AS NOTED.

P1.8 PROPOSED LOCATION OF GAS METER. 5 PSI GAS METER, YARDLINE AND REGULATOR ASSEMBLY PROVIDED BY LOCAL GAS COMPANY. CONTRACTOR TO COORDINATE WITH UTILITY COMPANY PRIOR TO BIDDING TO DETERMINE FINAL LOCATION AND DETERMINE ALL COST/FEES ASSOCIATED WITH GAS SERVICE AND INCLUDE ALL COST IN BID.

P1.9 CONTRACTOR SHALL PROVIDE 5 PSI TAP WITH SHUT OFF VALVE. ROUTE BELOW GRADE TO SERVE GENERATOR, SIZE AS NOTED.

P1.10 CONTRACTOR SHALL PROVIDE 5 PSI TAP WITH SHUT OFF VALVE. ROUTE BELOW GRADE TO SERVE BUILDING, SIZE AS NOTED.

MECHANICAL KEYED NOTES

M4.15 PROVIDE GRADE-MOUNTED CONDENSING UNIT AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, ENSURING ALL REQUIRED CLEARANCES ARE PROVIDED. ROUTE REFRIGERANT PIPING TO ASSOCIATED INDOOR FAN COIL UNIT. REFRIGERANT PIPING SHALL BE SIZED ACCORDING TO MANUFACTURER'S SPECIFICATIONS. CONTRACTOR SHALL VERIFY NUMBER OF REFRIGERANT LINES REQUIRED PER UNIT PRIOR INSTALLATION. RE: DETAIL 32/M6.1.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 203
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR ENGINEERING

SW	JG	JB	AR	-

TN PN

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

MEP1.1
MEP SITE PLAN

MECHANICAL KEYED NOTES

M1.1 TERMINATE EXHAUST DUCT AT SPUN ALUMINUM ROOF CAP, GREENHECK MODEL RCC-7 OR SIMILAR. RE: DETAIL 2/M6.1.

M1.4 ROUTE GAS FLUE TO GAS UNIT HEATER AND ROUTE UP THROUGH ROOF AT APPROXIMATE LOCATION SHOWN. COORDINATE ALL ROOF PENETRATIONS WITH STRUCTURAL. RE: DETAIL 21/M6.1.

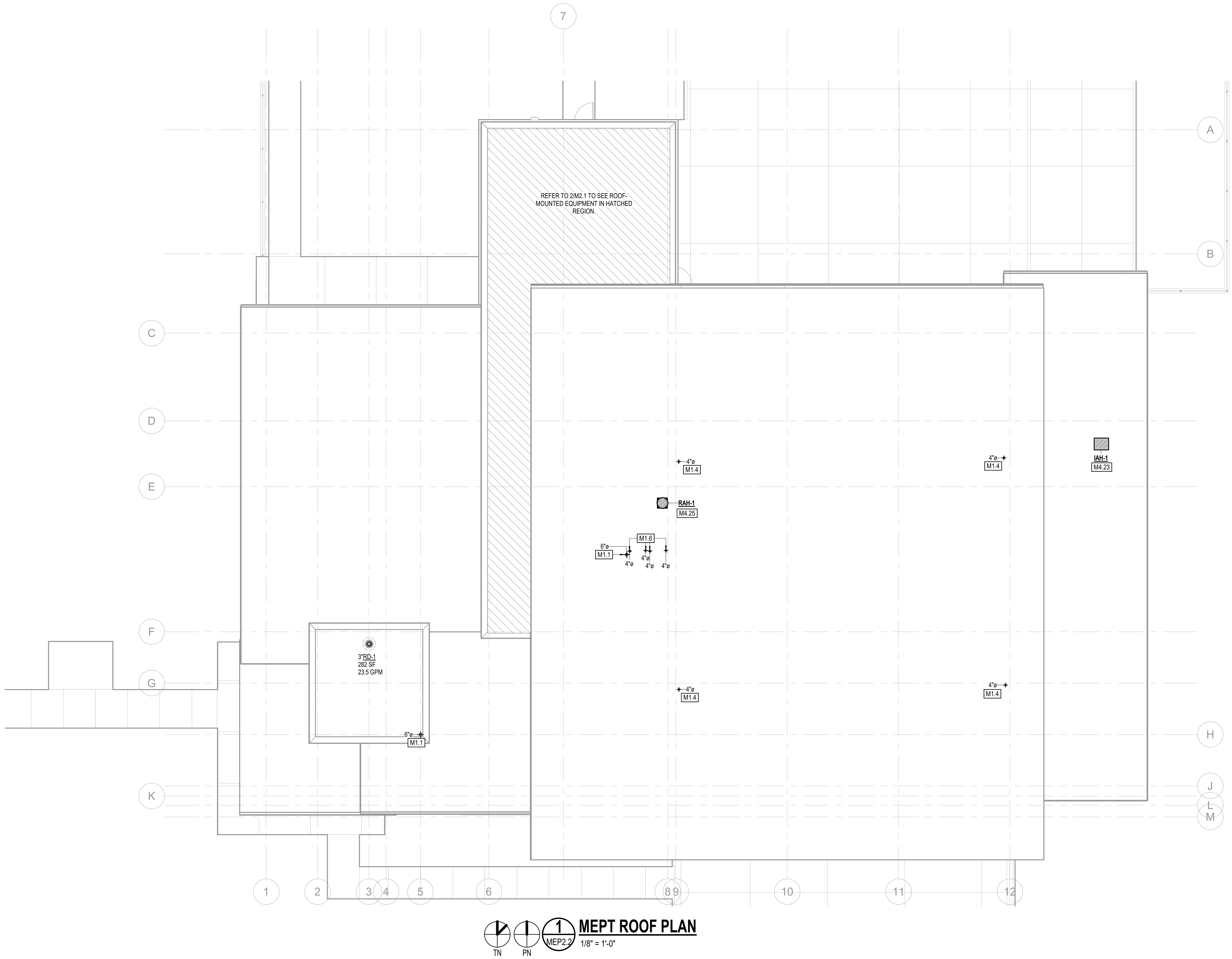
M1.6 ROUTE FLUE AND COMBUSTION AIR VENT DUCT FROM GAS WATER HEATER CONNECTIONS TO CPVC CONCENTRIC VENT KIT UP THROUGH ROOF. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. COORDINATE WITH PLUMBING FOR EXACT WATER HEATER LOCATION. COORDINATE WITH STRUCTURAL FOR ALL ROOF PENETRATIONS.

M4.23 PROVIDE INTAKE HOOD ON ROOF AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. ROUTE INTAKE AIR DUCT DOWN THROUGH THE ROOF. PROVIDE TRANSITIONS AS REQUIRED. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. RE: DETAIL 20/M6.1.

M4.25 PROVIDE RELIEF HOOD ON ROOF AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. ROUTE EXHAUST DUCT DOWN THROUGH THE ROOF. PROVIDE TRANSITIONS AS REQUIRED. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. RE: DETAIL 2/M6.1.

GENERAL PLUMBING NOTES

1. ALL PRIMARY AND OVERFLOW ROOF DRAIN AND STORM PIPE SIZING IS BASED ON A RAINFALL RATE OF EIGHT (8) INCHES PER HOUR.
2. CONFIRM FINAL DRAIN LOCATIONS WITH LATEST ARCHITECTURAL DRAWINGS PRIOR TO INSTALLATION. MAKE ADJUSTMENTS AS REQUIRED.
3. UNLESS NOTED OTHERWISE, THE ROOF EDGE IS TO PROVIDE A MEANS OF RAINWATER OVERFLOW IN AREAS WHERE NO OVERFLOW DRAINS ARE INDICATED.
4. UNLESS NOTED OTHERWISE, ROOF AREAS WITH NO ROOF DRAINS SHOWN ARE TO SHEET FLOW TO AND DRAIN VIA THE BUILDING EDGE. REFER TO ARCHITECTURAL DRAWINGS FOR ROOF CONSTRUCTION AND FOR ANY DETAILS REGARDING GUTTERS AND/OR DOWNSPOUTS.
5. IF VENT TERMINAL LOCATIONS ARE NOT SHOWN ON THIS DRAWING, REFER TO INDIVIDUAL FLOOR PLANS AND COORDINATE ACCORDINGLY.
6. ALL VENT TERMINALS SHALL BE LOCATED NO LESS THAN FIFTEEN (15) FEET AWAY FROM ANY OPERABLE WINDOW, DOOR, OUTSIDE AIR INTAKE, OR SUPPLY AIR FAN.
7. ALL VERTICAL STORM CONDUCTORS WITHIN THE BUILDING SHALL BE LOCATED AND ROUTED CONCEALED FROM PUBLIC VIEW WITHIN CHASES/FURR-OUTS PROVIDED. REFER TO LATEST ARCHITECTURAL DRAWINGS. COORDINATE IN FIELD AND MAKE ADJUSTMENTS AS REQUIRED.



1 MEP2.2 **MEPT ROOF PLAN**
1/8" = 1'-0"

EDWARD PUENTES 102338 LICENSED PROFESSIONAL ENGINEER STATE OF TEXAS
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 250 DALLAS, TEXAS 75204 214-528-8704 BRWARCH.COM

DBR
TBPE Firm Registration No. 2234
DBR Project # 245005
SW JG JB AR

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

MEP2.2
MEP ROOF PLAN

ABBREVIATIONS

A

A	AIR (COMPRESSED)
ABV	ABOVE
A/C	AIR CONDITIONING
AC	ALTERNATING CURRENT, AIR COMPRESSOR
ACCH	AIR COOLED CHILLER
ACCU	AIR COOLED CONDENSING UNIT
AD	ACCESS DOOR, AREA DRAIN
ADJ	ADJUSTABLE
AF	AIR FILTER
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHRI	AIR-CONDITIONING, HEATING, AND REFRIGERATION INSTITUTE
AHU	AIR HANDLING UNIT
AL	ALUMINUM
AMB	AMBIENT
AP	ACCESS PANEL
APD	AIR PRESSURE DROP
ARCH	ARCHITECT, ARCHITECTURAL
AS	AIR SEPARATOR
ASHRAE	AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
AV	ACID VENT, AIR VENT
AVG	AVERAGE
AW	ACID WASTE
AWS	AMERICAN WELDING SOCIETY
AUX	AUXILIARY

B

B	BOILER
BC	BELOW COUNTER
B/C	BACK OF CURB
BFF	BELOW FINISHED FLOOR
BFV	BUTTERFLY VALVE
BH	BOX HYDRANT
BLDG	BUILDING
BM	BENCHMARK
BOF	BOTTOM OF FOOTING
BOS	BOTTOM OF STRUCTURE
BP	BACKFLOW PREVENTER
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BWV	BACK WATER VALVE

C

C	CELSIUS
CAB	CABINET
CB	CATCH BASIN
CD	CONDENSATE DRAIN LINE
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CH	CHILLER
CHR	CHILLED WATER RETURN
CHS	CHILLED WATER SUPPLY
CHW	CHILLED WATER
CHWP	CHILLED WATER PUMP
CI	CAST IRON
CIRC	CIRCULATING
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNIT
COL	COLUMN
COMB	COMBINATION
COMP	COMPRESSOR
CONC	CONCRETE, CONCENTRIC
COND	CONDENSER, CONDENSATE
CONN	CONNECTION
CONT	CONTINUOUS,CONTINUATION
CTR	CENTER
CU	COPPER

D

D	DEPTH, DRAIN, DRYER
DB	DRY BULB
DC	DIRECT CURRENT
DDC	DIRECT DIGITAL CONTROL
DDMB	DUAL DUCT MIXING BOX
DESIG	DESIGNATION
DTL	DETAIL
DIA	DIAMETER
DIFF	DIFFUSER
DIM	DIMENSION
DISC	DISCONNECT
DN	DOWN
DPR	DAMPER
DW	DISHWASHER
DWG	DRAWING
DWH	DOMESTIC WATER HEATER
DWP	DOMESTIC WATER PUMP
DX	DIRECT EXPANSION

E

EA	EACH
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
ECC	ECCENTRIC
EDB	ENTERING DRY BULB
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
EFF	EFFICIENCY
EJ	EXPANSION JOINT
EL	ELEVATION
ELEC	ELECTRICAL
EMERG	EMERGENCY
ENCL	ENCLOSURE
ENGR	ENGINEER
EQ	EQUAL
EQUIP	EQUIPMENT
ESP	EXTERNAL STATIC PRESSURE
ET	EXPANSION TANK
ETR	EXISTING TO REMAIN
EVAP	EVAPORATOR
EWB	ENTERING WET BULB
EWT	ENTERING WATER TEMPERATURE
EX	EXPLOSION PROOF
EXT	EXTERNAL
EXTG	EXISTING

F

F	FAHRENHEIT, FIRE
FBO	FURNISHED BY OTHERS
FCO	FLOOR CLEAN OUT
FCS	FLOOR CONTROL STATION
FCU	FAN COIL UNIT
FD	FLOOR DRAIN, FIRE DAMPER
FDC	FIRE DEPARTMENT SIAMESE CONNECTION
FDV	FIRE DEPARTMENT VALVE
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FHR	FIRE HOSE RACK
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE
FLR	FLOOR
FPTU	FAN POWERED TERMINAL UNIT
FT	FOOT, FEET
FUT	FUTURE

G

G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GLV	GLOBE VALVE
GND	GROUND
GPM	GALLONS PER MINUTE
GV	GATE VALVE

H

HORIZ	HORIZONTAL
HP	HORSEPOWER
HSTAT	HUMIDISTAT
HT	HEIGHT
HTG	HEATING
HTR	HEATER
HW	HOT WATER
HWP	HEATING WATER PUMP
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
HX	HEAT EXCHANGER
HZ	HERTZ

I

ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IH	INFRARED HEATER
IN	INCH
INSUL	INSULATION
INT	INTERNAL, INTERIOR
INV	INVERT
IW	INDIRECT WASTE

J

JB	JUNCTION BOX
JP	JOCKEY PUMP

K

KEC	KITCHEN EQUIPMENT CONTRACTOR
KO	KNOCKOUT
KVA	KILOVOLT- AMPS
KW	KILOWATT

L

L	LENGTH
LAT	LEAVING AIR TEMPERATURE
LAV	LAVATORY
LF	LINEAR FEET
LP	LOW PRESSURE
LRA	LOCKED ROTOR AMPS
LVL	LEVEL
LWB	LEAVING WET BULB
LWCO	LOW WATER CUT OFF
LWT	LEAVING WATER TEMPERATURE

M

MAT	MIXED AIR TEMPERATURE
MAX	MAXIMUM
MBTUH	THOUSAND OF BTU'S
MC	MECHANICAL CONTRACTOR
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MI	MALLEABLE IRON
MIN	MINIMUM
MP	MEDIUM PRESSURE
MS	MOP SINK
MTD	MOUNTED
MU	MAKE-UP
MVD	MANUAL VOLUME DAMPER
MSAH	MINI-SPLIT AIR HANDLER
MSCU	MINI-SPLIT CONDENSING UNIT

N

N.C.	NORMALLY CLOSED
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
N.O.	NORMALLY OPEN
NO.	NUMBER
NTS	NOT TO SCALE

O

OA	OUTSIDE AIR
OAF	OUTSIDE AIR FAN
OAHU	OUTSIDE AIR HANDLING UNIT
OBD	OPPOSED BLADE DAMPER
OC	ON CENTER
OD	OUTSIDE DIAMETER, OVERFLOW DRAIN
OFCU	OUTSIDE AIR FAN COIL UNIT
OPG	OPENING
OS&Y	OPEN STEM AND YOLK

P

PG	PRESSURE GAUGE
PP	POLYPROPYLENE
PPM	PART PER MILLION
PRI	PRIMARY
PRS	PRESSURE REDUCING STATION
PRV	PRESSURE REDUCING VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE

Q

QTY	QUANTITY

R

RA	RETURN AIR
RAD	REFRIGERATED AIR DRYER
RAF	RETURN AIR FAN
RAG	RETURN AIR GRILLE
RAT	RETURN AIR TEMPERATURE
RCP	REFLECTED CEILING PLAN
RD	ROOF DRAIN
RE	REFERENCE, REFER
RED	REDUCER
REFR	REFRIGERATOR
REG	REGISTER
REINF	REINFORCING
REQD	REQUIRED
REV	REVISION, REVISE
RH	RELATIVE HUMIDITY
RHG	REFRIGERANT HOT GAS
RL	REFRIGERANT LIQUID
RLA	RUNNING LOAD AMPS
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
RS	REFRIGERANT SUCTION
RTU	ROOFTOP UNIT
RV	RELIEF VALVE

S

SA	SUPPLY AIR
SAF	SUPPLY AIR FAN
SAG	SUPPLY AIR GRILLE
SAN	SANITARY SEWER
SAR	SUPPLY AIR REGISTER
SC	STEAM CONDENSATE
SCHED	SCHEDULED
SD	STORM DRAIN
SEC	SECONDARY
SECT	SECTION
SENS	SENSIBLE
SF	SQUARE FEET
SFCS	SPRINKLER FLOOR CONTROL STATION
SH	SHOWER
SHT	SHEET
SIM	SIMILAR
SK	SINK
SM	SHEETMETAL
SP	STATIC PRESSURE, SUMP PUMP
SPEC	SPECIFICATION
SPR	SPRINKLER
SQ	SQUARE
SS	SERVICE SINK
SSSC	SOLID STATE SPEED CONTROL
STD	STANDARD
STL	STEEL
STR	STRAINER
SURF	SURFACE
SUSP	SUSPEND
SV	SANITARY VENT
SW	SOFT WATER

T

TC	TEMPERATURE CONTROL
TCC	TEMPERATURE CORNEAL COMPRESSOR
TD	TRENCH DRAIN
TDH	TOTAL DYNAMIC HEAD
TF	TRANSFER FAN
TH BLK	THRUST BLOCK
THERM	THERMOMETER
TMV	THERMOSTATIC MIXING VALVE
TP	TRAP PRIMER
TPD	TRAP PRIMER DEVICE
TSP	TOTAL STATIC PRESSURE
TSTAT	THERMOSTAT
TW	TEMPERED HOT WATER
TYP	TYPICAL

U

U	URINAL
UCD	UNDER CUT DOOR
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES, INC
UNO	UNLESS NOTED OTHERWISE
U/F	UNDERFLOOR
U/S	UNDERSLAB

V

V	VOLT
VA	VOLT- AMPERE
VAC	VACUUM
VAV	VARIABLE AIR VOLUME
VB	VALVE BOX, VACUUM BREAKER
VD	VOLUME DAMPER
VEL	VELOCITY
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VIB	VALVE IN BOX
VOV	VALVE ON VERTICAL
VP	VACUUM PUMP
VR	VARIABLE AIR VOLUME REHEAT
VTR	VENT THRU ROOF

W

W	WATT, WIDTH
W/	WITH
W/O	WITHOUT
WB	WET BULB
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WH	WALL HYDRANT
WM	WATER METER
WP	WEATHERPROOF
WPD	WATER PRESSURE DROP
WWF	WELDED WIRE FABRIC

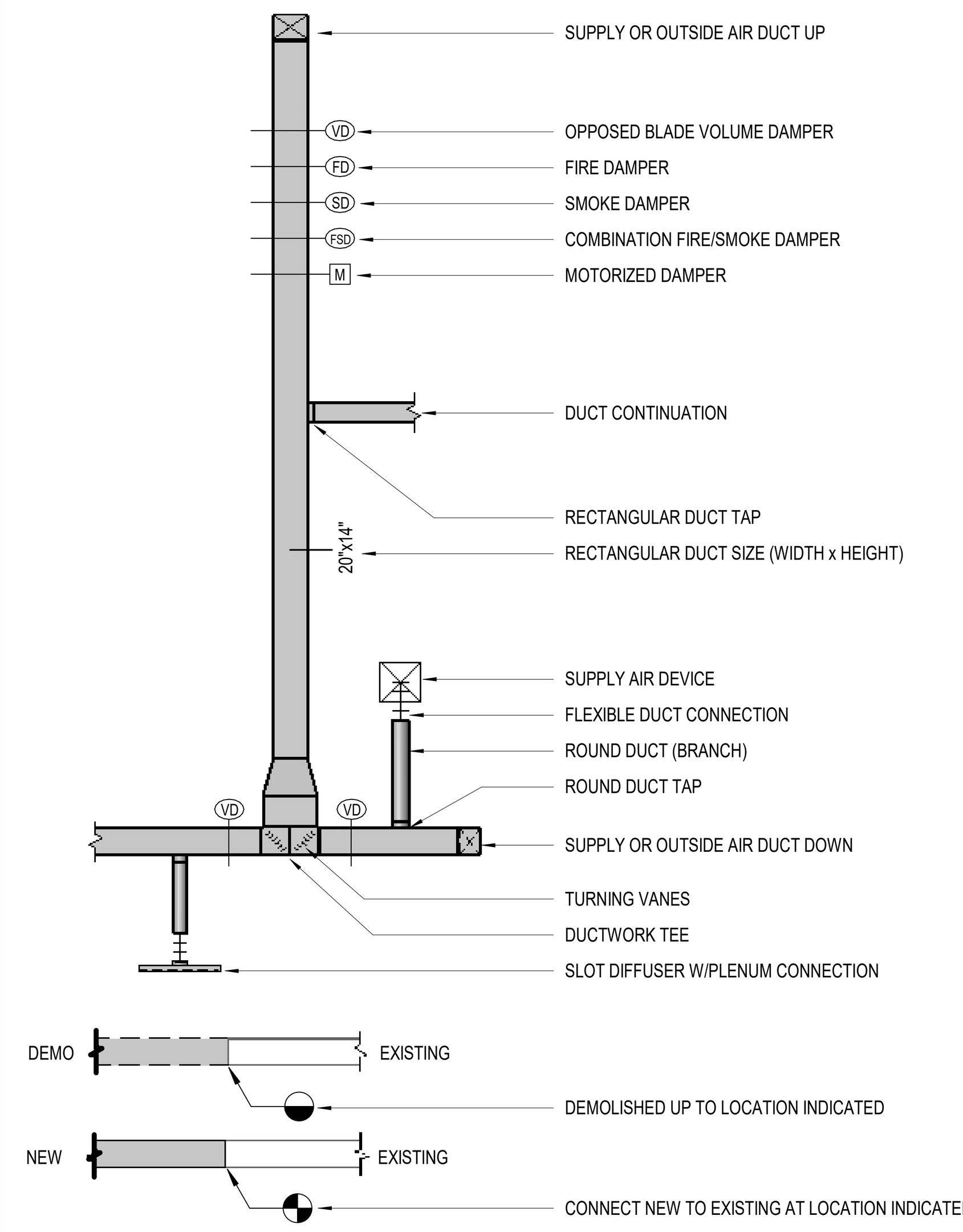
Y

Y	YARD HYDRANT

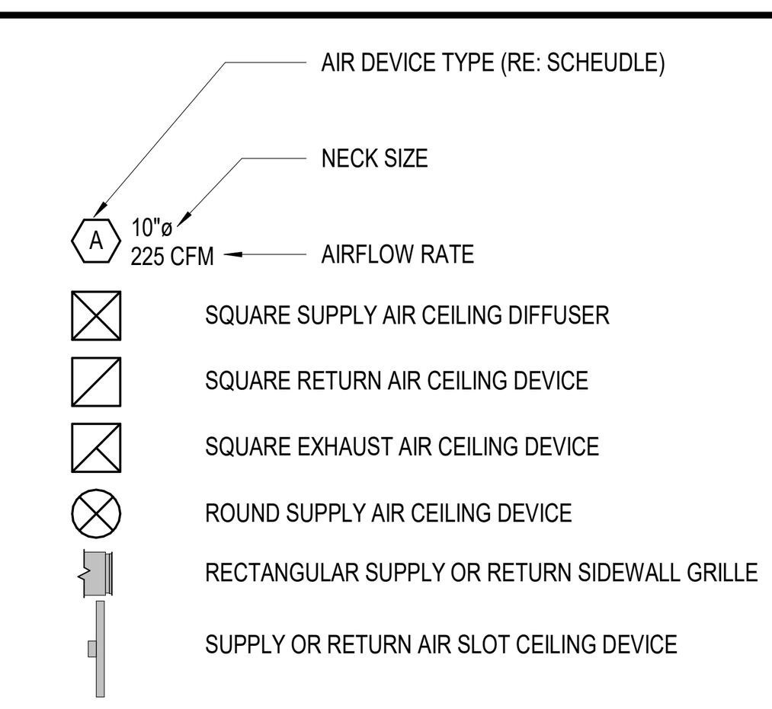
Z

Z	ZONE

DUCTWORK



AIR DEVICE TYPES



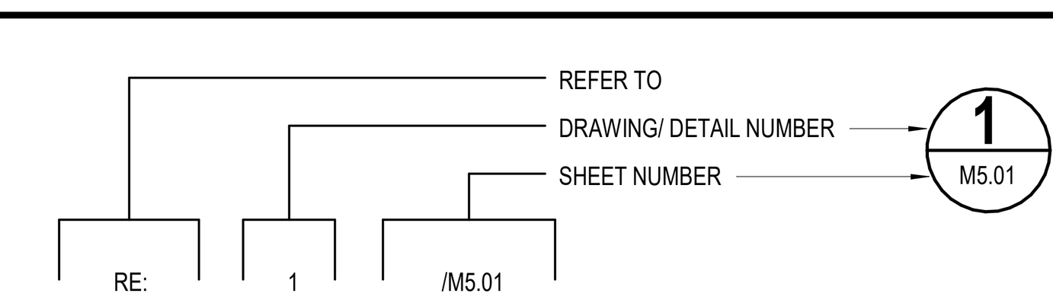
WALL MOUNTED SENSOR TYPES

T	THERMOSTAT	CO	CARBON MONOXIDE SENSOR
H	HUMIDISTAT	N	NITROGEN DIOXIDE SENSOR
C	CARBON DIOXIDE SENSOR	$	ON/OFF SWITCH

PIPING TYPES

CD	CONDENSATE DRAIN LINE	HWR	HOT WATER RETURN
CHS	CHILLED WATER SUPPLY	CWS	CONDENSER WATER SUPPLY
CHR	CHILLED WATER RETURN	CWR	CONDENSER WATER RETURN
HWS	HOT WATER SUPPLY	REF	REFRIGERANT PIPING SIZED BY MFR.

DRAWING/DETAIL REFERENCE KEY



MECHANICAL GENERAL NOTES

1. PIPING AND DUCTWORK SHOWN ON PLANS ARE SCHEMATIC ONLY. COORDINATE WITH OTHER TRADES FOR PIPING AND DUCTWORK ROUTING. OFFSET AND RUN PIPING DUCTWORK INSIDE THE STRUCTURE IF REQUIRED. PROVIDE ALL NECESSARY PIPING, DUCTWORK, FITTING, INSULATION, AND OTHER ACCESSORIES IN ORDER TO COMPLETE THE INSTALLATIONS.
2. EXACT LOCATIONS OF EQUIPMENT, GRILLES, AND DAMPERS SHALL BE FIELD COORDINATED WITH OTHER TRADES TO AVOID CONFLICTS AND ALLOW ADEQUATE CLEARANCES.
3. EQUIPMENT SIZES, DIMENSIONS, AND REQUIRED CONNECTIONS SHALL BE VERIFIED WITH THE MANUFACTURER DRAWINGS AND CUTSHEETS BEFORE FABRICATING OF DUCTWORK, PIPING, OR POURING OF CONCRETE HOUSEKEEPING PADS.
4. INSTALL EQUIPMENT TO ENSURE ACCESS PANELS ARE NOT BLOCKED. ACCESS FOR SERVICE MUST BE PROVIDED.
5. MECHANICAL CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR FOR ALL ELECTRICAL POWER REQUIREMENTS.
6. DUCT SIZES SHOWN ON PLANS ARE CLEAR INSIDE DIMENSIONS.
7. PROVIDE RECTANGULAR BRANCH DUCT TAP FOR ALL RECTANGULAR DUCT CONNECTIONS TO RECTANGULAR DUCT TRUNKS.
8. ALL DUCTWORK AND ASSOCIATED ACCESSORIES SHALL BE CONSTRUCTED TO MEET THE LATEST SMACNA STANDARDS FOR HVAC DUCT CONSTRUCTION.
9. ALL OUTSIDE AIR, SUPPLY AIR, AND RETURN AIR DUCTWORK AND PLENUMS SHALL BE INSULATED WITH A MINIMUM OF R-6 INSULATION WHERE LOCATED IN UNCONDITIONED SPACES AND SHALL BE INSULATED WITH A MINIMUM OF R-8 INSULATION WHERE LOCATED OUTSIDE THE BUILDING. REFER TO SPECIFICATION 23 07 13 DUCT INSULATION FOR FURTHER INFORMATION AND ADDITIONAL REQUIREMENTS.
10. ALL DUCTWORK SHALL BE CONSTRUCTED TO SEAL CLASS 'A' AS REFERENCED IN SMACNA STANDARDS. ALL NON-WELDED JOINTS AND SEAMS SHALL BE SEALED. THIS INCLUDES BUT IS NOT LIMITED TO TRANSVERSE JOINTS, LONGITUDINAL SEAMS, DUCT WALL PENETRATIONS, SPIN-INS, TAPS, AND OTHER BRANCH CONNECTIONS, ACCESS DOORS, ACCESS PANELS, AND DUCT CONNECTIONS TO EQUIPMENT. OPENINGS FOR ROTATING SHAFTS SHALL ALSO BE SEALED WITH BUSHINGS. REFER TO SPECIFICATION 23 31 13 METAL DUCTWORK FOR FURTHER INFORMATION.
11. ALL EXPOSED DUCTWORK AND PIPING WITH ASSOCIATED ACCESSORIES IN AREAS WITH NO CEILING OR PARTIAL CEILING SHALL BE PAINTED. REFER TO ARCHITECT FOR COLOR.
12. MECHANICAL CONTRACTOR SHALL COORDINATE WITH ELECTRICAL CONTRACTOR PRIOR TO ACTUAL INSTALLATION OF TEMPERATURE SENSORS AND HUMIDITY SENSORS.
13. PROVIDE REMOTE SPIN-IN DAMPER OPERATOR FOR SPIN-IN CONNECTIONS AND VOLUME DAMPERS LOCATED OVER GYPSUM CEILINGS.
14. PROVIDE AIRFOIL TYPE TURNING VANES IN ALL 90 DEGREE ELBOWS.
15. PROVIDE INSULATED ACCESS DOORS FOR DUCTWORK DOWNSTREAM OF AIR HANDLING UNITS AT EVERY 20'-0" TO FACILITATE DUCT CLEANING. PROVIDE ACCESS DOORS WITHIN 5'-0" OF EACH ELBOW.
16. COORDINATE LOCATIONS OF FLOOR AND WALL OPENINGS WITH ARCHITECT AND STRUCTURAL ENGINEER.
17. ALL CEILING MOUNTED AND WALL MOUNTED AIR DEVICE FINISHES SHALL MATCH ADJACENT ARCHITECTURAL SURFACE. CONTRACTOR SHALL COORDINATE COLOR WITH ARCHITECT.
18. NO PIPE HANGERS SHALL BE SPACED MORE THAN 10'-0" O.C. COMPLY WITH PIPE SPACING AS SPECIFIED IN THE PIPING SUPPORT SPECIFICATIONS.
19. ALL PIPING LOCATED INSIDE BUILDING SHALL BE SUPPORTED FROM THE STRUCTURE WITH SADDLE OR TRAPEZE HANGERS WITH ADJUSTABLE CLEVIS OR THREADED RODS.
20. MECHANICAL CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF ALL OUTSIDE AIR INTAKES TO MAINTAIN 15 FEET DISTANCE BETWEEN OUTSIDE AIR INTAKES AND ANY EXHAUST AIR OUTLET, FLUES OR PLUMBING VENTS.
21. MECHANICAL CONTRACTOR SHALL COORDINATE WITH PLUMBING CONTRACTOR FOR ALL CONDENSATE DRAIN PIPES CONNECTING TO A SINK DRAIN TAIL PIECE.
22. ALL KITCHEN GREASE EXHAUST DUCTWORK SHALL BE CONTINUOUSLY WELDED 16 GA. CARBON STEEL. ALL GREASE EXHAUST DUCTS SHALL BE WRAPPED WITH 3M 2 HR. FIRE RATED WRAP OR INSTALLED WITHIN A FIRE RATED ENCLOSURE.

ROOF MOUNTED EQUIPMENT ANCHORAGE REQUIREMENTS

1. ALL ROOF MOUNTED EQUIPMENT CURBS, ROOF MOUNTED EQUIPMENT, EQUIPMENT TIE DOWNS, AND CONNECTIONS OF ALL EQUIPMENT TO BUILDING STRUCTURE FOR WIND LOADING ARE TO BE DESIGNED AND ENGINEERED BY A REGISTERED SPECIALTY ENGINEER RETAINED BY THE CONTRACTOR. DESIGN CRITERIA FOR WIND LOADING SHALL BE AS INDICATED IN THE CONSTRUCTION DOCUMENTS AND PER LOCAL CODES FOR THE PROJECT LOCATION AND BUILDING CATEGORY. SIGNED AND SEALED DRAWINGS AND CALCULATIONS ARE TO BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL. THE SUBMITTAL SHALL INCLUDE ATTACHMENT DETAILS OF THE EQUIPMENT TO THE STRUCTURE WITH DESIGN LOADS, LOCATIONS, AND METHODS OF ATTACHMENT. THE CONTRACTOR SHALL ALSO SUBMIT THE INFORMATION TO THE STRUCTURAL ENGINEER TO COORDINATE THE DESIGN OF THE PRIMARY STRUCTURAL FRAME WITH THE FINAL LOADS AND ATTACHMENTS SUBMITTED.

CONTROLS SCHEMATIC SYMBOLS LEGEND

AI	ANALOG INPUT	FS	FLOW SWITCH
AO	ANALOG OUTPUT	DAT	DISCHARGE AIR TEMPERATURE SENSOR
DI/BI	DIGITAL/BINARY INPUT	S	WALL SENSOR
DO/BO	DIGITAL/BINARY OUTPUT	T	THERMOSTAT
MD	ON-OFF MOTORIZED DAMPER	CO2	CARBON DIOXIDE SENSOR
MMD	MODULATING TYPE MOTORIZED DAMPER	SP	SET POINT
AFMS	AIR FLOW MEASURING STATION	S/A	SUPPLY AIR
MCV	CONTROL VALVE MODULATING TYPE	R/A	RETURN AIR
VFD	VARIABLE FREQUENCY DRIVE	O/A	OUTSIDE AIR
CSR	CURRENT SENSING RELAY	HC	HEATING COIL
FRZ	FREEZESTAT	CC	COOLING COIL
HSL	HIGH STATIC LIMIT	DX	DIRECT EXPANSION COOLING COIL
SPT	STATIC PRESSURE TRANSMITTER	PICCV	PRESSURE INDEPENDENT CHARACTERIZED CONTROL VALVE
DPT	DIFFERENTIAL PRESSURE TRANSDUCER	AFC	AIRFLOW CROSS
FM	FLOW METER	DPS	DIFFERENTIAL PRESSURE SWITCH

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005
SW | JG | JB | AR | -

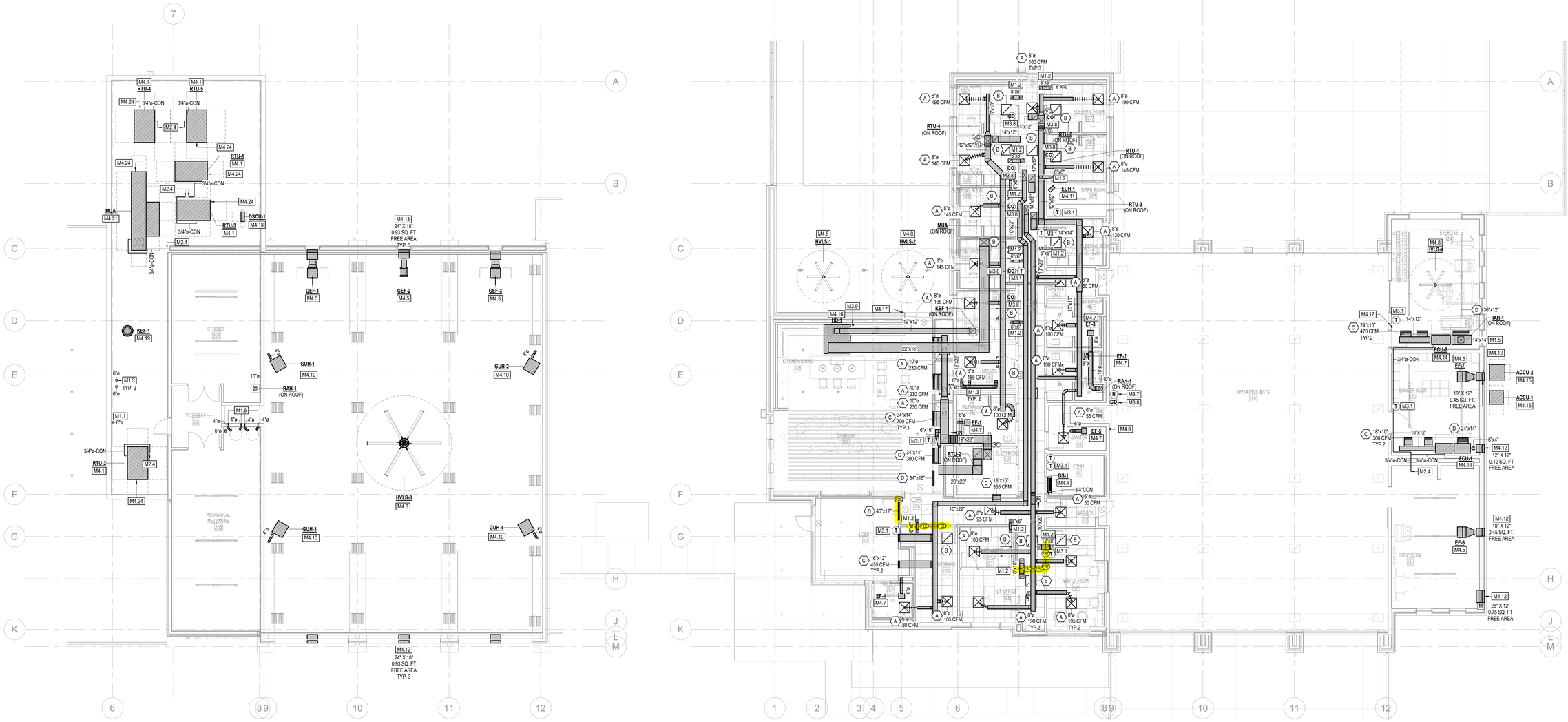
DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

M0.1

MECHANICAL SYMBOL LEGEND



2 MECHANICAL PLAN LEVEL 2

TN PN

M2.1

1/8" = 1'-0"

1 MECHANICAL PLAN LEVEL 1

TN PN

M2.1

1/8" = 1'-0"

MECHANICAL KEYED NOTES

M1.1 TERMINATE EXHAUST DUCT AT SPUN ALUMINUM ROOF CAP, GREENHECK MODEL RCC-7 OR SIMILAR. RE: DETAIL 2/M6.1.

M1.2 PROVIDE RETURN AIR TRANSFER BOOT. SIZE AS INDICATED. RE: DETAIL 7/M6.1.

M1.3 ROUTE 6" DRYER EXHAUST DUCT INTO MANUFACTURER'S ROOF CAP. INSTALL PER MANUFACTURER'S RECOMMENDATIONS AND PROVIDE WITH RECESSED DRYER VENT BOX AND APPROPRIATE TERMINATION. RE: DETAIL 12/M6.1.

M1.5 PROVIDE DUCT UP THROUGH ROOF TO INTAKE HOOD AT APPROXIMATE LOCATION. COORDINATE ALL ROOF PENETRATIONS WITH STRUCTURAL.

M1.6 ROUTE FLUE AND COMBUSTION AIR VENT DUCT FROM GAS WATER HEATER CONNECTIONS TO CPVC CONCENTRIC VENT KIT UP THROUGH ROOF. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. COORDINATE WITH PLUMBING FOR EXACT WATER HEATER LOCATION. COORDINATE WITH STRUCTURAL FOR ALL ROOF PENETRATIONS.

M2.4 ROUTE CONDENSATE DRAIN LINE TO DISCHARGE AT FLOOR DRAIN AT APPROXIMATE LOCATION SHOWN. REFER TO PLUMBING FOR EXACT LOCATION. SIZE PIPE AS NOTED ON PLANS. RE: DETAILS 23/24/M6.1.

M3.1 PROVIDE THERMOSTAT AT APPROXIMATE LOCATION SHOWN. THERMOSTAT SHALL BE INSTALLED AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE FINAL LOCATION WITH ARCHITECT AND OTHER TRADES TO AVOID CONFLICTS.

M3.7 PROVIDE NITROGEN DIOXIDE DETECTOR. DETECTOR SHALL BE INSTALLED AND CALIBRATED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. DETECTOR SHALL BE INSTALLED AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE FINAL LOCATION WITH ARCHITECT AND OTHER TRADES TO AVOID CONFLICT.

M3.8 PROVIDE CARBON MONOXIDE DETECTOR. SHALL BE INSTALLED AND CALIBRATED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. SHALL BE INSTALLED AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE FINAL LOCATION WITH ARCHITECT AND OTHER TRADES TO AVOID CONFLICT.

MECHANICAL KEYED NOTES

M3.9 PROVIDE RECESSED WALL MOUNTED LIGHT AND FAN CONTROL FOR HOOD. CONTROL SHALL BE MOUNTED AT SAME ELEVATION AS ELECTRICAL RECEPTACLES.

M4.1 PROVIDE PACKAGED ROOFTOP UNIT WITH VERTICAL INLET AND DISCHARGE AS SCHEDULED ON ROOF AT APPROXIMATE LOCATION SHOWN. PROVIDE UNIT WITH ROOF CURB TO MATCH ROOF SLOPE. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, PROVIDING ALL CLEARANCES AROUND UNIT AS REQUIRED BY EQUIPMENT MANUFACTURER. COORDINATE FINAL LOCATION WITH STRUCTURAL. RE: DETAIL 16/17/M6.1.

M4.4 PROVIDE WALL-MOUNTED DUCTLESS MINI-SPLIT SYSTEM AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. RE: DETAIL 25/26/28/30/M6.1.

M4.5 PROVIDE IN-LINE FAN AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, PROVIDING ALL REQUIRED CLEARANCES. SUSPEND FROM STRUCTURE AND PROVIDE VIBRATION ISOLATION. RE: DETAIL 19/M6.1.

M4.7 PROVIDE CEILING MOUNTED EXHAUST FAN AT APPROXIMATE LOCATION SHOWN. SUSPEND FROM STRUCTURE. ROUTE EXHAUST DUCT TO TERMINATE ABOVE THE ROOF AT A SPUN ALUMINUM ROOF CAP, GREENHECK MODEL RCC-7 OR SIMILAR. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, ENSURING ALL REQUIRED CLEARANCES ARE PROVIDED. RE: DETAIL 18/M6.1.

M4.8 PROVIDE HVLS FAN SCHEDULED AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS. SUSPEND FROM STRUCTURE ENSURING THAT ALL REQUIRED CLEARANCES ARE PROVIDED.

M4.9 PROVIDE HVLS FAN SYSTEM CONTROLLER AT APPROXIMATE LOCATION SHOWN. PLACE AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE EXACT LOCATION WITH ARCHITECT, ELECTRICAL AND ALL OTHER DISCIPLINES. PROVIDE WITH 120V POWER CONNECTION AND DATA DROP.

MECHANICAL KEYED NOTES

M4.10 PROVIDE GAS UNIT HEATER AT APPROXIMATE LOCATION SHOWN. MOUNT AT 16 FEET A.F.F. PROVIDE THERMOSTAT. MOUNT THERMOSTAT ON THE UNIT HEATER. COORDINATE WITH ARCHITECT AND OTHER TRADES PRIOR TO CONSTRUCTION TO AVOID CONFLICT WITH EQUIPMENT. HEATER SHALL BE SET TO TURN ON THE HEATER WHEN SPACE TEMPERATURE FALLS BELOW 50F (ADJUSTABLE). BAY HEATERS SHOULD BE SET TO AUTOMATICALLY TURN OFF WHEN THE BAY DOORS ARE OPEN. RE: DETAIL 21/M6.1.

M4.11 PROVIDE ELECTRIC UNIT HEATER AT APPROXIMATE LOCATION SHOWN. MOUNT AT 9 FEET A.F.F. PROVIDE THERMOSTAT. MOUNT THERMOSTAT AT SAME ELEVATION AS LIGHT SWITCHES. COORDINATE WITH ARCHITECT AND OTHER TRADES PRIOR TO CONSTRUCTION TO AVOID CONFLICT WITH EQUIPMENT. HEATER SHALL BE SET TO TURN ON THE HEATER WHEN SPACE TEMPERATURE FALLS BELOW 50F (ADJUSTABLE). RE: DETAIL 22/M6.1.

M4.12 PROVIDE INTAKE LOUVER RUSKIN MODEL ELF6375DX OR SIMILAR AT APPROXIMATE LOCATION SHOWN. PROVIDE LOUVER WITH FULL-SIZED FIELD FABRICATED SHEET METAL PLENUM AND MOTORIZED DAMPER. LOUVER SHALL HAVE MINIMUM FREE AREA NOTED ON PLAN. COORDINATE FINAL LOCATION, DIMENSIONS, AND FINISH WITH ARCHITECT. RE: DETAIL 9/M6.1.

M4.13 PROVIDE EXHAUST LOUVER RUSKIN MODEL ELF6375DX OR SIMILAR AT APPROXIMATE LOCATION SHOWN. INTERLOCK WITH GEF-1 THRU GEF-3. COORDINATE FINAL LOCATION, DIMENSIONS, AND FINISH WITH ARCHITECT. RE: DETAIL 13/M6.1.

M4.14 PROVIDE FAN COIL UNIT AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. SUPPORT UNIT FROM STRUCTURE. PROVIDE ALL CLEARANCES AS REQUIRED BY EQUIPMENT MANUFACTURER. COORDINATE WITH ADJACENT PIPING, WALLS, CONDUIT, STRUCTURAL MEMBERS, ETC. RE: DETAIL 14/M6.1.

M4.15 PROVIDE GRADE-MOUNTED CONDENSING UNIT AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, ENSURING ALL REQUIRED CLEARANCES ARE PROVIDED. ROUTE REFRIGERANT PIPING TO ASSOCIATED INDOOR FAN COIL UNIT. REFRIGERANT PIPING SHALL BE SIZED ACCORDING TO MANUFACTURER'S SPECIFICATIONS. CONTRACTOR SHALL VERIFY NUMBER OF REFRIGERANT LINES REQUIRED PER UNIT PRIOR INSTALLATION. RE: DETAIL 32/M6.1.

MECHANICAL KEYED NOTES

M4.16 PROVIDE RANGE HOOD IN APPROXIMATE LOCATION. ROUTE EXHAUST DUCT UP THROUGH THE ROOF AND CONNECT TO ROOF MOUNTED EXHAUST FAN. COORDINATE FINAL LOCATION WITH ARCHITECT.

M4.17 PROVIDE WALL MOUNTED, BLUETOOTH HVLS FAN SYSTEM CONTROLLER AT APPROXIMATE LOCATION SHOWN. COORDINATE EXACT LOCATION WITH CONTROLS AND ELECTRICAL CONTRACTORS.

M4.18 PROVIDE ROOF-MOUNTED CONDENSING UNIT AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, ENSURING ALL REQUIRED CLEARANCES ARE PROVIDED. ROUTE REFRIGERANT PIPING TO ASSOCIATED DUCTLESS MINI-SPLIT UNIT. REFRIGERANT PIPING SHALL BE SIZED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS. 16/M6.1.

M4.19 PROVIDE CENTRIFUGAL ROOF MOUNTED EXHAUST FAN, AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. ROUTE WELDED BLACK STEEL EXHAUST DUCT TO KITCHEN HOOD EXHAUST CONNECTION(S). PROVIDE TRANSITIONS AS NEEDED TO MAKE CONNECTION. ENCLOSE EXHAUST DUCT AND EXHAUST HOOD ABOVE CEILING IN A 2-HOUR RATED DUCT WRAP. RE: DETAIL 33/M6.1.

M4.21 PROVIDE ROOF MOUNTED MAKEUP AIR UNIT WITH GAS HEATER AS SCHEDULED AT APPROXIMATE LOCATION SHOWN. INSTALL PER MANUFACTURER'S RECOMMENDATIONS, ENSURING ALL REQUIRED CLEARANCES ARE PROVIDED. RE: DETAIL 35/M6.1.

M4.24 ORIENT MECHANICAL EQUIPMENT SUCH THAT THE OUTSIDE AIR INTAKE IS ON THIS END. CONTRACTOR SHALL PROVIDE A FULL-SIZED EXTENSION OF THE OUTDOOR AIR INTAKES AS REQUIRED TO ACCOMMODATE OUTDOOR AIRFLOW MONITORING STATIONS.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
TBPLS Firm Registration No. 10194647

NO.	REVISION	DATE
SW		-
JCS		-
JB		-
AR		-

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRVV PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2

3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

M2.1

MECHANICAL PLANS

HOOD INFORMATION

HOOD NO.	MARK	MODEL	HOOD DIMENSIONS (IN.) LENGTH	WIDTH	HEIGHT	HOOD CONSTR.	COOKING LOAD / DUTY RATING	EXHAUST TOTAL CFM	COLLAR(S) WIDTH	LENGTH	DIA.	CFM	S.P.	SUPPLY MUA CFM	AC CFM	HANGING WEIGHT LBS.	SECTION LOCATION
1	HOOD 1	GXEW-60-S	60	48	24	430 SS WHERE EXPOSED	HEAVY	1125			10	1125	0.759	900		210	SINGLE

HOOD INFORMATION

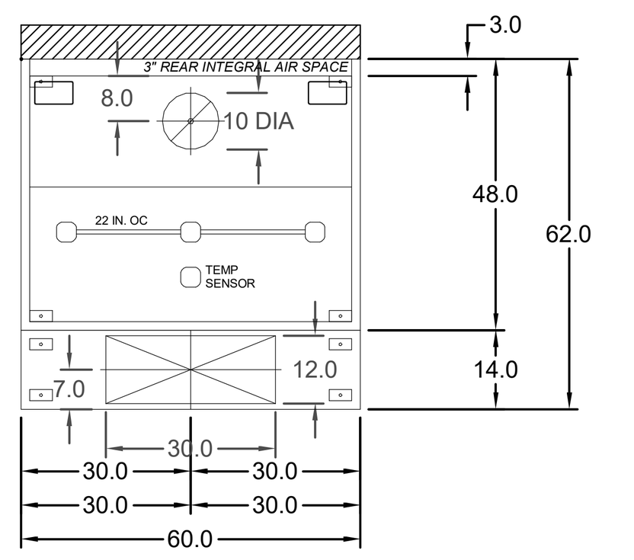
HOOD NO.	MARK	LIGHTING DETAILS FIXTURE TYPE BULB / LAMP INFO	QTY	FOOT CANDLES	GREASE FILTRATION DETAILS TYPE / MODEL MATERIAL	QTY	SIZE (IN.) L	H	UTILITY CABINET(S) LOCATION	FIRE SYSTEM TYPE	SIZE	CONTROLS MODEL	INTERFACE
1	HOOD 1	INCANDESCENT (GLOBE) 100W A19 (BULBS NOT INCL.)	3	43.28	X-TRACTOR (SPARK ARRESTOR INCL.) STAINLESS STEEL	0	16	20					
						3	20						

SUPPLY PLENUM INFORMATION

HOOD NO.	MARK	POS.	TYPE	SIZE (IN.) L	W	H	INSULATED	DAMPER(S)	LED LIGHT(S) SUPPLIED	QTY	TOTAL CFM	TOTAL S.P.	COLLARS TYPE	MOUNTING	QTY	W	L	DIA.	CFM	VEL.
1	HOOD 1	FRONT	ASP	60	14	4	NO	YES	NO		900	0.03	MUA	FACTORY	1	12	30		900	360

HOOD OPTIONS

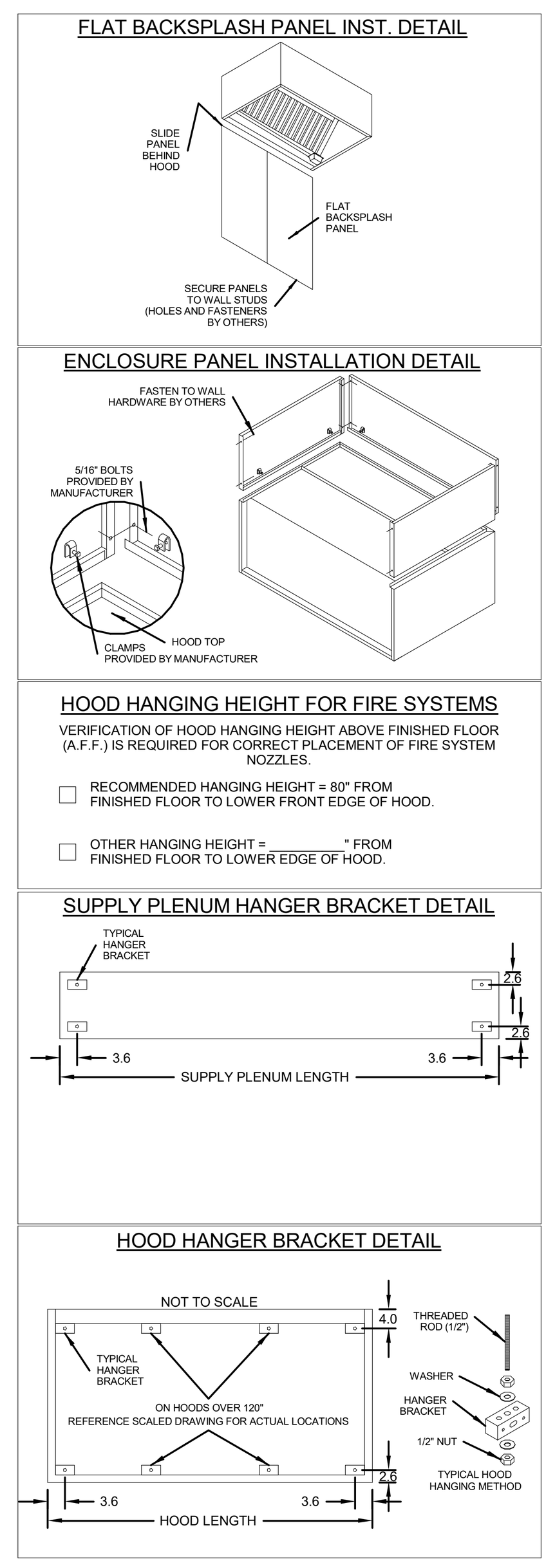
- UL 710 LISTED W/ OUT EXHAUST FIRE DAMPER - UL #MH11726
- BACK INTEGRAL AIR SPACE - 3 IN WIDE
- 18 IN HIGH CEILING ENCLOSURES - FRONT LEFT RIGHT - FIELD INSTALLED
- FACTORY MOUNTED EXHAUST COLLAR(S)
- BACKSPLASH 80.00 IN HIGH 60.00 IN LONG
- PERFORMANCE ENHANCING LIP (PEL) TECHNOLOGY
- STANDING SEAM CONSTRUCTION FOR SUPERIOR STRENGTH

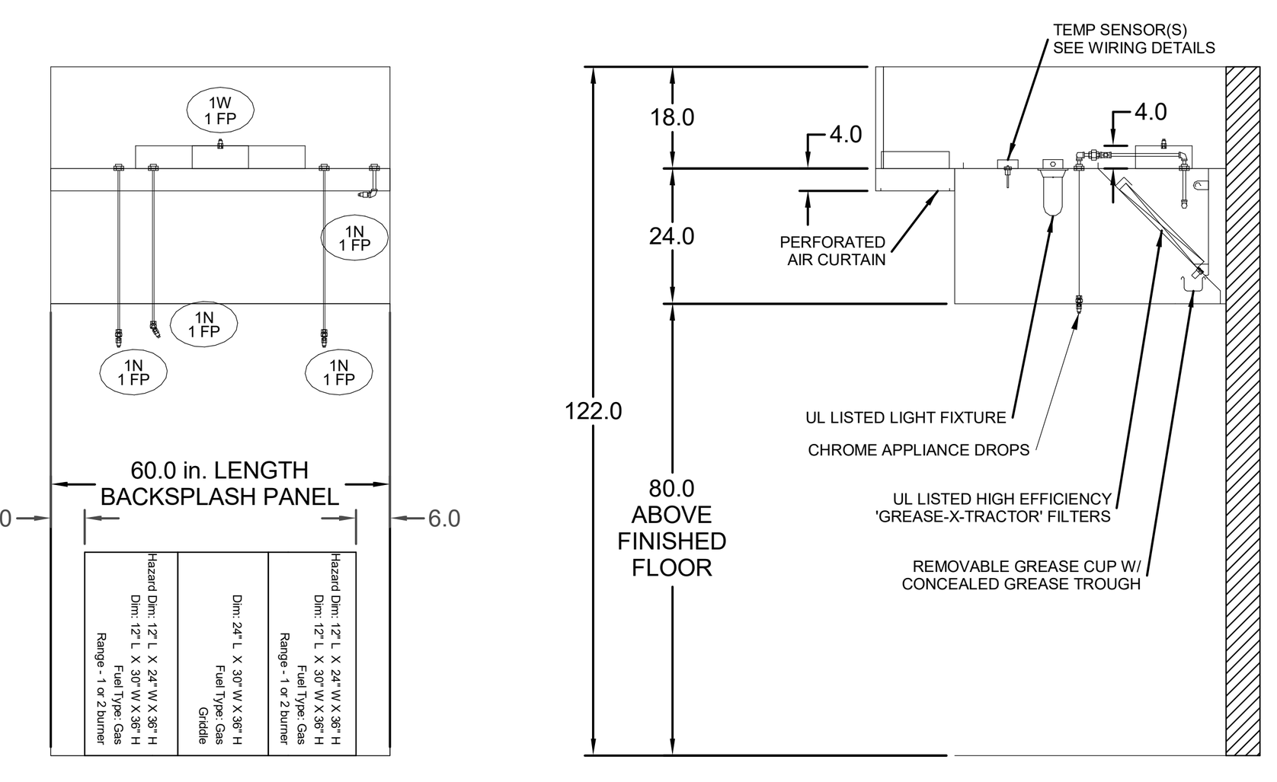


Fire (piping/drops/nozzles/etc.) subject to change. As built's can be provided at time of order and included with product shipment

FIRE SYSTEM MARK: FSS
PIPE & CONDUIT BY ANSUL DISTRIBUTOR

MARK: Hood 1 - SECTION 1
PLAN VIEW





MARK: Hood 1 - SECTION 1
ELEVATION VIEW

MARK: Hood 1
SECTION VIEW

EQUIPMENT SCHEDULE

Tempered Make-Up Air Unit — Mark: MUA

Qty	Greenheck Model	Volume	External SP	Total SP	MCA	MOP	Weight	SCCR
1	DGX-P116-H12-D1-3	900 CFM	0.5 in. wg	1.165 in. wg	21.4	30	1,289 lb	5kA

Motor Information

Size	V/C/P	Enclosure	Motor with Shaft Gounding	Motor RPM	Operating Power
1/2 hp	208/60/3	ODP	No	1200	0.29 hp

Heating

Type	Gas Type	Temperature Winter DB	Max Δ	Max LAT	Energy Input	Output	Efficiency	Connection Size (IN)	Gas Pressure	Control Access	Gas Pressure Min	Max
Direct Gas	Natural	25.2 F	44.8 F	70.0 F	47.3 MBH	43.6 MBH	92%	3/4"	1/2 PSI	Right Hand	7 in. wg	0.5 PSI

Cooling

Cooling Type	Coil Model	Rows Deep	Fins Per Inch	Face Velocity	Total Energy	Sensible Energy	Entering Air (F) Dry	Wet	Leaving Air (F) Dry	Wet
Packaged DX	DX38S02S10-30x30	2	10	144 ft/min	42.7 MBH	29.6 MBH	99.7 F	79.1 F	66.6 F	66.6 F

Coil SP	Refrigerant	Suction Temp	Liquid Temp	Super Heat	Code 18/19	Suction Conn Qty / Size	Liquid Conn Qty / Size
NA	R-454B	53.7 F	110 F	8 F	0	NA	NA

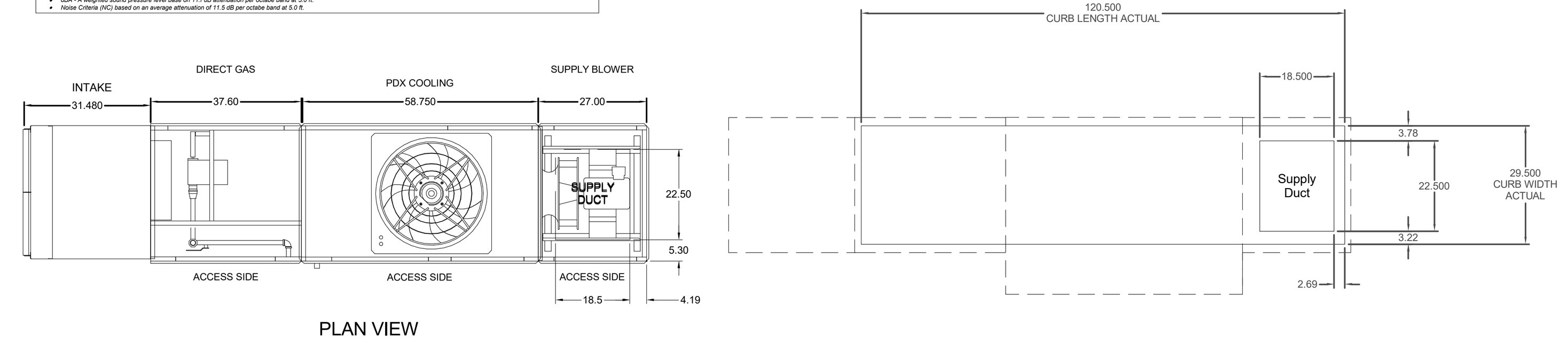
Outlet Sound Power By Octave Band

62.5	125	250	500	1000	2000	4000	8000	LwA	dBA	Sones
59.3	*60.3*	*53.6*	*52.4*	*51.7*	*49.3*	*47.8*	*44.7*	*57*	*46*	*3.5*

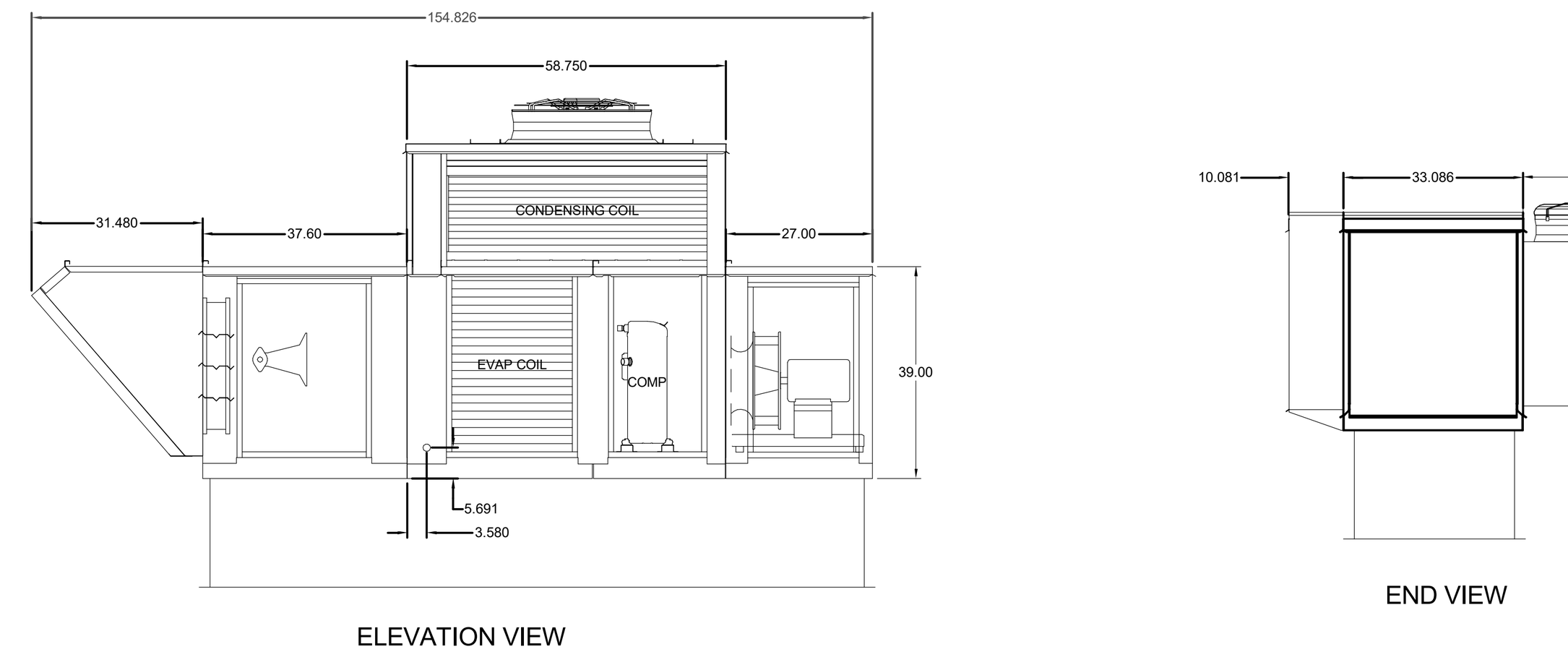
- *LwA - A weighted sound power level based on ANSI S1.4*
- *dBA - A weighted sound pressure level base on 11.f dB attenuation per octabe band at 5.0 ft.*
- *Noise Criteria (NC) based on an average attenuation of 11.5 dB per octabe band at 5.0 ft.*

OPTIONS AND ACCESSORIES

- Extended Compressor Warranty: 5 years
- Air Flow Arrangement: Outdoor Air Only
- Weatherhood: Aluminum Mesh, 16x20x2 - (4)
- Damper: Inlet
- Outdoor Air Intake Position: End
- Discharge Position: Bottom
- Coating: Galvanized
- Cooling Coil Coating - None
- Insulation: Double Wall - Tempering On
- Supply Fan Control: VFD
- VFD Control: Constant Volume
- Hinged Access
- Access Side: Right-Hand
- Unit Weight: 1289 lb
- Control Center
- Freeze Protection
- Heat Inlet Air Sensor
- Cool Inlet Air Sensor
- Unit Controls: Microprocessor
- Temperature Control: Discharge
- BMS Protocol: None



PLAN VIEW



ELEVATION VIEW

END VIEW

NOTE: Roof Opening Requirements:

Minimum Roof Opening: The minimum roof opening size is the illustrated duct diameter plus 0.25 in. on all sides.
For example: If the duct size is 14 x 14 in. square, the minimum roof opening size is 14.5 x 14.5 in. square.

Maximum Roof Opening: There must be a minimum perimeter of 1.75 in. between the roof opening and the roof curb.
For example: If the roof curb is 75 x 30 in. square, the maximum roof opening is 71.5 x 26.5 in. inches square.
NOTE: The weatherhood and filter sections of the make-up air unit are not supported by the curb. This is by design, in
order to help alleviate water infiltration issues.

Direct Drive Upblast Centrifugal Roof Exhaust Fan

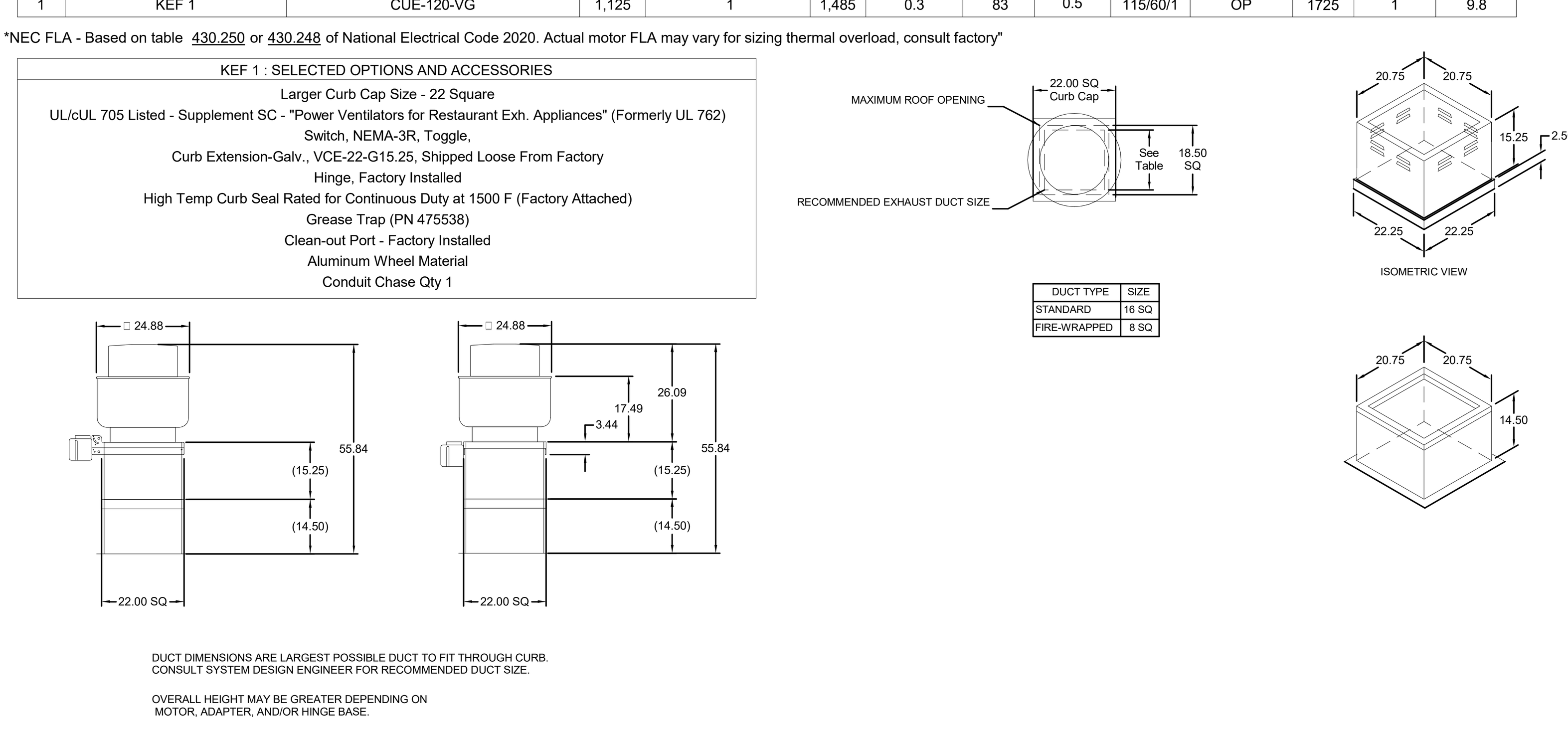
QTY	MARK	MODEL	VOLUME (CFM)	TOTAL EXTERNAL SP (IN WG)	FAN RPM	OPERATING POWER (HP)	WEIGHT (LB.)	SIZE (HP)	V/C/P	ENCLOSURE	MOTOR RPM	WINDINGS	NEC FLA*
1	KEF 1	CUE-120-VG	1,125	1	1,485	0.3	83	0.5	115/60/1	OP	1725	1	9.8

(MARK INFORMATION: QTY, MARK; FAN INFORMATION: MODEL through WEIGHT; MOTOR INFORMATION: SIZE through NEC FLA)

*NEC FLA - Based on table 430.250 or 430.248 of National Electrical Code 2020. Actual motor FLA may vary for sizing thermal overload, consult factory"

KEF 1 : SELECTED OPTIONS AND ACCESSORIES

- Larger Curb Cap Size - 22 Square
- UL/cUL 705 Listed - Supplement SC - "Power Ventilators for Restaurant Exh. Appliances" (Formerly UL 762)
- Switch, NEMA-3R, Toggle,
- Curb Extension-Galv., VCE-22-G15.25, Shipped Loose From Factory
- Hinge, Factory Installed
- High Temp Curb Seal Rated for Continuous Duty at 1500 F (Factory Attached)
- Grease Trap (PN 475538)
- Clean-out Port - Factory Installed
- Aluminum Wheel Material
- Conduit Chase Qty 1



DUCT TYPE	SIZE
STANDARD	16 SQ
FIRE-WRAPPED	8 SQ

DUCT DIMENSIONS ARE LARGEST POSSIBLE DUCT TO FIT THROUGH CURB. CONSULT SYSTEM DESIGN ENGINEER FOR RECOMMENDED DUCT SIZE.

OVERALL HEIGHT MAY BE GREATER DEPENDING ON MOTOR, ADAPTER, AND/OR HINGE BASE.

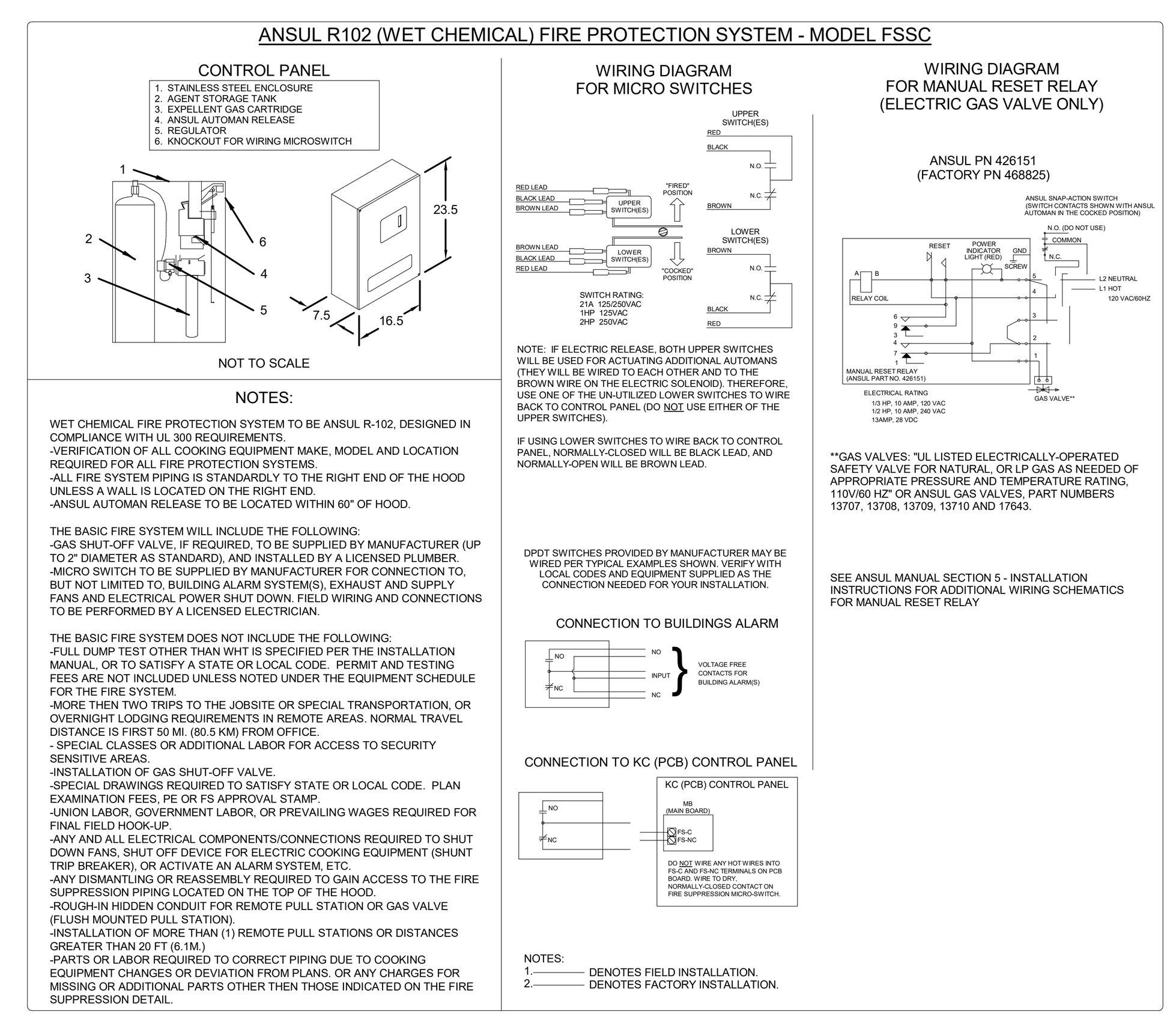
FIRE SYSTEM INFORMATION

MARK	MODEL	LOCATION	FLOW POINTS HOODS	PCU	SUPPLY LINE	DETECTION	MARK(S) PROTECTED BY FIRE SYSTEM
FSS	ANSUL R-102 WET CHEMICAL	REMOTE MOUNTED	5 UTILIZED 5 AVAILABLE		CONTINUOUS	FUSIBLE LINK	HOOD 1 SECTION 1

FIRE SYSTEM OPTIONS AND ACCESSORIES

- FULL INSTALLATION (INCLUDES PRE-PIPED HOOD(S) WITH DETECTION AND FACTORY COORDINATED INSTALL)
- CHROME SLEEVES FOR FACTORY PROVIDED APPLIANCES DROPS - INCLUDED
- METAL BLOW-OFF CAPS - INCLUDED
- GAS VALVE - INCLUDED - ELECTRICAL SHUTOFF VALVE, 2", 110V, 60HZ - PART# 455398
- HOOD SUPPRESSION TANK - INCLUDED - 1.5 GAL. - [(1) 1.5 TANK(S)]
- REMOTE PULL STATION - STANDARD - FIELD INSTALLATION AT SINGLE POINT OF EGRESS

ANSUL R102 (WET CHEMICAL) FIRE PROTECTION SYSTEM - MODEL FSSC

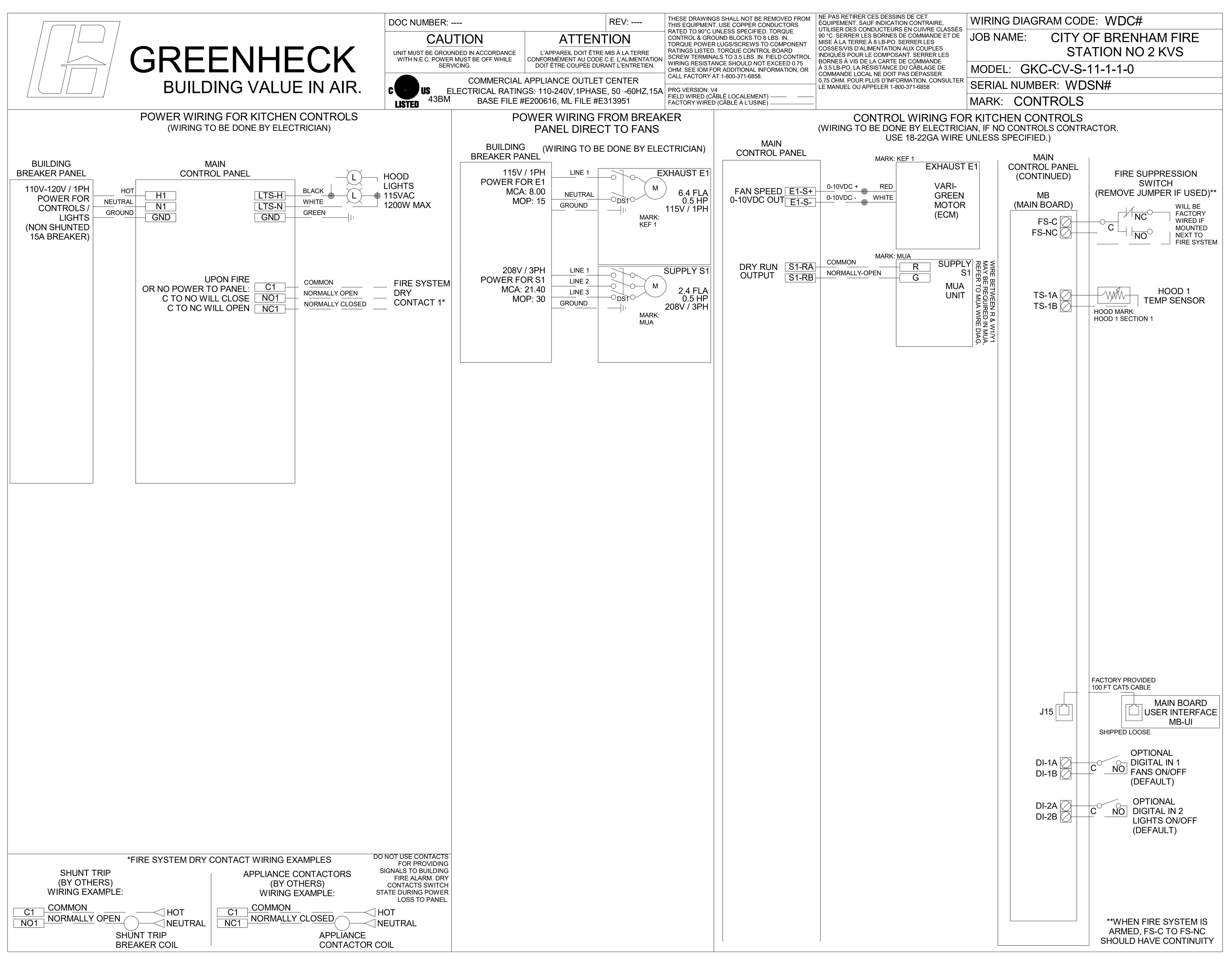


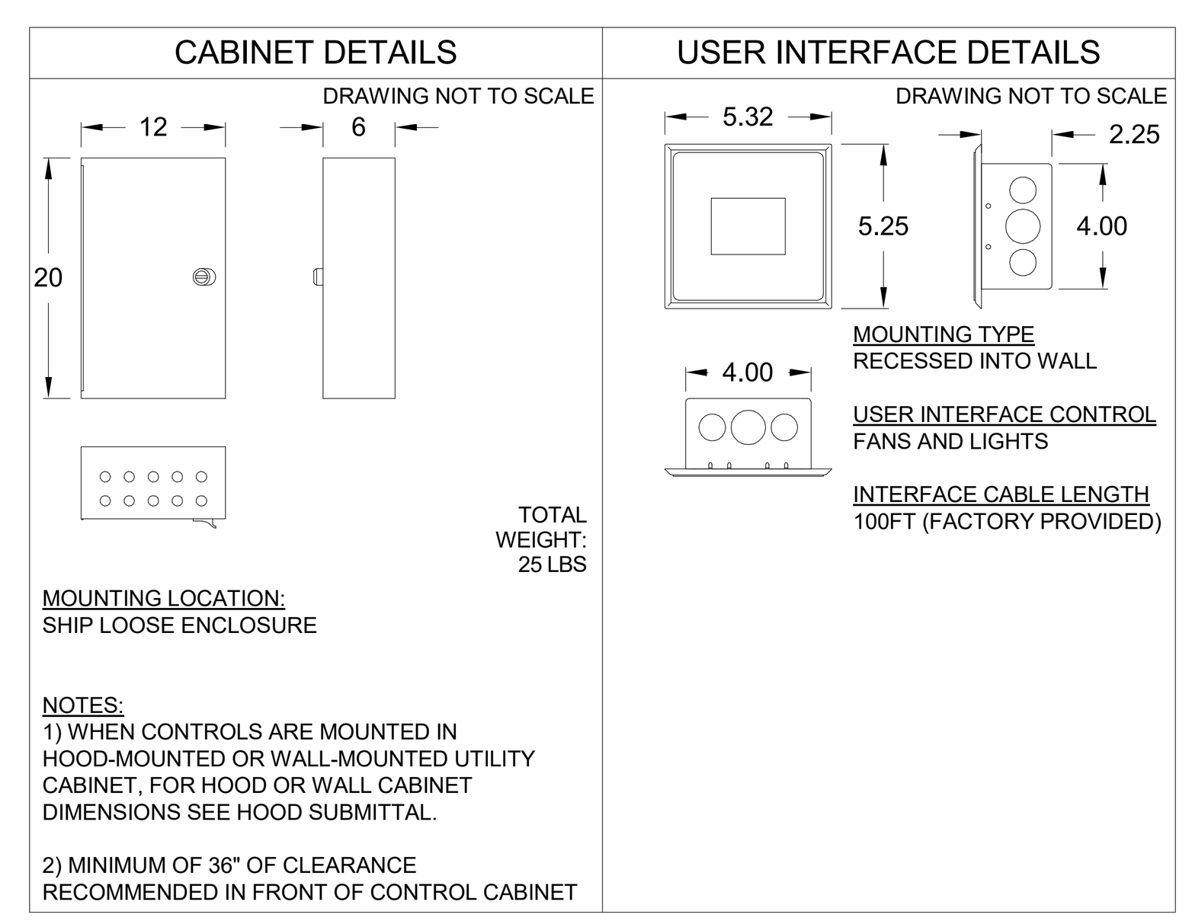
CONTROL INFORMATION

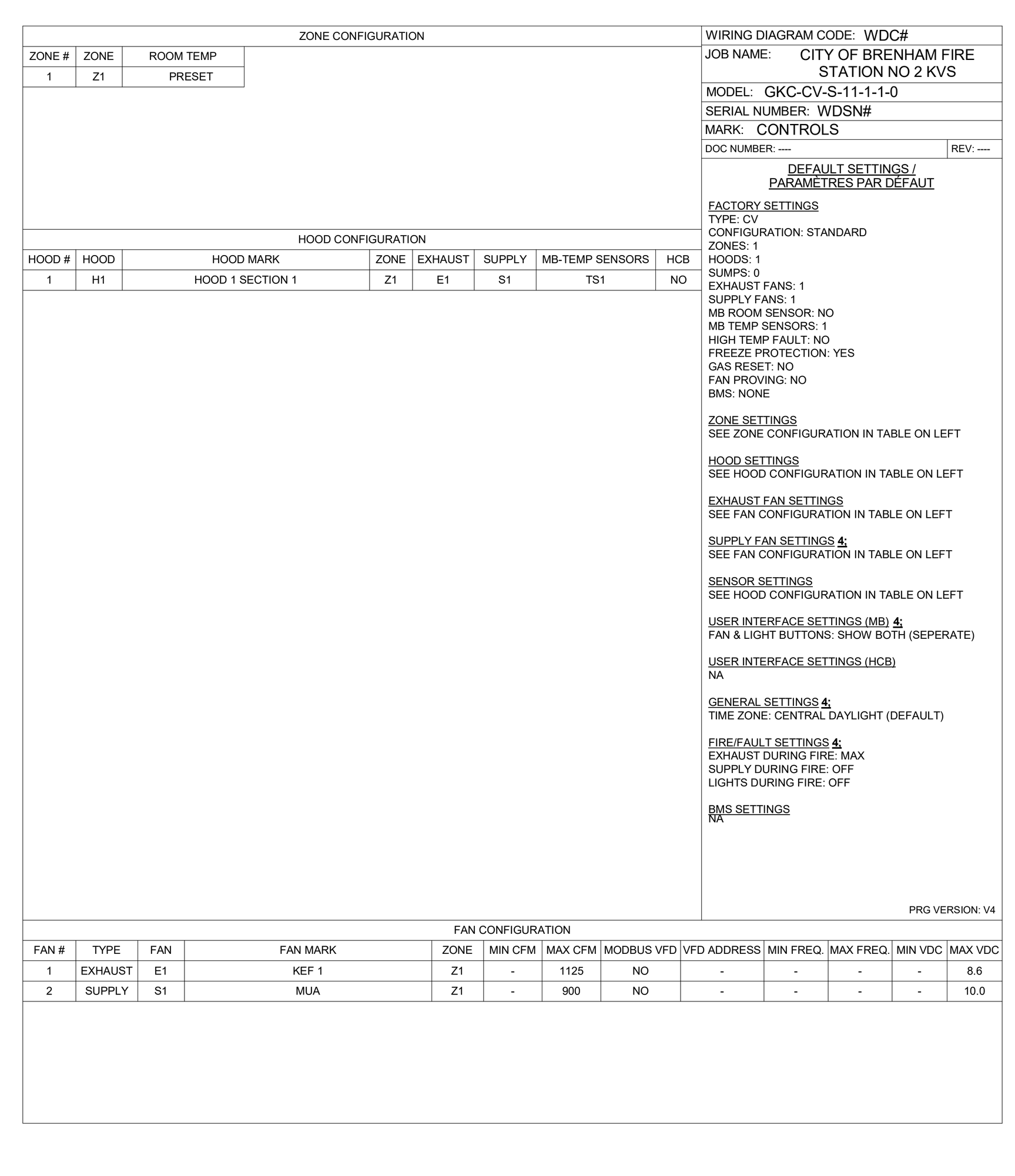
MARK	ELECTRICAL CONTROL PACKAGE MODEL	LOCATION	USER INTERFACE TYPE	LOCATION	FANS CONTROLLED FAN #	TYPE	FAN	FAN MARK	ZONE	CFM	MOTOR HP	MOTOR VOLT	CYCLE	MOTOR PHASE	MOTOR STARTER IN PANEL	VFD IN PANEL
CONTROLS	GKC-CV-S-11-1-1-0	SHIP LOOSE ENCLOSURE	FULL COLOR TOUCHSCREEN	SHIP LOOSE	1	EXHAUST	E1	KEF 1	1	1125	0.5	115	60	1	NO	NO
					2	SUPPLY	S1	MUA	1	900	0.5	208	60	3	NO	NO

CONTROL FEATURES

- HOOD LIGHT CONTROL
- TEMP SENSORS (FACTORY INSTALLED) - QTY. 1
- DRY FIRE CONTACTS - QTY. 1
- LIGHTS OFF DURING FIRE
- EXHAUST MAX DURING FIRE
- SUPPLY OFF DURING FIRE







STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRW ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005
SW | JG | JB | AR | -

TN PN

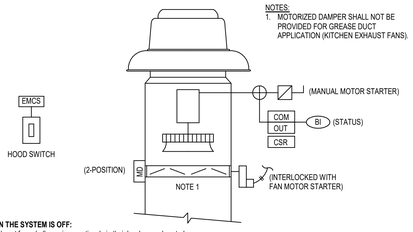
DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

M3.1

KITCHEN HOOD PLAN



SYSTEM OFF - WHEN THE SYSTEM IS OFF:
Manually controlled exhaust fans shall remain operational via their local manual controls.

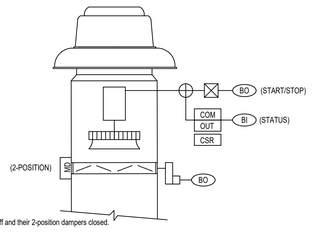
SYSTEM START-UP - SYSTEM START-UP SHALL BE INITIATED:
By an operator command at local manual control.

MANUALLY CONTROLLED EXHAUST FANS: Manually controlled exhaust fans shall utilize two-position motorized damper interlocked with their manual motor starter. The EMCS shall monitor the status of each manually controlled exhaust fan and shall assign the scheduled exhaust numerical CFM value to each fan as indicated on the mechanical equipment schedules.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:
Fan Failure: Commanded on, but the status is off.
Fan in Hand: Commanded off, but the status is on.
Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

3 Manually Controlled Exhaust/Supply Fans - Control Schematic and Sequence of Operations — KEF-1
NOT TO SCALE



SYSTEM OFF - When the system is off:
Automatically controlled exhaust fans shall be off and their 2-position dampers closed.

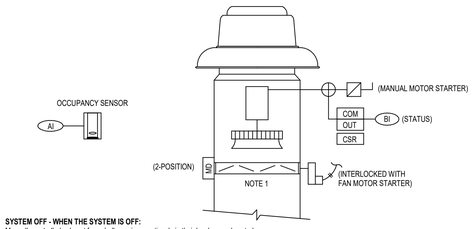
SYSTEM START-UP - System start-up shall be initiated:
By an operator entered manual command at the EMCS.
Automatically by the EMCS based on Night-Setback or Time of Day schedule.

AUTOMATICALLY CONTROLLED EXHAUST FANS: Upon activation of building occupied mode and start-up of the air handling system, the EMCS shall energize all automatically controlled exhaust fans and open their respective two-position motorized dampers. The EMCS shall monitor the status of each automatically controlled exhaust fan and shall assign the scheduled exhaust numerical CFM value to each fan as indicated on the mechanical equipment schedules. Upon activation of the building unoccupied mode, the automatically controlled building exhaust fans shall be de-energized.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:
Fan Failure: Commanded on, but the status is off.
Fan in Hand: Commanded off, but the status is on.
Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

2 Automatically Controlled Exhaust/Supply Fans - Control Schematic and Sequence of Operations — EF-5, EF-7, GEF-2
NOT TO SCALE



SYSTEM OFF - WHEN THE SYSTEM IS OFF:
Manually controlled exhaust fans shall remain operational via their local manual controls.

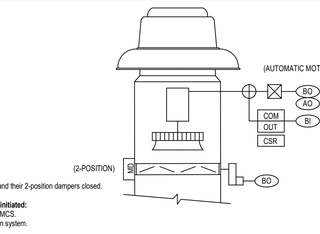
SYSTEM START-UP - SYSTEM START-UP SHALL BE INITIATED:
By an operator command at local manual control.

MANUALLY CONTROLLED EXHAUST FANS: Manually controlled exhaust fans shall utilize two-position motorized damper interlocked with their manual motor starter. The EMCS shall monitor the status of each manually controlled exhaust fan and shall assign the scheduled exhaust numerical CFM value to each fan as indicated on the mechanical equipment schedules.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:
Fan Failure: Commanded on, but the status is off.
Fan in Hand: Commanded off, but the status is on.
Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).

5 Manually Controlled Exhaust/Supply Fans - Control Schematic and Sequence of Operations — EF-1, EF-2, EF-3, EF-4
NOT TO SCALE



SYSTEM OFF - When the system is off:
Automatically controlled exhaust fans shall be off and their 2-position dampers closed.

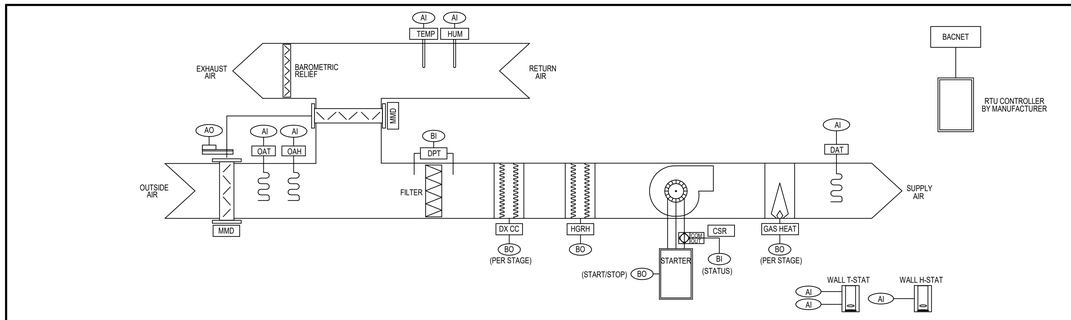
SYSTEM START-UP - System start-up shall be initiated:
By an operator entered manual command at the EMCS.
Automatically by the EMCS based on gas detection system.

AUTOMATICALLY CONTROLLED EXHAUST FANS: Upon receiving an activation signal from the gas detection system, the EMCS shall energize all automatically controlled exhaust fans and open their respective two-position motorized dampers. The EMCS shall monitor the status of each automatically controlled exhaust fan and shall assign the scheduled exhaust numerical CFM value to each fan as indicated on the mechanical equipment schedules. Upon receiving a de-activation signal from the gas detection system, the automatically controlled building exhaust fans shall be de-energized. The exhaust fan shall be provided with a relay to the local emergency switch such that the exhaust fan will provide the scheduled maximum airflow rate when an emegency purge event is activated from the local emergency switch, regardless of gas detection system signal given. The exhaust fan shall operate at its maximum scheduled airflow rate indefinitely until manually overriden or reset to normal operation via the EMCS. Upon receiving an "open door" signal from a roll-up door sensor, the exhaust fan shall de-energize and override any EMCS singals until all roll-up door sensors indicate a "closed door" signal.

Fan Status:
The controller shall monitor the fan status.

Alarms shall be provided as follows:
Fan Failure: Commanded on, but the status is off.
Fan in Hand: Commanded off, but the status is on.
Fan Runtime Exceeded: Fan status runtime exceeds a user definable limit (adj.).
Purge Event: Emergency purge push button activated.

4 Automatically Controlled Exhaust Fans w/ Local Emergency Switch - Control Schematic and Sequence of Operations — GEF-1, GEF-3
NOT TO SCALE



System Off - When the system is off:
The outside air/economizer damper shall be closed.
The return air damper shall be open.
The supply air fan shall be off.
The compressors shall be disabled.
The hot gas reheat valve shall be closed.
The gas burner(s) shall be disabled.
The control loops shall be disabled.

System Startup - System start-up shall be initiated:
By an operator entered manual command at the EMCS.
Automatically by the EMCS based on Pre-Start Mode or Night-Setback Mode.

Pre-Start Mode:
The system shall be enabled automatically by the EMCS based on the Optimal Start/Stop algorithm. Once enabled, the system shall operate per the system Operation section, as detailed below. Operation of the system during Pre-Start Mode shall not include ventilation air. Economizer mode shall be permitted to operate per the System Operation section as detailed below.

Night Setback Mode:
The system shall be enabled automatically by the EMCS when the space temperature drifts outside the active Unoccupied Cooling or Heating Setpoint. Once enabled, the system shall operate per the System Operation section as detailed below. Operation of the system during Night-Setback Mode shall not include ventilation air. Economizer mode shall be permitted to operate per the System Operation section as detailed below.

System Operation - When system start-up has been initiated:
The supply air fan shall start and the unit shall be controlled by one of the following modes:
COOLING MODE: When the space temperature is above the Cooling Setpoint, the supply fan shall operate at the scheduled airflow value and the refrigerant compression shall be staged to maintain the space temperature within +/- 0.5 °F of the Cooling Setpoint.

ECONOMIZER MODE (APPLICABLE FOR RTU-2): When the outside air enthalpy is less than 28.0 btu/lb, the outside air dry bulb temperature is less than 75°F, and there is a call for cooling, the outside air/economizer and return air dampers shall be modulated such that the unit provides 100% outside air for space cooling, and the refrigerant compression shall be staged to maintain the space temperature within +/- 0.5 °F of the Cooling Setpoint. The barometric relief damper integral to the unit shall prevent building over-pressurization. If the outside air enthalpy exceeds 28.0 btu/lb or the outside air temperature exceeds 75°F, or if there is no longer a call for cooling, Economizer Mode shall be disabled.

HEATING MODE: When the space temperature is below the Heating Setpoint, the supply fan shall operate at the scheduled airflow value and the gas heater shall be staged to maintain the space temperature within +/- 0.5 °F of the Heating Setpoint.

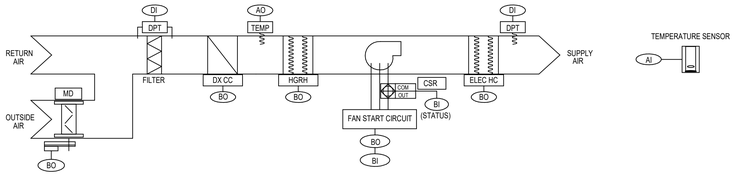
System Setpoints - The setpoints for the system shall be determined as follows:
The Occupied Heating Setpoint shall be set initially at 72 °F (adjustable).
The Occupied Cooling Setpoint shall be set initially at 74 °F (adjustable).
The Unoccupied Heating Setpoint shall be set initially at 55 °F (adjustable).
The Unoccupied Cooling Setpoint shall be set initially at 85 °F (adjustable).
The space humidity high-limit setpoint shall be set initially at 60% RH (adjustable).
The reheat setpoint shall be set initially at 75 °F (adjustable).
The minimum outside air flow rate setpoint shall be set at the scheduled minimum flow rate from the unit schedules on the mechanical drawings.
The maximum outside air flow rate setpoint shall be set at the scheduled maximum flow rate from the unit schedule on the mechanical drawings.
The space carbon dioxide high-limit setpoint be set to 1000 ppm (adj).
The air filter pressure differential high-limit shall be set at 1.0 in.wc. (adj).

System Shutdown - System shutdown shall be initiated:
By operator entered manual command at the EMCS.
Automatically by the EMCS based on Night-Setback or Time of Day schedule.
Automatically by supply fan current sensor status failure.

System Alarms - The EMCS shall generate an alarm if:
If the space temperature is outside the active low or high limits by more than 2°F for 5 minutes (adj).
If the space humidity level exceeds its high-limit for more than 20 minutes (adj).
If the space carbon dioxide level exceeds its high-limit for more than 20 minutes (adj) or the space carbon dioxide level exceeds the high-limit by 10% or more.
If the filter differential pressure exceeds the trip point.
If the current sensor relay indicates a supply fan failure status.
All alarms shall be inhibited when the supply fan is not operating except the space temperature alarms. The alarms, except the fan failure and the space temperature alarms, shall remain inhibited following startup of the unit for 2 minutes.

Notes:
The equipment manufacturer's unit controller shall include controls to perform all equipment functions. The EMCS Contractor shall integrate with the unit controller via BACnet for detailed setpoint adjustments, unit monitoring, alarm inputs, and equipment scheduling.

1 Direct Expansion Single Zone Constant Volume Rooftop Unit w/ Gas Heat, Econ., De-humidification - Control Schematic and Sequence of Operations
NOT TO SCALE



System Off - When the system is off:
The supply air fan shall be off.
The outside air damper shall be closed.
The DX cooling coil shall be disabled.
The electric heating coils shall be disabled.
The control loops shall be disabled.

System Start-up - System start-up shall be initiated:
By an operator entered manual command at the EMCS.
Automatically by the EMCS based on Time of Day Schedule.

System Operation - When system start-up has been initiated, the following sequences shall be implemented:
The fan coil unit shall be integrated with the EMCS to monitor fan status, schedule run times, and to adjust space temperature setpoints. The outside air motorized isolation damper shall open.

COOLING MODE: When the space temperature is above the Cooling Setpoint, the supply fan shall be energized and DX cooling coil shall be staged to maintain the space temperature within +/- 0.5 °F of the Cooling Setpoint.
HEATING MODE: When the space temperature is below the Heating Setpoint, the supply fan shall be energized and the electric heating coil shall be staged to maintain the space temperature within +/- 0.5 °F of the Heating Setpoint.

System Setpoints - The setpoints for the system shall be set as follows:
The Cooling Setpoint shall be set initially at 75 °F (adjustable).
The Heating Setpoint shall be set initially at 70 °F (adjustable).
The design airflow rates shall be set at the values given in the Mechanical Drawings.

System Alarms - The EMCS shall generate an alarm as follows:
If the space temperature is 5 °F (adj.) above the cooling setpoint.
If the space temperature is 5 °F (adj.) below the heating setpoint.
All alarms shall be inhibited when the supply fan is not operating except the space temperature alarms. The alarms, except the fan failure and the space temperature alarms, shall remain inhibited following startup of the unit for 2 minutes.

7 Fan Coil Unit - Control Schematic and Sequence of Operations — FCU-1, FCU-2
NOT TO SCALE

Outdoor Air Conditions
The sensors shall be mounted in an area on the north side of the building where the representative temperature and humidity can be monitored, both shall have sun shields. Based on the outdoor air temperature and humidity the EMCS shall calculate the outdoor air enthalpy, wet bulb and dew point temperatures. These outdoor air conditions shall be broadcast as global data points for use by other control programs. These shall be displayed on all major air and water systems graphics.

Electrical Switchgear Power Meter Monitoring
The EMCS shall provide BACnet/IP or Modbus TCP communications to the interface modules to monitor the building power usage. The interface modules shall be provided by the switchgear manufacturer per Division 26. The EMCS shall monitor building kW, kWH, kVAR, Power Factor, 3-Phase Amps and Volts, along with all variables available via this interface. The EMCS shall provide a graphic representation to show the current usage, monthly usage, year to date usage, and time and date of the highest peak demand for the month and year. Demand thresholds may be set to adjust setpoints and shed loads in order to reduce peak consumption.

Electrical Branch Circuit Power Meter Monitoring
The EMCS shall provide BACnet/IP or Modbus TCP communications to the power monitor. The power monitor locations shall be shown on the Division 26 drawings. The EMCS shall monitor kW, kWH, kVAR, Power Factor, 3-Phase Amps and Volts, along with all variables available via this interface. The EMCS shall provide a graphic representation to show the current usage, monthly usage, year to date usage, and time and date of the highest peak demand for the month and year. Demand thresholds may be set to adjust setpoints and shed loads in order to reduce peak consumption.

Intelligent Lighting Controls Integration
The EMCS shall provide BACnet/IP communications to the Lighting Control System interface module to monitor and control the building and site lighting. The interface shall be provided by the manufacturer per Division 26. The EMCS shall monitor and control the lighting circuits as shown on the Electrical Drawings.

Emergency Generator Monitoring
The EMCS shall monitor the run status and alarm output of the generator. The EMCS shall display the values and trend log all Change of State (COS) events. The EMCS shall report alarms to the computers, pagers, and/or text message compatible devices designated by the Owner.

Sump Pumps and Sump Pits Monitoring
The EMCS shall monitor the run status of the pumps and alarm outputs on the water level indicators. The EMCS shall display the values and trend log all Change of State (COS) events. The EMCS shall report alarms to the computers, pagers, and/or text message compatible devices designated by the Owner.

Building Domestic Water Pump Monitoring
The EMCS shall provide BACnet/IP or MS/TP communications to the interface module to monitor the pump package. The interface module shall be provided by the manufacturer per Division 22. The EMCS shall monitor all variables available via this interface. The EMCS shall provide a graphic representation to show the current values. The EMCS shall report alarms to the computers, pagers, and/or text message compatible devices designated by the Owner.
OR (if no communication interface is provided by pump vendor.)
The EMCS shall monitor the run status of the pumps and alarm outputs. The EMCS shall display the values and trend log all Change of State (COS) events. The EMCS shall report alarms to the computers, pagers, and/or text message compatible devices designated by the Owner.

IDF and MDF Room Monitoring
The EMCS shall monitor the space temperature and humidity in the IDF and MDF rooms. The primary cooling for IDF and MDF rooms will be supplied by the packaged computer room units. The EMCS shall report high/low temperature/humidity alarms to the computers, pagers, and/or text message compatible devices designated by the Owner. Alarms shall be sent if the space conditions deviate from the following, temperature between 60 °F and 80 °F (adj), humidity between 40% RH and 70% RH (adj), for more than 10 minutes.

HVAC Ventilation Emergency Shutdown Switch
A mushroom button type, local override switch shall be installed to deactivate the building's ventilation and exhaust systems in case of emergency. All 100% outside air conditioning units or outside air supply fans shall be deactivated and all outside air dampers shall be closed. All exhaust and relief fans shall be deactivated and their associated isolation dampers shall be closed. Once depressed, the switch must be manually reset to allow the ventilation and exhaust systems to resume normal operation. The final location of the switch shall be determined by the Owner.

6 MISCELLANEOUS SYSTEMS
NOT TO SCALE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 203
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234

SW	JG	JB	AR	-

TN PN

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRVV PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

M4.1
MECHANICAL CONTROLS

PACKAGED DX ROOF TOP UNIT SCHEDULE

MARK	RTU-1	RTU-2	RTU-3	RTU-4	RTU-5
SERVES	LOBBY	DAYROOM / KITCHEN	LT OFFICE	PLAN WEST SLEEPING ROOMS	PLAN EAST SLEEPING ROOMS
DUCT CONFIGURATION	VERTICAL DISCHARGE	VERTICAL DISCHARGE	VERTICAL DISCHARGE	VERTICAL DISCHARGE	VERTICAL DISCHARGE
DESIGN SUPPLY AIR (CFM)	1,450	3,090	1,200	1,100	1,200
DESIGN OUTDOOR AIR (CFM)	120	150	165	220	260
IEER (SEER2)	(13.4)	(13.4)	(13.4)	(13.4)	(13.4)
EXT. S.P. (IN. W.G.)	0.50	0.50	0.50	0.50	0.50
FAN MOTOR HORSEPOWER	0.6	1.8	0.5	0.3	0.5
FAN TYPE	ECM	ECM	ECM	ECM	ECM
FAN DRIVE	DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
COOLING DATA					
AMBIENT AIR (°F)	105.0	105.0	105.0	105.0	105.0
TOTAL COOLING CAPACITY (MBH)	41.6	84.5	37.6	27.4	41.9
TOTAL SENSIBLE CAPACITY (MBH)	33.5	68.9	29.6	28.9	32.1
EAT DB/WB (°F)	76.4 / 63.6	75.6 / 63.2	77.8 / 64.4	79.3 / 65.2	79.8 / 65.4
LAT DB/WB (°F)	55.0 / 54.0	55.0 / 54.0	55.0 / 54.0	55.0 / 54.0	55.0 / 54.0
HEATING DATA					
HEATING TYPE	NATURAL GAS	NATURAL GAS	NATURAL GAS	NATURAL GAS	NATURAL GAS
HEATING CAPACITY INPUT (MBH)	67.0	125.0	67.0	67.0	67.0
HEATING CAPACITY (MBH)	28.4	56.2	23.2	26.9	26.9
EAT DB (°F)	66.9	68.2	63.8	62.4	60.1
LAT DB (°F)	85.0	85.0	85.0	85.0	85.0
ELECTRICAL DATA					
VOLTS/PHASE/HERTZ	208 / 3 / 60	208 / 3 / 60	208 / 3 / 60	208 / 3 / 60	208 / 3 / 60
MCA	26.0	39.0	26.0	20.0	26.0
MOCP	30.0	41.0	30.0	30.0	30.0
MANUFACTURER	CARRIER	CARRIER	CARRIER	CARRIER	CARRIER
MODEL NO.	48FCDB05J2M5-3W1C0	48FCDN08J2M5-8F7F0	48FCDB05J2M5-3F7F0	48FCDB04J2M5-3F7F0	48FCDB05J2M5-3F7F0
OPERATING WEIGHT (LBS)	997.3	1,065.0	752.0	691.0	752.0
NOTES	1,2,3,4,5,6,7,8,10,12	1,2,3,4,5,6,7,8,9,10,11,12	1,2,3,4,5,6,7,8,10,12	1,2,3,4,5,6,7,8,10,12	1,2,3,4,5,6,7,8,10,12

NOTES:
1. EXTERNAL STATIC PRESSURE DOES NOT ACCOUNT FOR LOSSES DUE TO COIL(S), FILTERS, HOUSING, NOR ACCESSORIES.
2. PROVIDE UNIT WITH OUTDOOR AIR INTAKE HOOD WITH MODULATING MOTORIZED DAMPER.
3. PROVIDE UNIT WITH SINGLE POINT ELECTRICAL CONNECTION.
4. PROVIDE FLOAT SWITCH IN PRIMARY DRAIN PAN TO DE-ENERGIZE THE UNIT WHEN PRIMARY DRAIN LINE BECOMES RESTRICTED.
5. PROVIDE UNITS WITH MINIMUM MERV 13 FILTERS.
6. PROVIDE UNIT CONTROLLER BY MANUFACTURER. PROVIDE CONTROLLER WITH BACNET INTERFACE CARD FOR INTEGRATION WITH EMCS.
7. PROVIDE UNIT WITH HOT GAS REHEAT FOR HUMIDITY CONTROL.
8. PROVIDE UNIT WITH CONDENSER HAIL GUARD AND 14" PREFABRICATED ROOF CURB.
9. PROVIDE UNIT WITH COMPARATIVE ENTHALPY ECONOMIZER AND BAROMETRIC RELIEF.
10. PROVIDE UNIT WITH INTEGRAL DISCONNECT SWITCH.
11. PROVIDE UNIT WITH DUCT MOUNTED SMOKE DETECTORS IN SUPPLY DUCTWORK FOR ALL UNITS DISCHARGING IN EXCESS OF 2,000 CFM.
12. PROVIDE UNIT WITH A MINIMUM SHORT CIRCUIT CURRENT RATING (SCCR) OF 10,000 AIC.

DUCTLESS SPLIT SYSTEM SCHEDULE

OUTDOOR UNIT MARK	**DSCU-1**
SERVES	DS-1
GRAND TOTAL COOLING (BTUH)	24,000
GRAND TOTAL HEATING (BTUH)	-
AMBIENT TEMP. (°F)	105
STEPS OF CAPACITY	1
VOLTS/PHASE/HERTZ	208/1/60
MCA	19.0
MOCP	26.0
SEER2	21.3
REFRIGERANT TYPE	R-410A
MANUFACTURER	MITSUBISHI
MODEL NUMBER	TRUYA0241HA70NA
UNIT WEIGHT (LBS)	151.0
INDOOR UNIT MARK	**DS-1**
SERVES	COMMS
UNIT TYPE	WALL MOUNTED
COOLING CAPACITY (BTUH)	18,600
HEATING CAPACITY (BTUH)	-
VOLTS/PHASE/HERTZ	208/1/60
COOLING POWER CONSUMPTION (WATTS)	1,960
COOLING OUTPUT RANGE (BTUH)	14,000
HEATING POWER CONSUMPTION (WATTS)	-
HEATING OUTPUT RANGE (BTUH)	-
SUPPLY AIR CFM (DRY AIR)	775
MANUFACTURER	MITSUBISHI
MODEL NUMBER	TPKA0A0241KA80A
UNIT WEIGHT (LBS)	46.0
NOTES	1,2,3,4,5,6,7

NOTES:
1. INDOOR UNITS RECEIVE POWER FROM OUTDOOR UNITS THRU FIELD SUPPLIED INTERCONNECTED WIRING.
2. INSTALL PER MANUFACTURER'S SPECIFICATIONS.
3. REFRIGERANT LINES TO BE SIZED BY MANUFACTURER.
4. PROVIDE UNIT WITH MANUFACTURER THERMOSTAT.
5. PROVIDE WITH BACNET INTERFACE TO INTERLOCK UNIT CONTROLS WITH EMCS FOR SCHEDULING, MONITORING, AND ALARMS.
6. PROVIDE UNIT WITH 1 1/4" PVC CONDENSATE DRAIN LINE DOWN TO FUNNEL DRAIN AT FLOOR.
7. UNIT SHALL STAY ENERGIZED EVEN DURING FREEZING OUTDOOR TEMPERATURES.

HVLS FAN SCHEDULE

MARK	HVLS-1	HVLS-2	HVLS-3	HVLS-4
SERVES	PATIO	PATIO	APPARATUS BAY	EXERCISE
TYPE/DRIVE	CIRCULATION	CIRCULATION	CIRCULATION	CIRCULATION
FAN SIZE (DIA.)	6'	6'	14'	6'
POWER	31.6 (W)	31.6 (W)	1.5	31.6 (W)
RPM (MAX.)	170	170	109	170
VOLTS/PHASE/HERTZ	208 / 1 / 60	208 / 1 / 60	208 / 3 / 60	208 / 3 / 60
WEIGHT (LBS.)	35.7	35.7	209.0	35.7
MANUFACTURER	BIG ASS FANS	BIG ASS FANS	BIG ASS FANS	BIG ASS FANS
MODEL NUMBER	i6	i6	POWERFOIL 8	i6
NOTES	1,2,4,5	1,2,4,5	1,3,4	1,2,4,5

NOTES:
1. PROVIDE FAN WITH STANDARD MOUNTING HARDWARE. MOUNT FAN ACCORDING TO MANUFACTURER'S SPECIFICATIONS AND INSTALLATION INSTRUCTIONS.
2. PROVIDE FAN WITH DIRECT DRIVE MOTOR CAPABLE OF 0-100% SPEED MODULATION.
3. PROVIDE FAN WITH WIRED WALL MOUNT CONTROLLER.
4. COLOR SHALL BE APPROVED BY ARCHITECT PRIOR TO ORDERING.
5. PROVIDE FAN WITH BLUETOOTH WALL CONTROLLER.

GAS UNIT HEATER SCHEDULE

MARK	GUH-1	GUH-2	GUH-3	GUH-4
SERVES	APPARATUS BAYS	APPARATUS BAYS	APPARATUS BAYS	APPARATUS BAYS
INPUT (MBH)	30.0	30.0	30.0	30.0
MAX. OUTPUT (MBH)	24.6	24.6	24.6	24.6
CFM	456	456	456	456
TYPE OF FUEL	NATURAL GAS	NATURAL GAS	NATURAL GAS	NATURAL GAS
GAS INLET (INCHES)	1/2	1/2	1/2	1/2
VENT CONNECTION (INCHES)	4	4	4	4
FAN MOTOR HP	0.06	0.06	0.06	0.06
VOLTS / PHASE / HERTZ	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60
MANUFACTURER	REZNOR	REZNOR	REZNOR	REZNOR
MODEL	UDXC-30	UDXC-30	UDXC-30	UDXC-30
UNIT WEIGHT (LBS)	57.0	57.0	57.0	57.0
NOTES	1,2,3,4	1,2,3,4	1,2,3,4	1,2,3,4

NOTES:
1. INSTALL PER MANUFACTURER'S SPECIFICATIONS.
2. PROVIDE WITH HANGER KIT, OUTSIDE COMBUSTION AIR INLET KIT, AND VENT CAP.
3. PROVIDE WITH UNIT-MOUNTED THERMOSTAT AND MANUAL SHUT-OFF SWITCH. HEATERS SHALL BE ENERGIZED WHEN TEMPERATURE DROPS BELOW 45°F (ADJ.).
4. UNIT SHALL BE INTERLOCKED TO THE APPARATUS BAY DOORS' OPEN/CLOSE SENSOR. UNIT SHALL DE-ENERGIZE UPON RECEIVING AN "OPEN" SIGNAL FROM SENSOR.

GRAVITY HOOD SCHEDULE

MARK	IAH-1	RAH-1
SERVES	FCU-2	EF-2 & EF-3
DESIGN AIRFLOW (CFM)	105	250
MAX. P.D. (IN. W.G.)	0.06	0.05
TYPE	INTAKE	EXHAUST
THROAT WIDTH (IN.) X HEIGHT (IN.)	8 X 8	8 X 8
HOOD LENGTH (IN.) X WIDTH (IN.) X HEIGHT (IN.)	27 X 22 X 26	20.5 X 20.5 X 19.25
MODEL	FGI-8X8	GRSR-8
MANUFACTURER	GREENHECK	GREENHECK
UNIT WEIGHT (LBS.)	49.33	9.33
NOTES	1,2	3,4

NOTES:
1. PROVIDE WITH PREFABRICATED 12" ROOF CURB, 2" WASHABLE ALUMINUM AIR FILTER AND INTEGRAL ALUMINUM BIRD SCREEN.
2. PROVIDE WITH MOTORIZED DAMPER INTERLOCKED WITH ASSOCIATED MECHANICAL EQUIPMENT SUCH THAT DAMPER IS OPEN WHEN UNIT IS ENERGIZED AND SHUT WHEN UNIT IS DE-ENERGIZED. DAMPER TO BE INSTALLED IN ACCESSIBLE LOCATION.
3. PROVIDE WITH PREFABRICATED 12" ROOF CURB AND INTEGRAL ALUMINUM BIRD SCREEN.
4. PROVIDE WITH BAROMETRIC RELIEF DAMPER WITH ADJUSTABLE COUNTERBALANCE WEIGHT INITIALLY SET TO 0.10 IN. W.G. (ADJ.)

ELECTRIC UNIT HEATER SCHEDULE

MARK	EUH-1
SERVES	FIRE RISER
CFM	400
CAPACITY (KW)	3.3
VOLTS/PHASE/HERTZ	208 / 3 / 60
MCA (AMPS)	9.17
MANUFACTURER	REDD-I
MODEL NUMBER	F2F5103N
UNIT WEIGHT (LBS)	25
NOTES	1,2,3

NOTES:
1. INSTALL PER MANUFACTURER'S SPECIFICATIONS.
2. MOUNT UNIT HEATER 12" BELOW STRUCTURE.
3. PROVIDE THERMOSTAT TO CONTROL HEATER. MOUNT AT SAME ELEVATION AS LIGHT SWITCHES. THERMOSTAT SHALL ENERGIZE HEATER WHEN TEMPERATURE REACHES 50°F (ADJ.).

AIR DEVICE SCHEDULE

MARK	MFR. & MODEL	TYPE	REMARKS
A	TITUS TMS-AA	LOUVERED FACE SUPPLY AIR DIFFUSER	24"x24" FACE, ALUMINUM CONSTRUCTION WITH FRAME TO MATCH THE CEILING TYPE.
B	TITUS PAR-AA	PERFORATED FACE RETURN AIR GRILLE	24"x24" FACE, ALUMINUM CONSTRUCTION WITH FRAME TO MATCH THE CEILING TYPE. PROVIDE 22"x22" NECK UNLESS OTHERWISE NOTED. PROVIDE O.B.D. FOR DUCTED EXHAUST.
C	TITUS 300FL	SIDEWALL SUPPLY AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR SURFACE MOUNT. 3/4" BLADE SPACING, DOUBLE DEFLECTION WITH FRONT BLADES PARALLEL TO LONG DIMENSION. PROVIDE O.B.D.
D	TITUS 350FL	SIDEWALL RETURN AIR GRILLE	ALUMINUM CONSTRUCTION WITH FRAME FOR SURFACE MOUNT. 3/4" BLADE SPACING, 35° DEFLECTION WITH BLADES PARALLEL TO LONG DIMENSION. PROVIDE O.B.D. FOR DUCTED EXHAUST.

NOTES:
1. REFER TO ARCHITECTURAL DRAWINGS FOR FINISH.
2. REFER TO MECHANICAL FLOOR PLAN FOR NECK SIZES.

DX FAN COIL UNIT SCHEDULE

MARK	FCU-1	FCU-2
SERVES	BUNKER	EXERCISE
SUPPLY AIR (CFM)	600	940
OUTSIDE AIR (CFM)	70	105
EXT. S.P. (IN. W.G.)	0.5	0.5
FAN MOTOR HORSEPOWER	1/2	1/2
FAN MOTOR CONTROL (VFD OR STARTER)	STARTER	STARTER
COOLING EAT DB/WB (°F)	77.3 / 64.2	77.1 / 64.0
COOLING LAT DB/WB (°F)	55.0 / 54.0	55.0 / 54.0
TOTAL COOLING CAPACITY (MBH)	18.3	28.2
SENSIBLE COOLING CAPACITY (MBH)	14.5	22.4
HEATING TYPE	ELECTRIC	ELECTRIC
HEATING EAT DB (°F)	65.6	65.8
HEATING LAT DB (°F)	85.0	85.0
HEATING CAPACITY (KW)	3.7	5.7
NO. OF HEATING STAGES	2	2
MCA / MOCP	27.5 / 30.0	43.3 / 45.0
VOLTS/PHASE/HERTZ	208 / 1 / 60	208 / 1 / 60
MANUFACTURER	CARRIER	CARRIER
MODEL NO.	FT4BNXB24L00	FT4BNXC36L00
UNIT WEIGHT (LBS)	124.0	146.0
NOTES	1,2,3	1,2,3,4

NOTES:
1. EXTERNAL STATIC PRESSURE DOES NOT ACCOUNT FOR LOSSES DUE TO COIL(S), FILTERS, HOUSING, NOR ACCESSORIES.
2. UNIT SHALL BE SUSPENDED FROM STRUCTURE ABOVE. PROVIDE WITH VIBRATION ISOLATION PER SPECIFICATIONS.
3. PROVIDE SECONDARY DRAIN PAN WITH FLOAT SWITCH TO DE-ENERGIZE UNIT WHEN PRIMARY DRAIN BECOMES RESTRICTED.
4. UNIT SHALL BE INTERLOCKED WITH ROLLING DOOR'S OPEN/CLOSE SENSOR. UNIT SHALL DE-ENERGIZE UPON RECEIVING AN "OPEN" SIGNAL FROM THE SENSOR.

AIR COOLED CONDENSING UNIT SCHEDULE

MARK	ACCU-1	ACCU-2
SERVES	FCU-1	FCU-2
TOTAL COOLING CAPACITY (MBH)	18.3	28.2
AMBIENT TEMP. (°F)	105	105
STEPS OF CAPACITY	2	2
SEER2	16.0	16.0
VOLTS/PHASE/HERTZ	208 / 3 / 60	208 / 3 / 60
MCA	14.1	19.8
MOCP	20.0	35.0
MANUFACTURER	CARRIER	CARRIER
MODEL NUMBER	24TPA724W003	24TPA736W003
OPERATING WEIGHT (LBS.)	189.0	227.0
NOTES	1,2,3,4	1,2,3,4

NOTES:
1. INSTALL PER MANUFACTURER'S SPECIFICATIONS.
2. REFRIGERANT LINES TO BE SIZED BY MANUFACTURER.
3. PROVIDE WITH CONDENSER COIL HAIL GUARD.
4. PROVIDE WITH LOW AMBIENT HEAD PRESSURE CONTROL.

FAN SCHEDULE

MARK	EF-1	EF-2	EF-3	EF-4	EF-5	EF-6	EF-7	GEF-1	GEF-2	GEF-3
SERVES	BATHROOM 114	BATHROOM 115	BATHROOM 117	PUBLIC RR 102	JAN 113	SHOP/SCBA	BUNKER GEAR	APPARATUS BAYS	APPARATUS BAYS	APPARATUS BAYS
TYPE/DRIVE	CEILING/DIRECT	CEILING/DIRECT	CEILING/DIRECT	CEILING/DIRECT	CEILING/DIRECT	INLINE/DIRECT	INLINE/DIRECT	INLINE/DIRECT	INLINE/DIRECT	INLINE/DIRECT
INTERLOCK	OCC. SENSOR	OCC. SENSOR	OCC. SENSOR	OCC. SENSOR	BREAKER	BREAKER	BREAKER	GAS DETECTION SYSTEM	BREAKER	GAS DETECTION SYSTEM
CFM (MIN./MAX.)	125	125	125	90	75	450	330	1,295	200	1,295
EXT. S.P. (IN. W.G.)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
HORSEPOWER	18 (W)	18 (W)	18 (W)	30 (W)	17 (W)	60 (W)	68 (W)	3/4	27 (W)	3/4
FAN SPEED (RPM)	977	977	977	650	950	933	1,267	900	1,013	900
SONES (MAX.)	2.5	2.5	2.5	2.5	0.9	0.8	2.0	4.6	1.3	4.6
VOLTS/PHASE/HERTZ	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60	115 / 1 / 60
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK	GREENHECK
MODEL NUMBER	SP-A390-VG	SP-A390-VG	SP-A390-VG	SP-B110ES	SP-A110	CSP-A700-VG	CSP-A390-VG	SQ-140-VG	CSP-A390-VG	SQ-140-VG
UNIT WEIGHT (LBS)	24.0	24.0	24.0	10.0	17.0	39.0	24.0	90.0	24.0	90.0
NOTES	1,3,5,7,9	1,3,5,7,9	1,3,5,7,9	1,5,7,9	1,5,7	1,2,3,4	1,2,3,4	1,2,3,4,10,11	1,2,3,4	1,2,3,4,10,11

NOTES:
1. EXTERNAL STATIC PRESSURE DOES NOT ACCOUNT FOR LOSSES DUE TO FILTERS, HOUSING, NOR ACCESSORIES.
2. PROVIDE WITH MOTORIZED DAMPER INTERLOCKED WITH FAN OPERATION SUCH THAT DAMPER SHALL OPEN WHEN FAN IS ENERGIZED AND SHUT WHEN FAN IS DE-ENERGIZED. DAMPER SHALL BE INSTALLED IN ACCESSIBLE LOCATION.
3. PROVIDE WITH DIRECT DRIVE, ELECTRONICALLY COMMUTATED FAN MOTOR (ECM).
4. FAN SHALL BE SUSPENDED FROM STRUCTURE ABOVE. PROVIDE WITH VIBRATION ISOLATORS.
5. PROVIDE WITH FAN MOUNTED MOTOR RATED TOGGLE SWITCH.
6. FAN SHALL BE HARDWIRE INTERLOCKED WITH ASSOCIATED WALL/HOOD SWITCH.
7. PROVIDE WITH MANUFACTURER'S ROOF CAP, GREENHECK MODEL RCC-7 OR SIMILAR.
8. PROVIDE WITH PRE-FABRICATED ROOF CURB, VENTED CURB EXTENSION, DRAIN CONNECTION, GREASE TRAP, HEAT BAFFLE, HINGING KIT, AND WEATHERPROOF COMBINATION STARTER DISCONNECT SWITCH.
9. FAN SHALL BE HARDWIRE INTERLOCKED WITH ASSOCIATED OCC. SENSOR.
10. FAN SHALL BE INTERLOCKED WITH ALERTING SYSTEM AND START THE ON-DELAY START SEQUENCE UPON RECEIVING AN ALERT FROM GAS DETECTION SYSTEM OR LOCAL EMERGENCY SWITCH.
11. FAN SHALL HAVE AN ON-DELAY START. FAN SHALL REMAIN OFF FOR 3 MINUTES THEN START. FAN SHALL RUN FOR 10 MINUTES, THEN DE-ENERGIZE. IF ANOTHER CALL COMES IN DURING THIS SEQUENCE FAN SHALL RE-START AT ON-DELAY AND CONTINUE.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

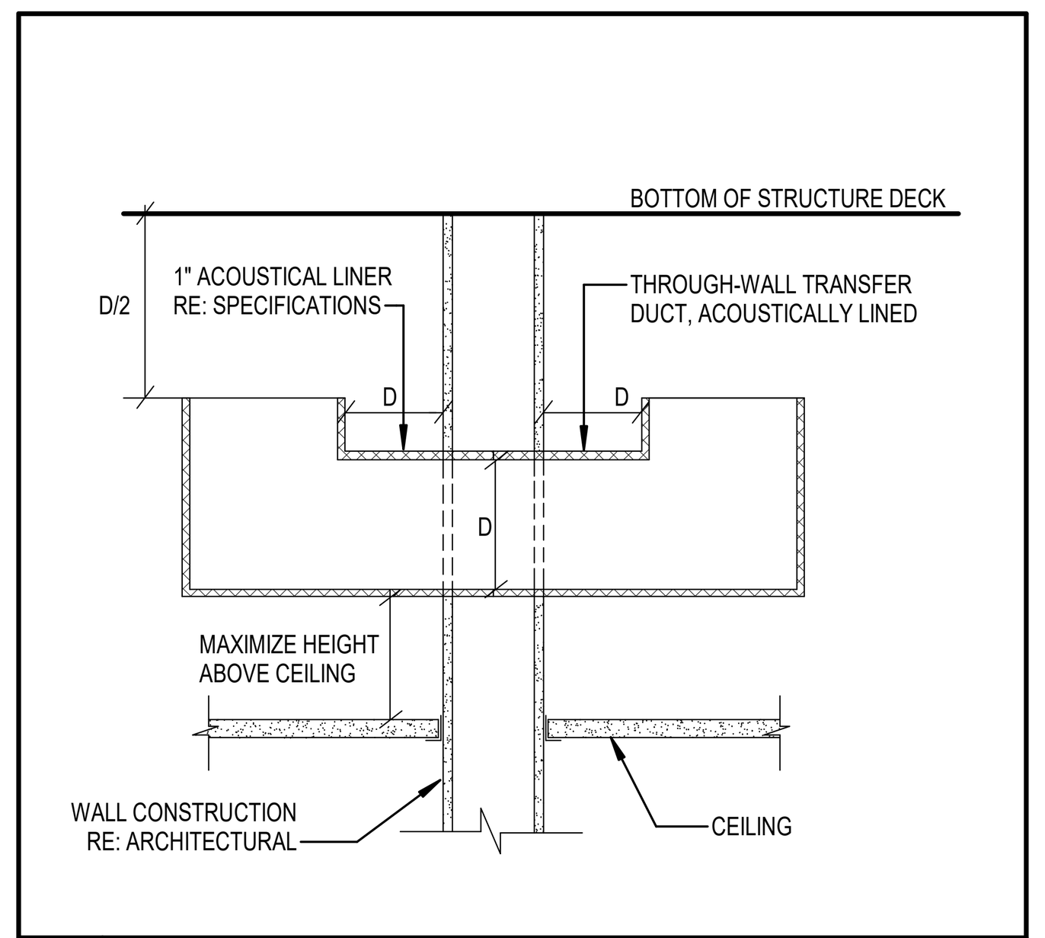
DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
TBPLS Firm Registration No. 10194

NO.	REVISION	DATE
SW	JCS	10/24/2024
JB	DBR	
AR	DBR	
-		

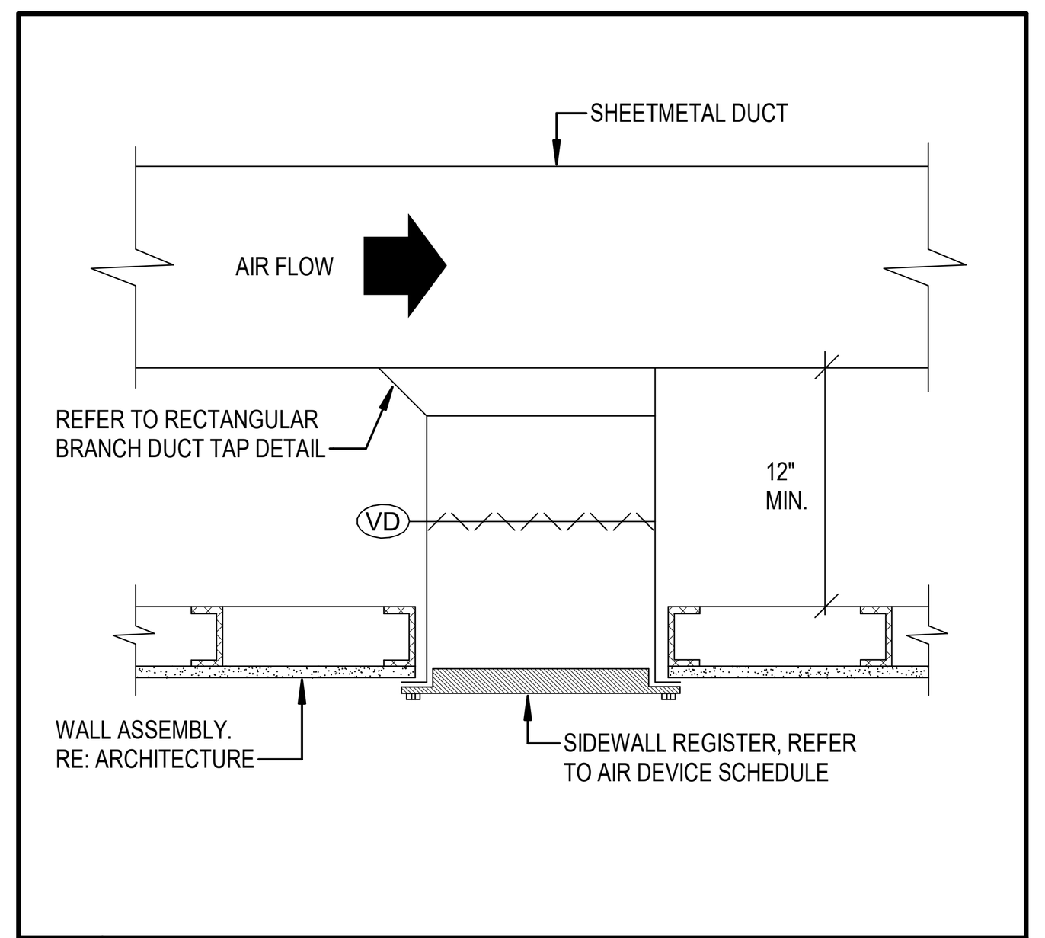
DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

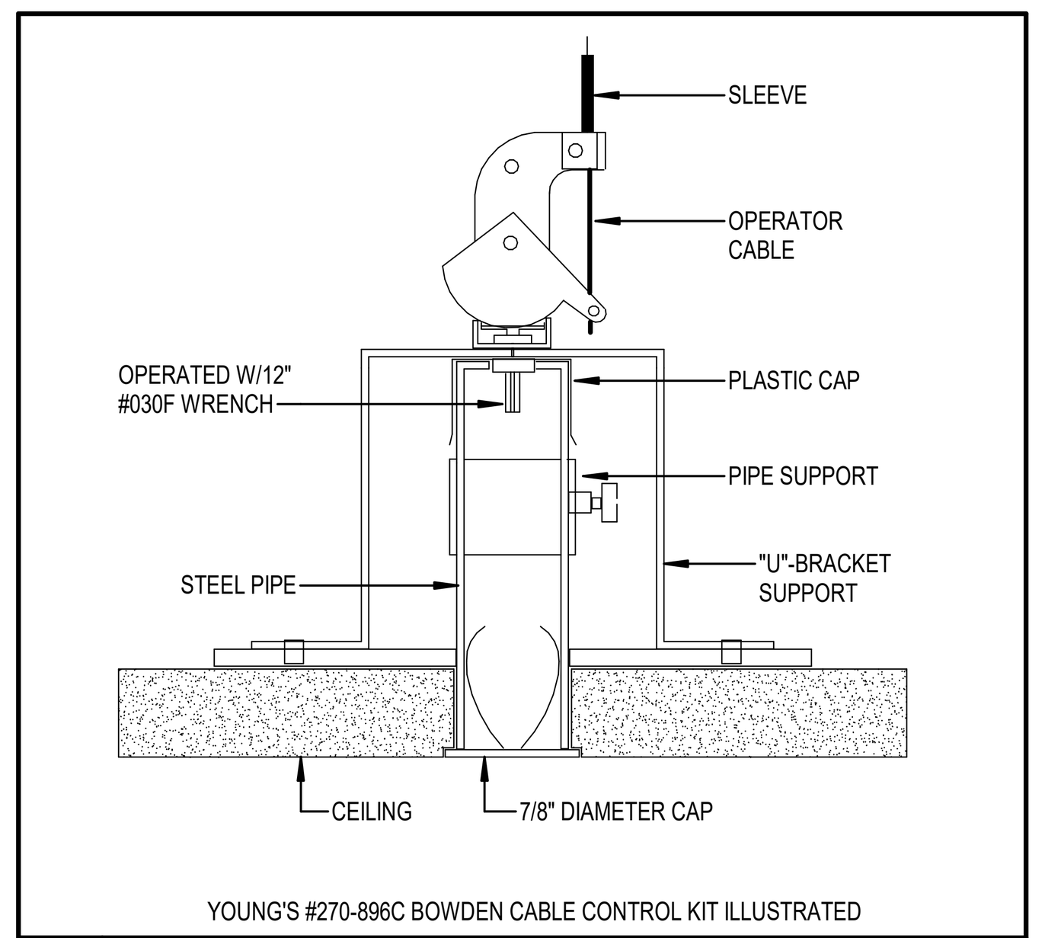
M5.1
MECHANICAL SCHEDULES



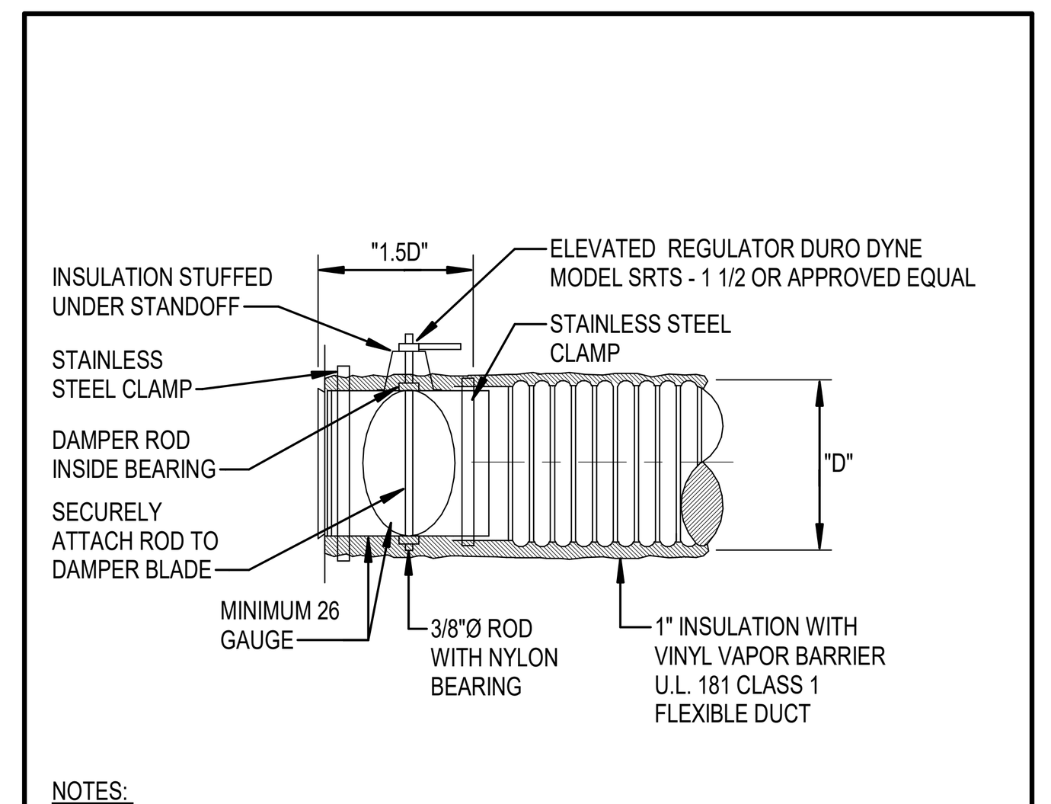
7 RETURN AIR BOOT THRU WALL
NOT TO SCALE



6 SIDEWALL SUPPLY REGISTER DETAIL
NOT TO SCALE

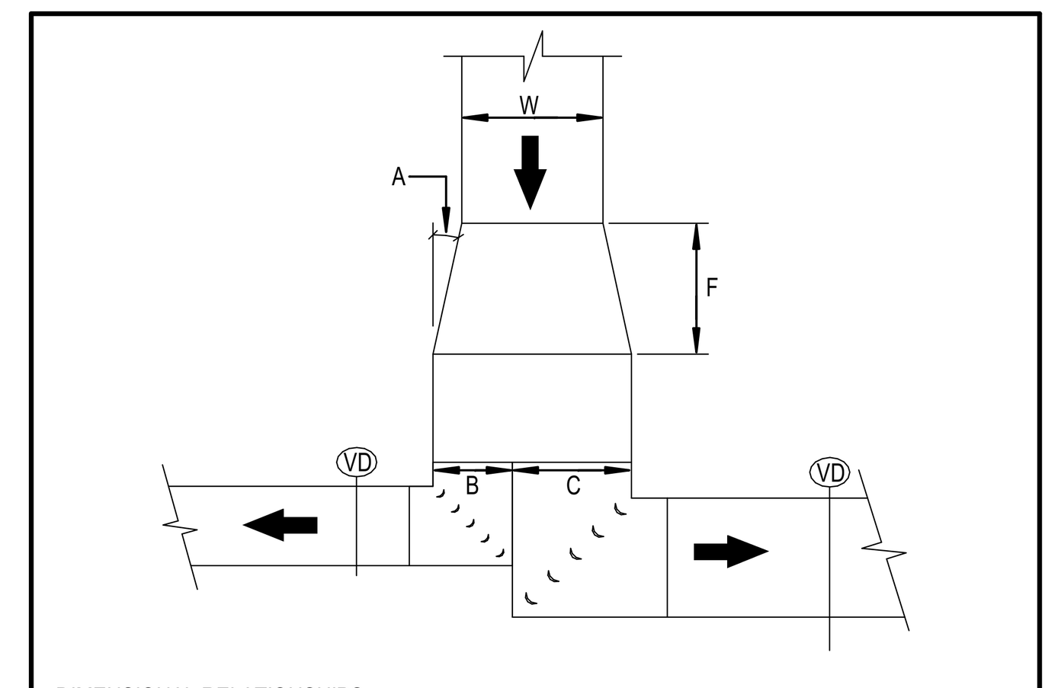


5 REMOTE DAMPER OPERATOR
NOT TO SCALE



NOTES:
1. ALL FLEXIBLE DUCT OFFSETS AND BENDS SHALL MAINTAIN A RADIUS OF 1.5 X ("D") MINIMUM 3'-0" AND MAXIMUM 6'-0"
2. TYPICAL OF ROUND DUCT CONNECTIONS TO RECTANGULAR DUCTS
3. ALL JOINTS SHALL BE SEALED WITH MASTIC AND FIBER CLOTH PER SPECIFICATIONS.

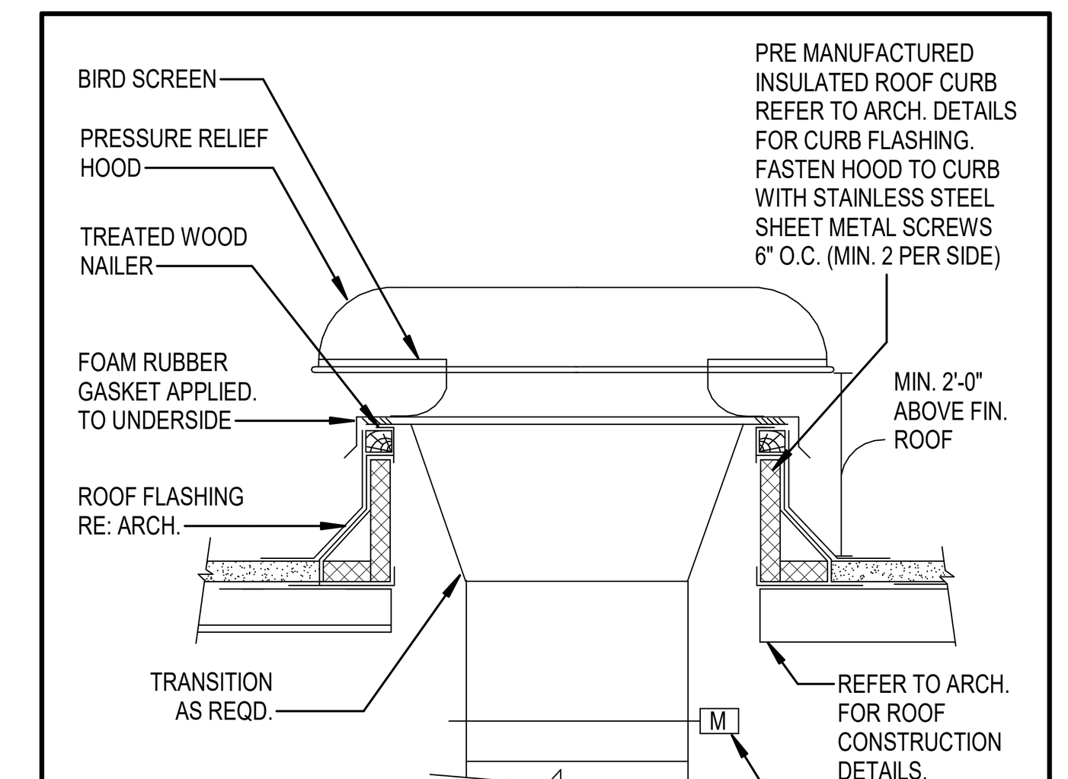
4 SPIN-IN DETAIL
NOT TO SCALE



DIMENSIONAL RELATIONSHIPS
1. ANGLE 'A' TO BE 15° OR LESS (BOTH SIDES)
2. SEE FLOOR PLANS FOR B, C, & W.
3. VERTICAL DIMENSION TO BE MAINTAINED THRU F.
4. CHANGE IN VERTICAL DIMENSION TO OCCUR AFTER TURNS.

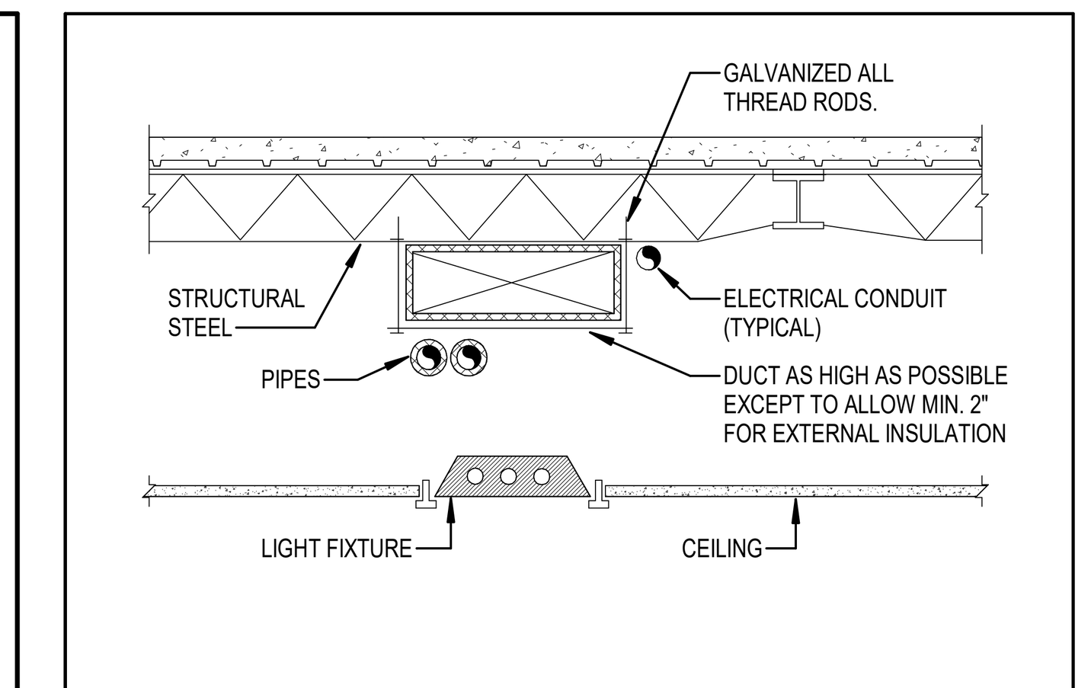
NOTES:
VOLUME DAMPERS REQUIRED FOR LOW PRESSURE DUCT SYSTEMS ONLY.

3 DUCTWORK TEE DETAIL
NOT TO SCALE



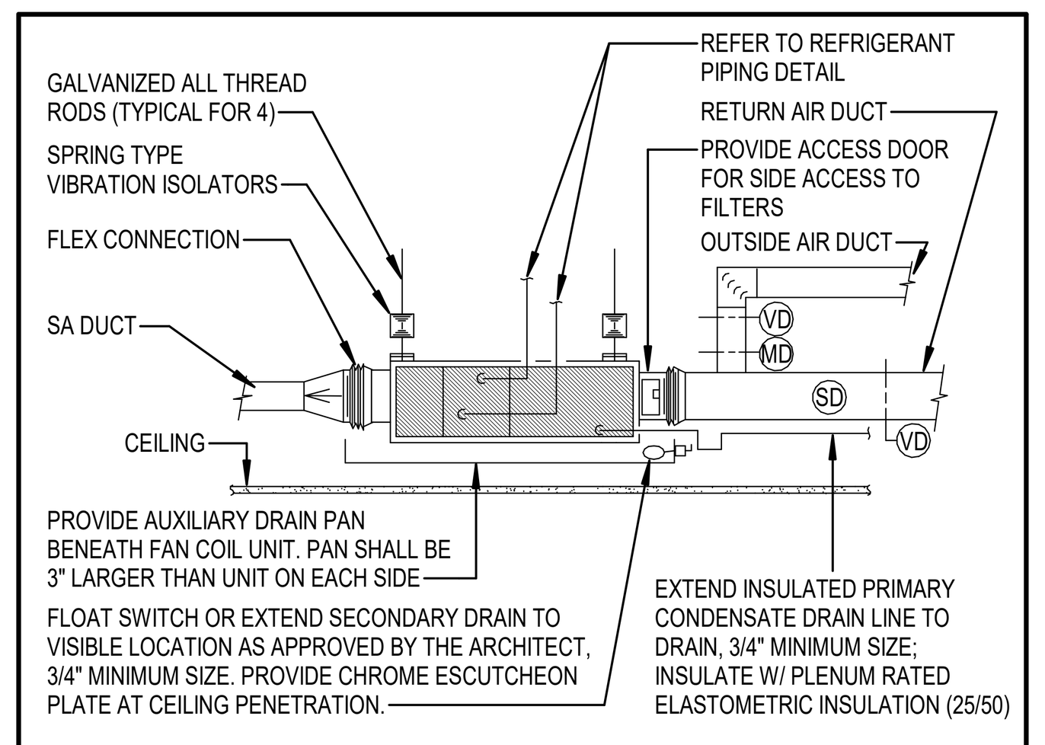
NOTE:
PROVIDE MOTORIZED DAMPER FOR EXHAUST AIR OVER 300 CFM. INTERLOCK DAMPER WITH EXHAUST FAN. DAMPER SHALL BE INSTALLED IN READILY ACCESSIBLE LOCATION.

2 EXHAUST AIR HOOD
NOT TO SCALE



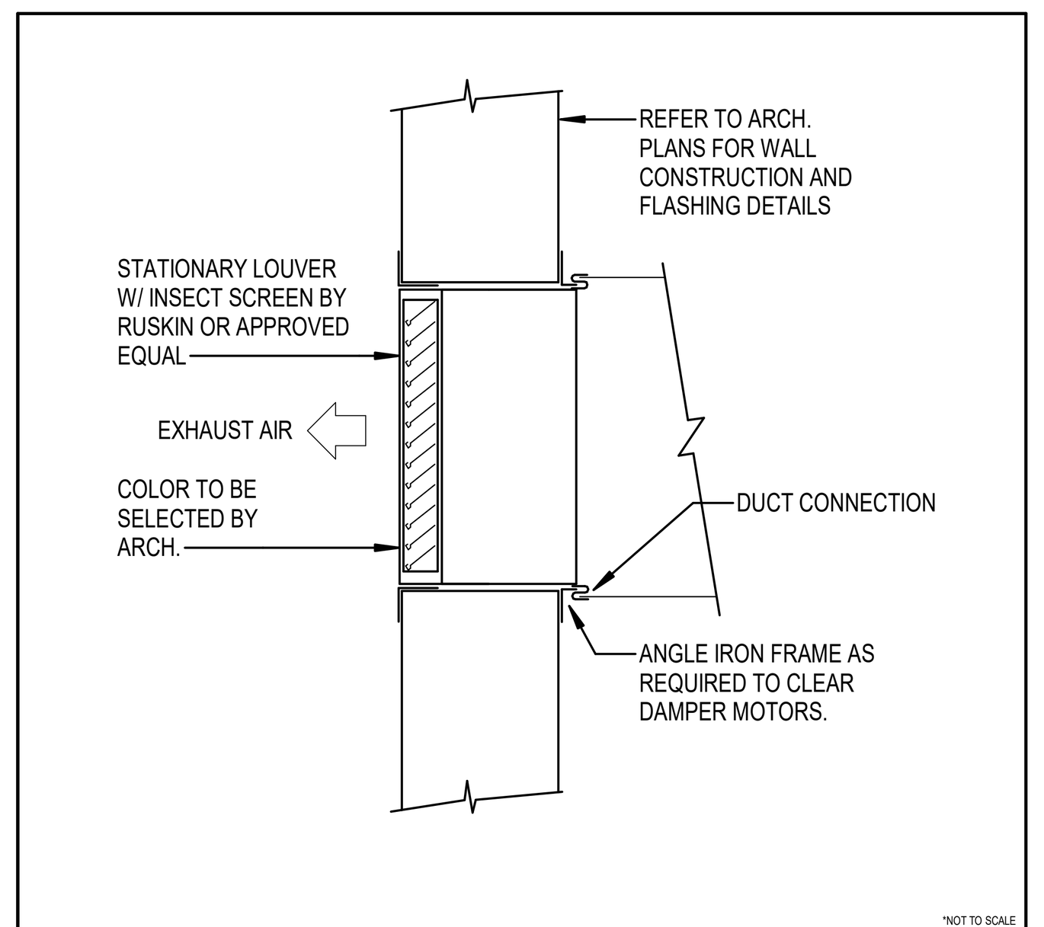
NOTES:
1. PIPES (INCLUDING SPRINKLER PIPING) AND ELECTRICAL CONDUIT CAN BE ROUTED BETWEEN JOISTS OR THROUGH JOIST WEB SPACE AS REQUIRED. DUCT SHALL BE LOCATED AS HIGH AS POSSIBLE.
2. U.L. DESIGN ASSEMBLY NUMBERS ARE SHOWN ON ARCHITECTURAL PLANS WHEN REQUIRED.
3. INSTALLATION OF ALL SERVICES MUST BE COORDINATED BY THE CONTRACTOR.

1 TYP. MEP INSTALLATION DETAIL
NOT TO SCALE

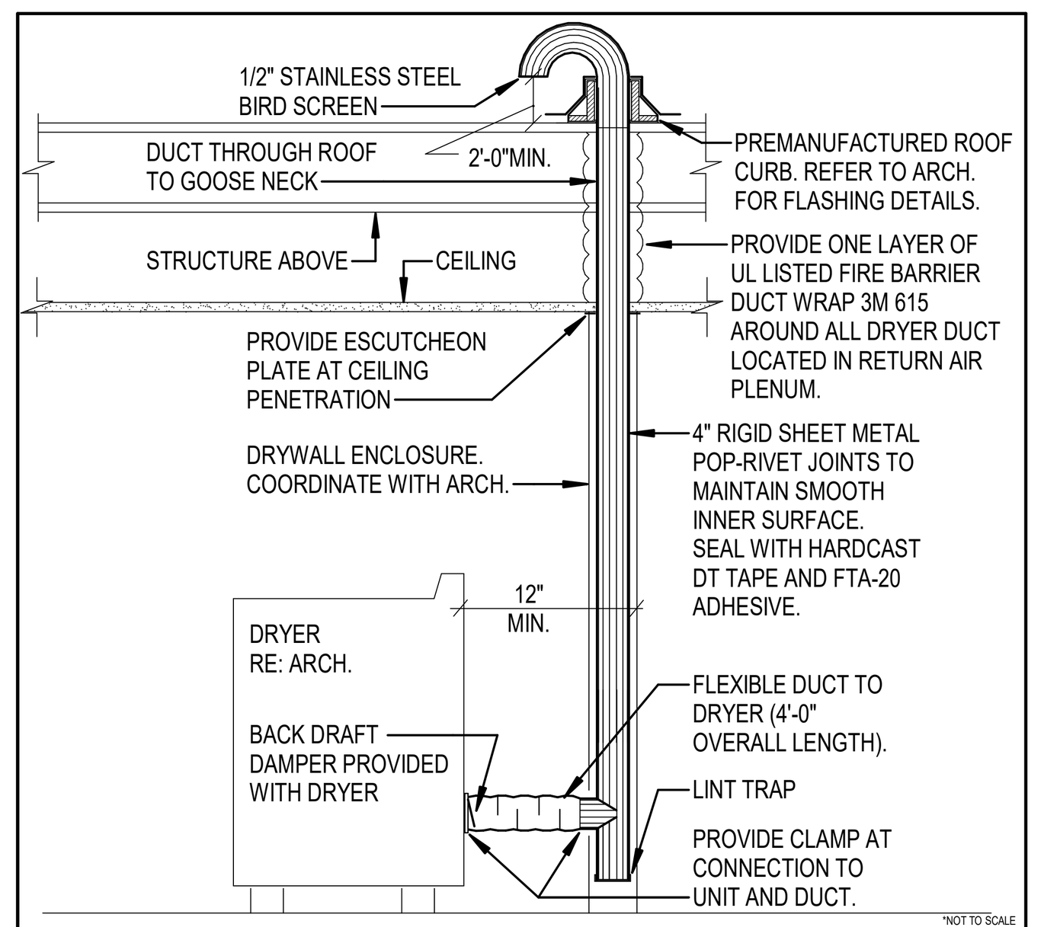


NOTES:
1. PROVIDE MISC. GALV. SUPPORT ANGLE OR CHANNEL AS REQUIRED TO BRIDGE STRUCTURE.
2. ALL CONDENSATE DRAIN PIPING SHALL BE SCHEDULE 40 GALVANIZED STEEL WITH MALLEABLE IRON SCREWED FITTINGS.

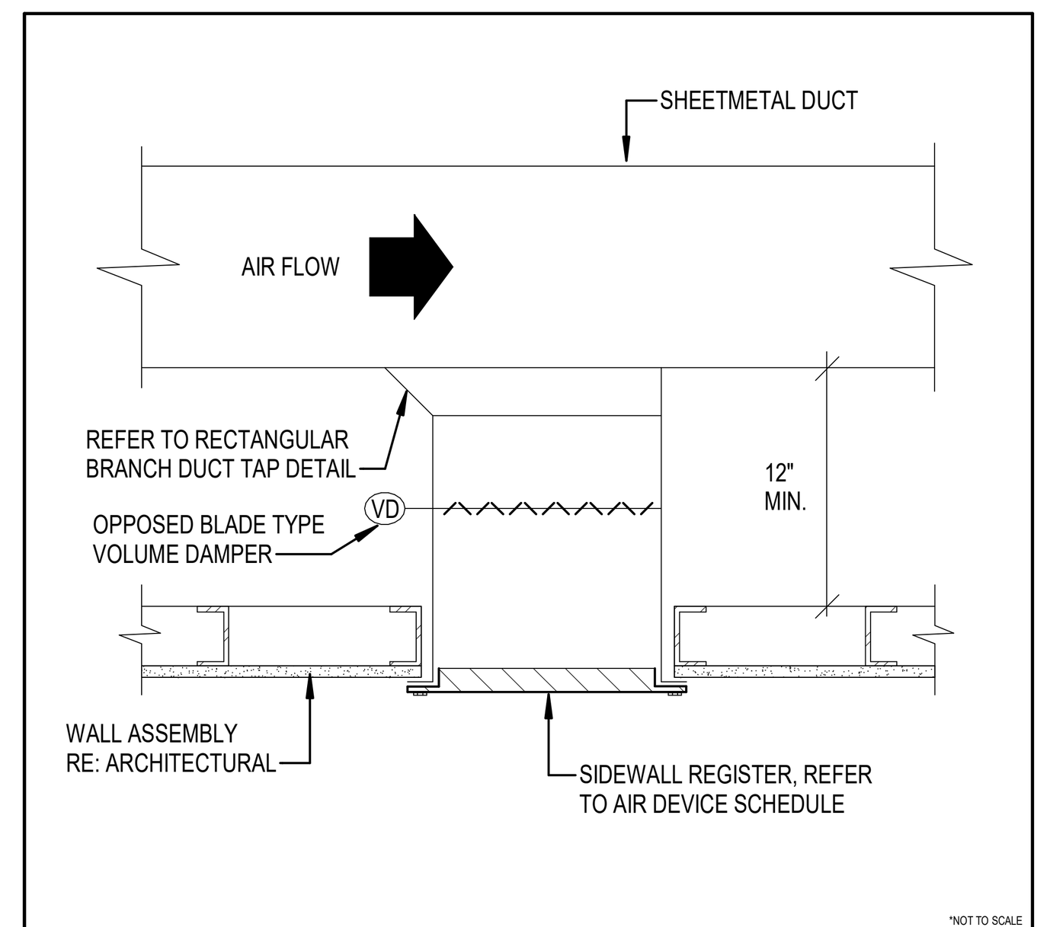
14 FAN COIL UNIT MOUNTING
NOT TO SCALE



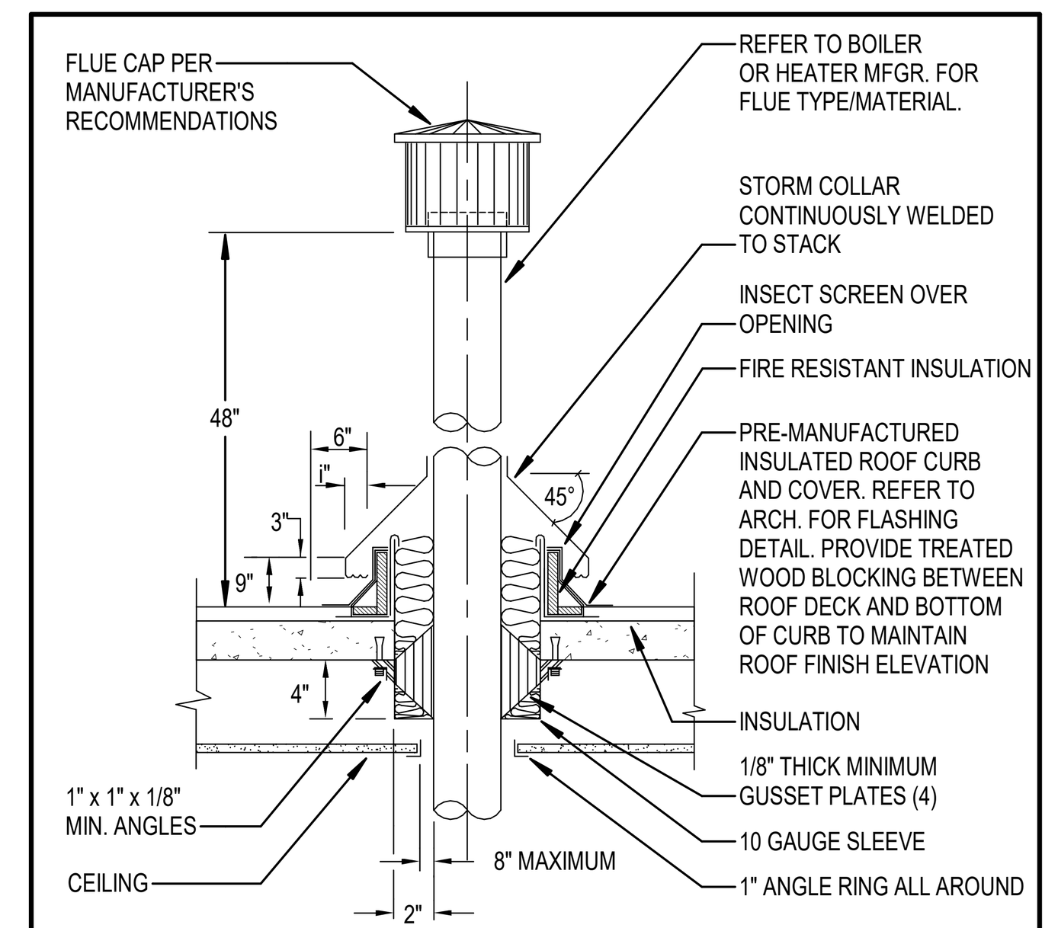
13 EXHAUST LOUVER MOUNTING
NOT TO SCALE



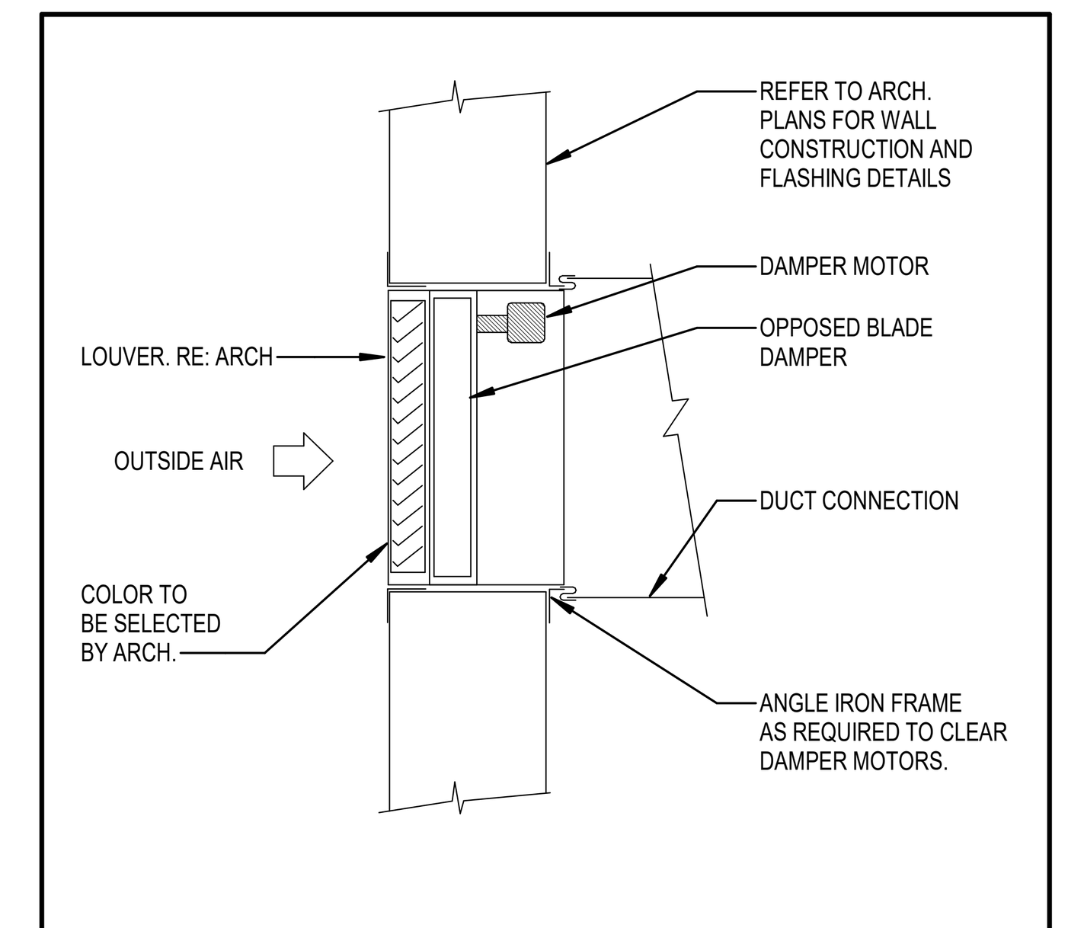
12 DRYER EXHAUST THROUGH ROOF
NOT TO SCALE



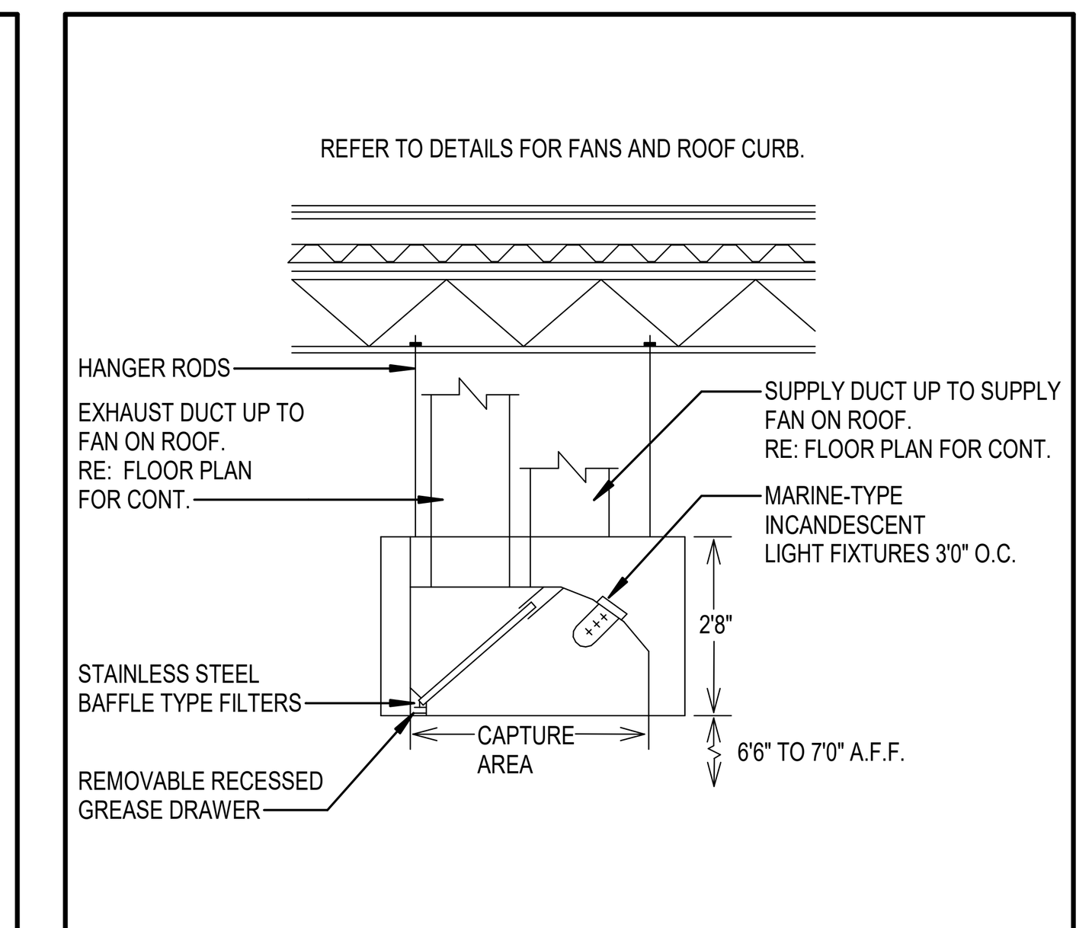
11 SIDEWALL SUPPLY REGISTER DETAIL
NOT TO SCALE



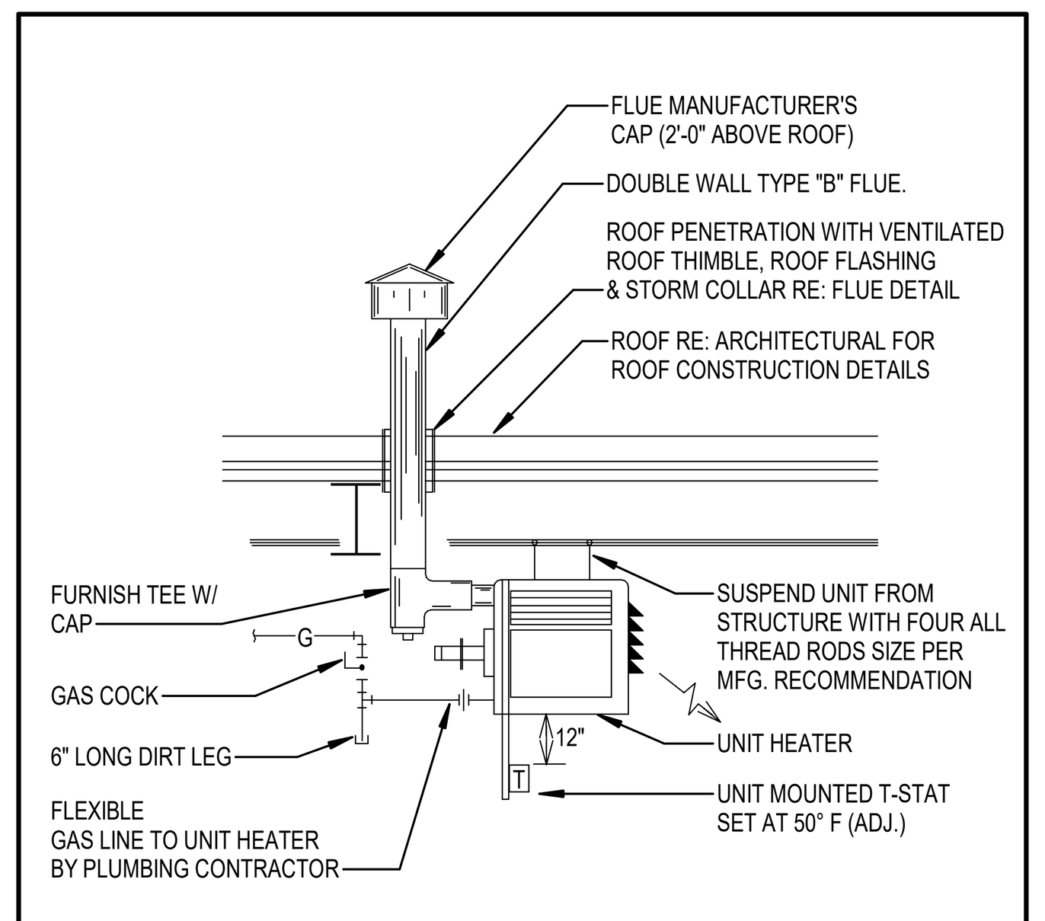
10 STEEL FLUE THRU ROOF DETAIL
NOT TO SCALE



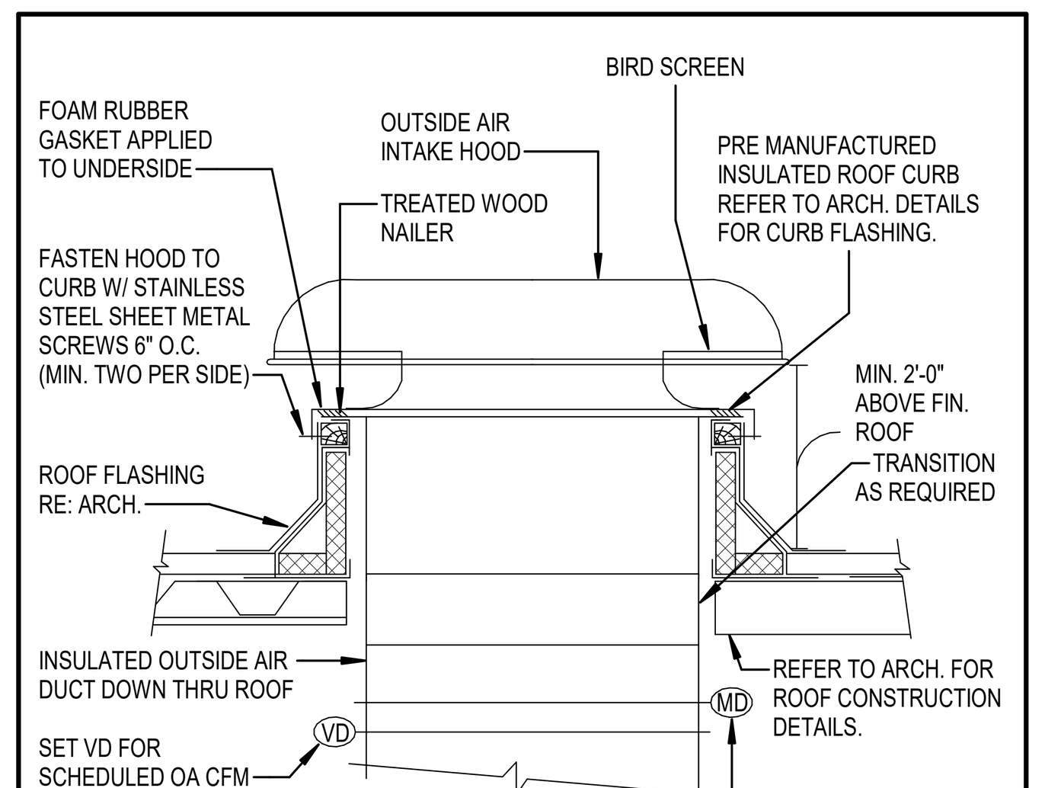
9 INTAKE LOUVER MOUNTING
NOT TO SCALE



8 KITCHEN EXHAUST HOOD DETAIL
NOT TO SCALE

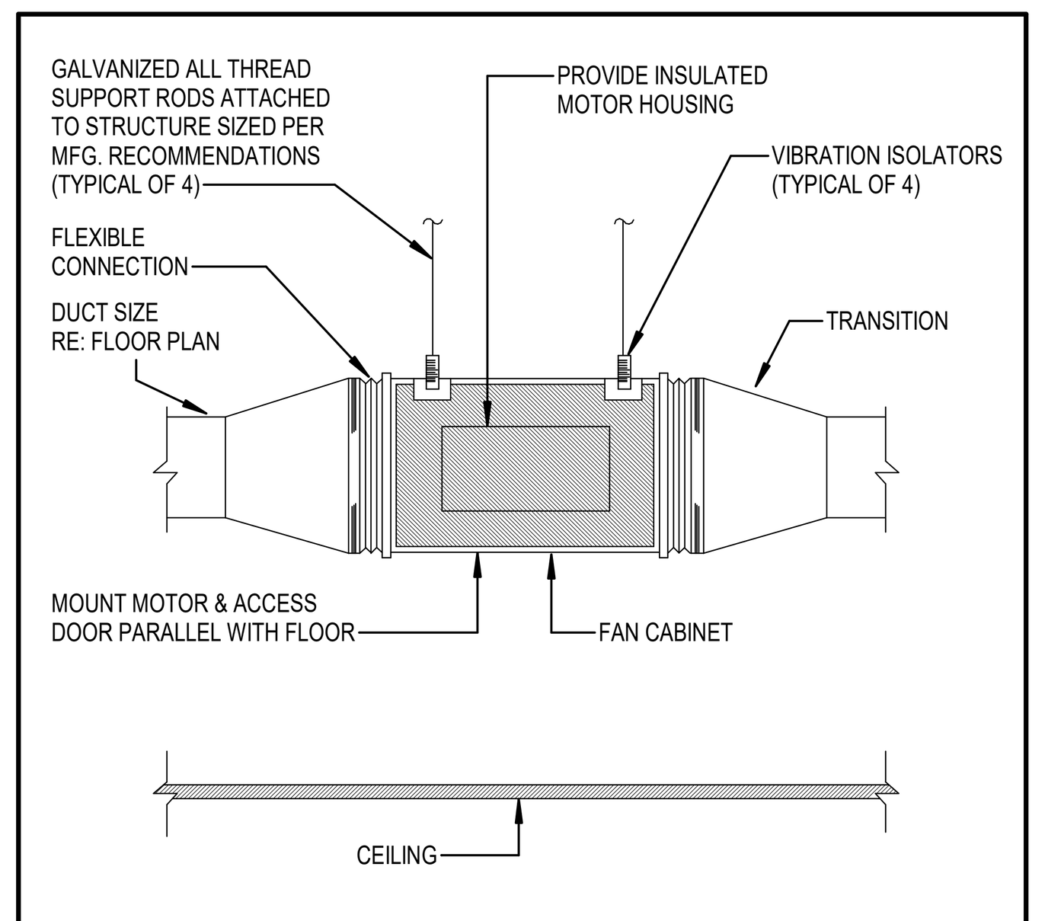


21 GAS UNIT HEATER MOUNTING
NOT TO SCALE

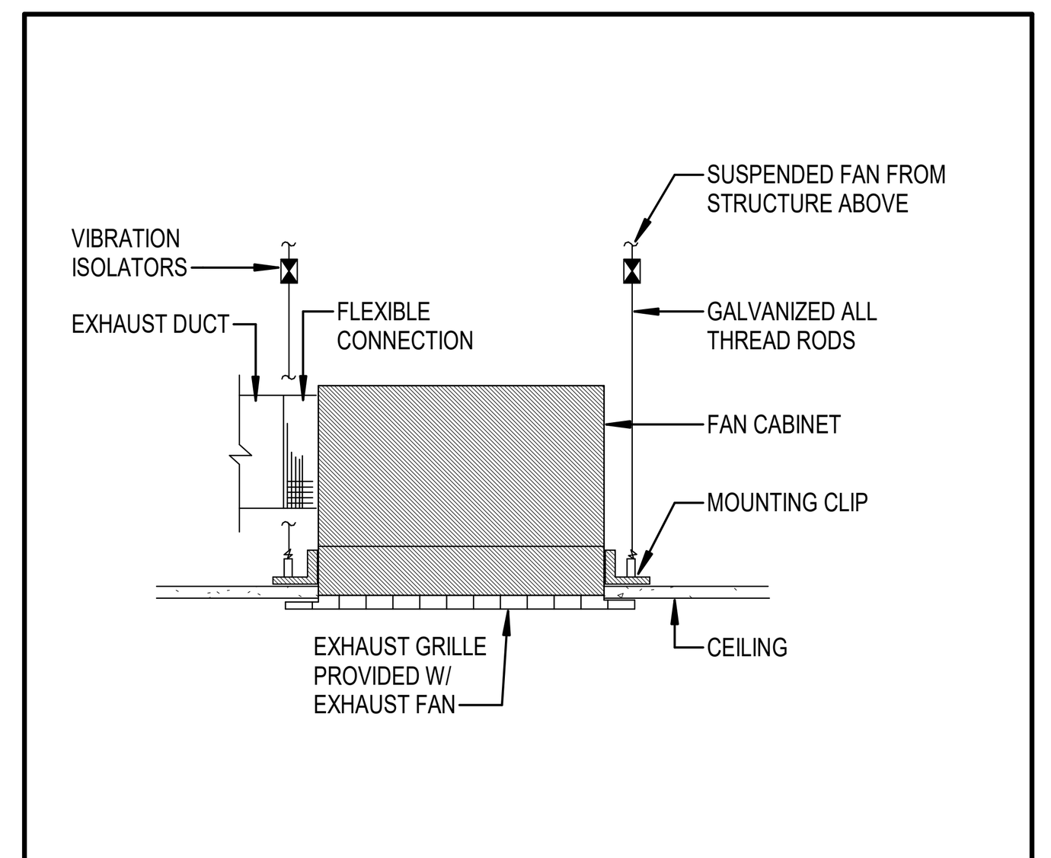


PROVIDE MOTORIZED DAMPER FOR OUTSIDE AIR OVER 300 CFM. INTERLOCK DAMPER WITH THE RESPECTIVE A/C UNIT IT SERVES. DAMPER SHALL BE INSTALLED IN READILY ACCESSIBLE LOCATION.

20 OUTSIDE AIR INTAKE HOOD
NOT TO SCALE

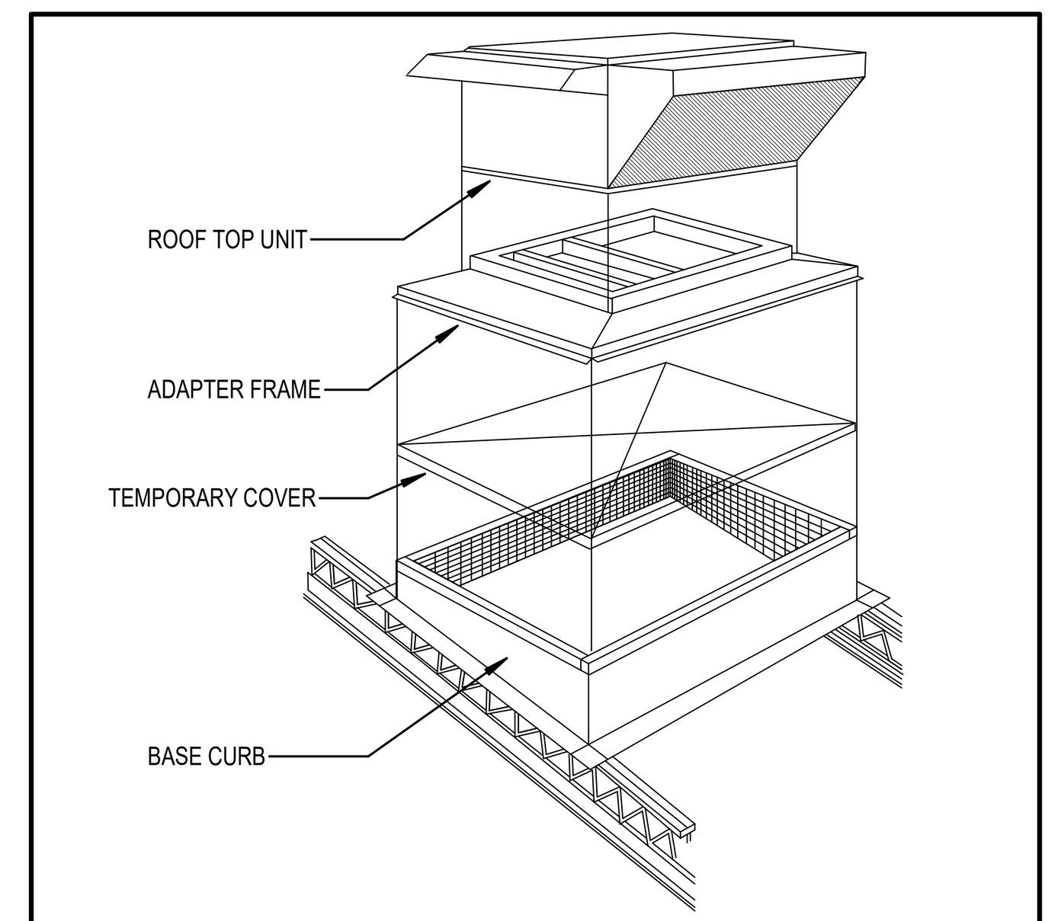


19 IN-LINE EXHAUST FAN DETAIL
NOT TO SCALE

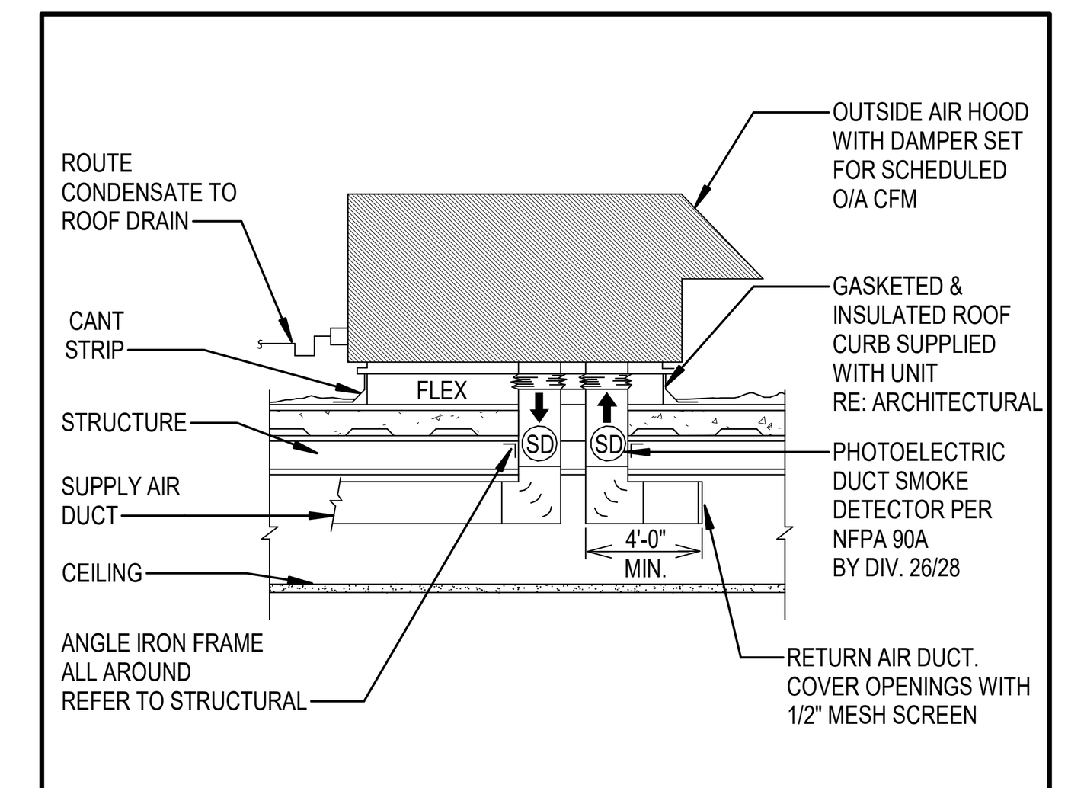


NOTE: PROVIDE FAN U.L. RADIATION DAMPER FOR FIRE RATED CEILING.

18 CEILING MOUNTED EXHAUST FAN
NOT TO SCALE

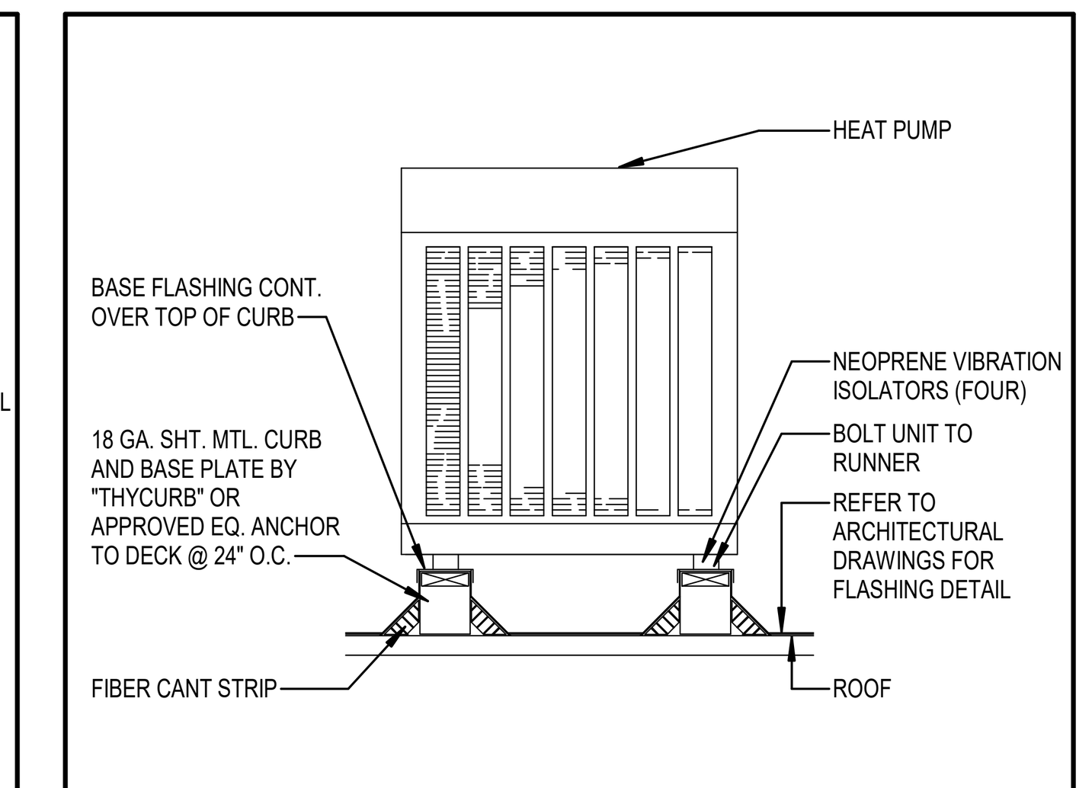


17 BASE CURB DETAIL
NOT TO SCALE



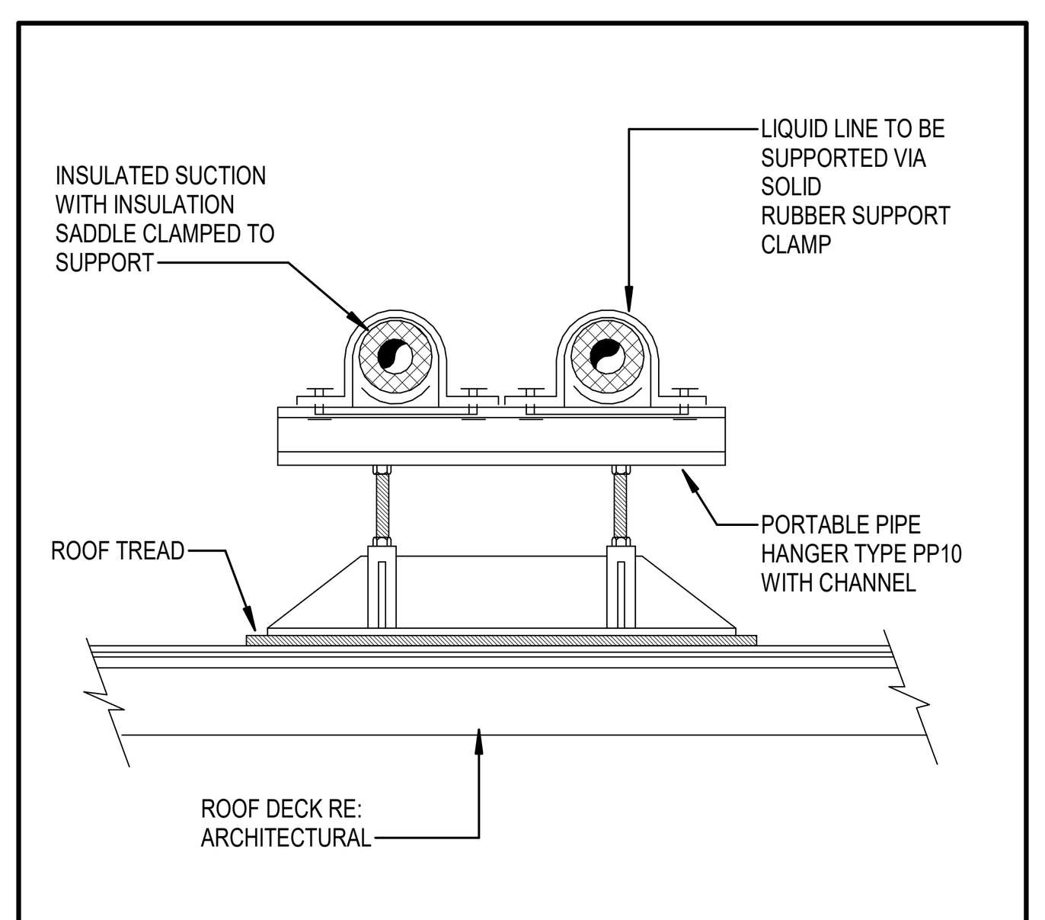
NOTE:
ALL CONDENSATE DRAIN PIPING SHALL BE SCHEDULE 40 GALVANIZED STEEL WITH MALLEABLE IRON SCREWED FITTINGS.

16 ROOF TOP UNIT MOUNTING DETAIL
NOT TO SCALE

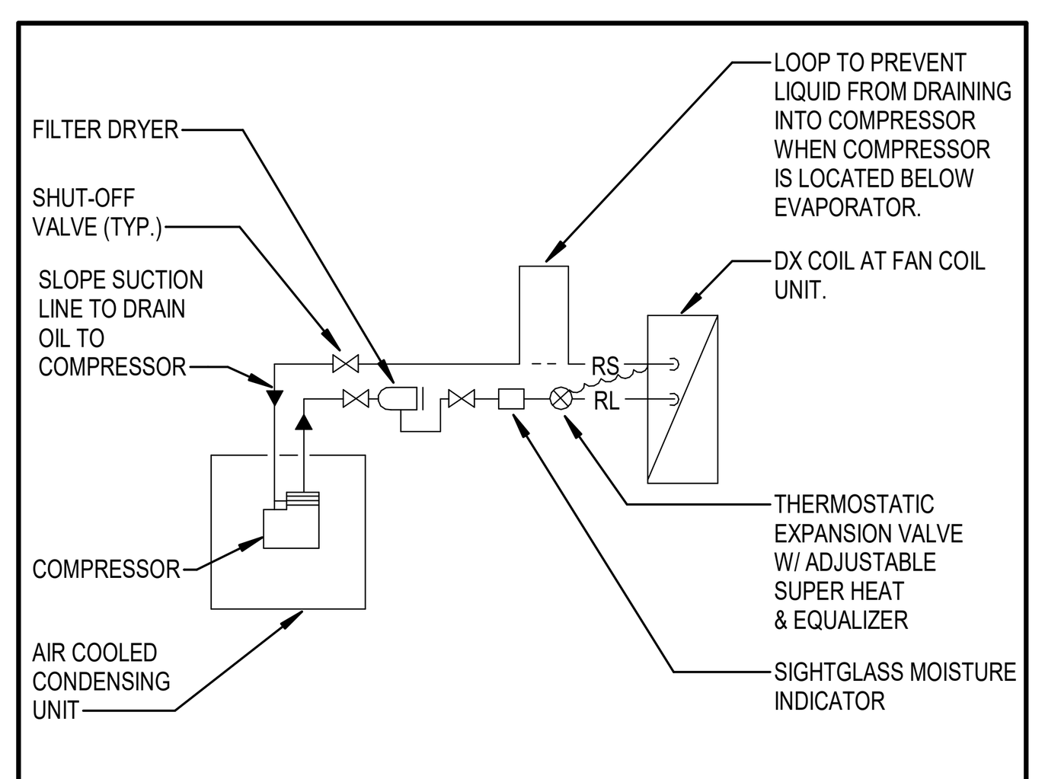


NOTE:
1. PROVIDE CLEARANCE AROUND UNIT FOR AIRFLOW AND SERVICE PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.

15 HEAT PUMP ROOF MOUNTED
NOT TO SCALE

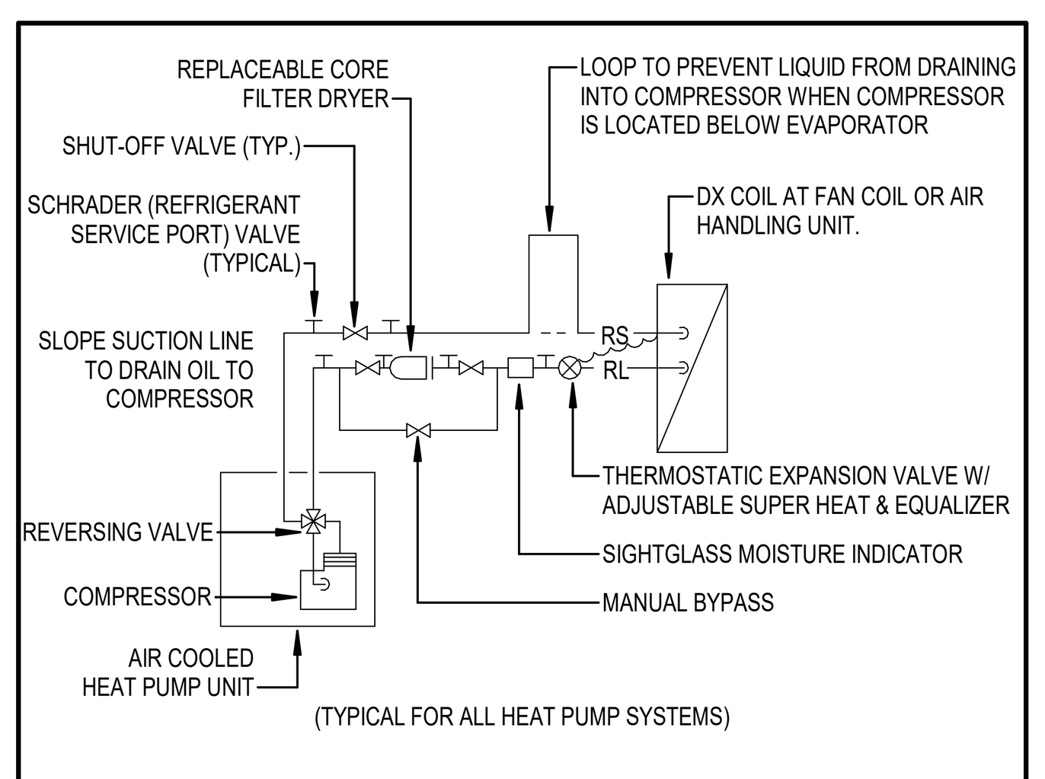


28 ROOF MTD. REFR. PIPE SUPPORT
NOT TO SCALE



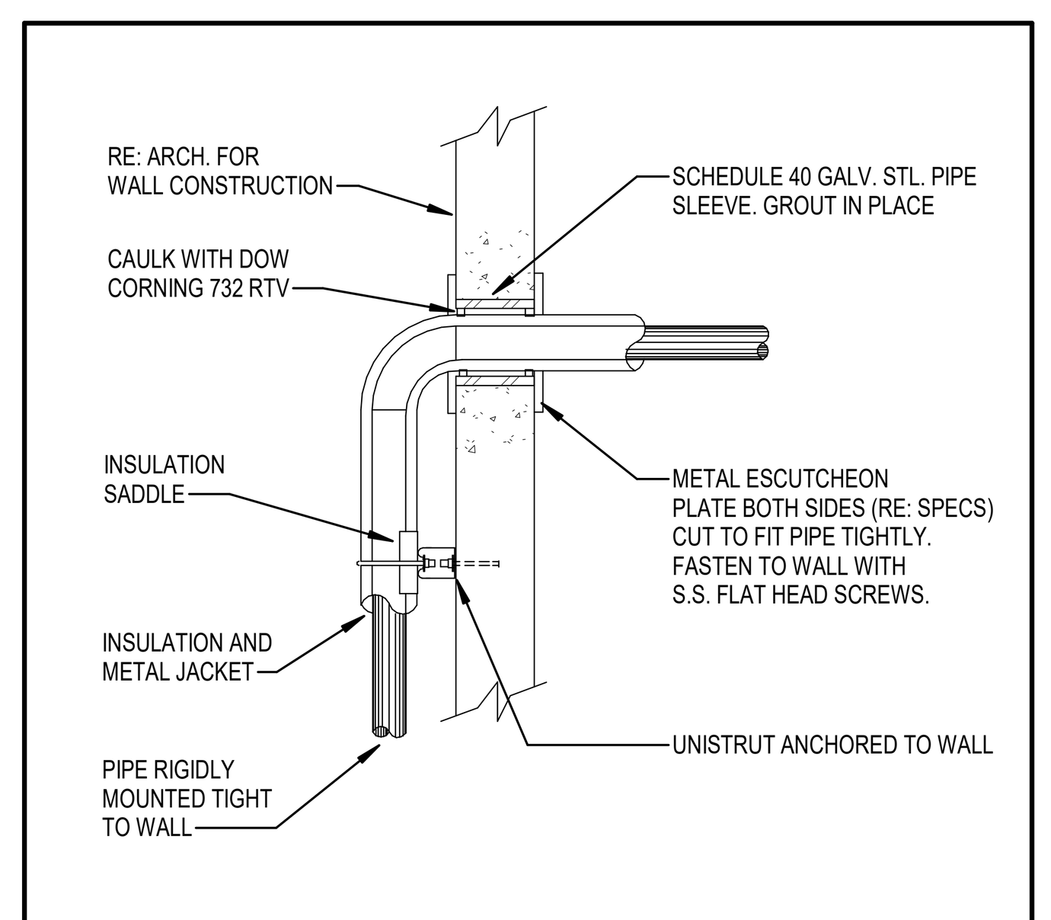
NOTE:
1. COMPLY WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
2. TYPICAL FOR EACH SEPARATE REFRIGERANT CIRCUIT.
3. PROVIDE FILTER DRYER ON ALL SYSTEMS.
4. USE "ACR" HARD DRAWN COPPER REFRIGERANT PIPE.

27 REFRIGERANT PIPING SCHEMATIC
NOT TO SCALE

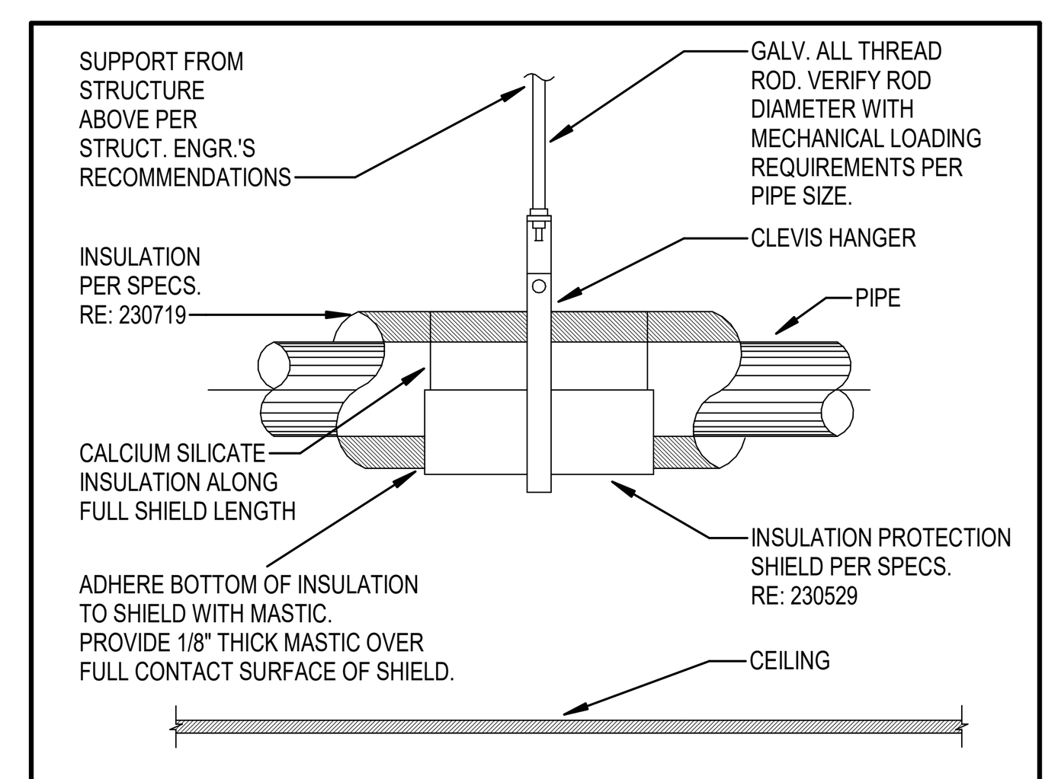


NOTE:
1. COMPLY WITH MANUFACTURER'S PRINTED INSTALLATION INSTRUCTIONS.
2. TYPICAL FOR EACH SEPARATE REFRIGERANT CIRCUIT.
3. PROVIDE REPLACEABLE CORE FILTER DRYER WITH BYPASS ON ALL SYSTEMS.
4. USE "ACR" HARD DRAWN COPPER REFRIGERANT PIPE.

26 HEAT PUMP PIPING DETAIL
NOT TO SCALE

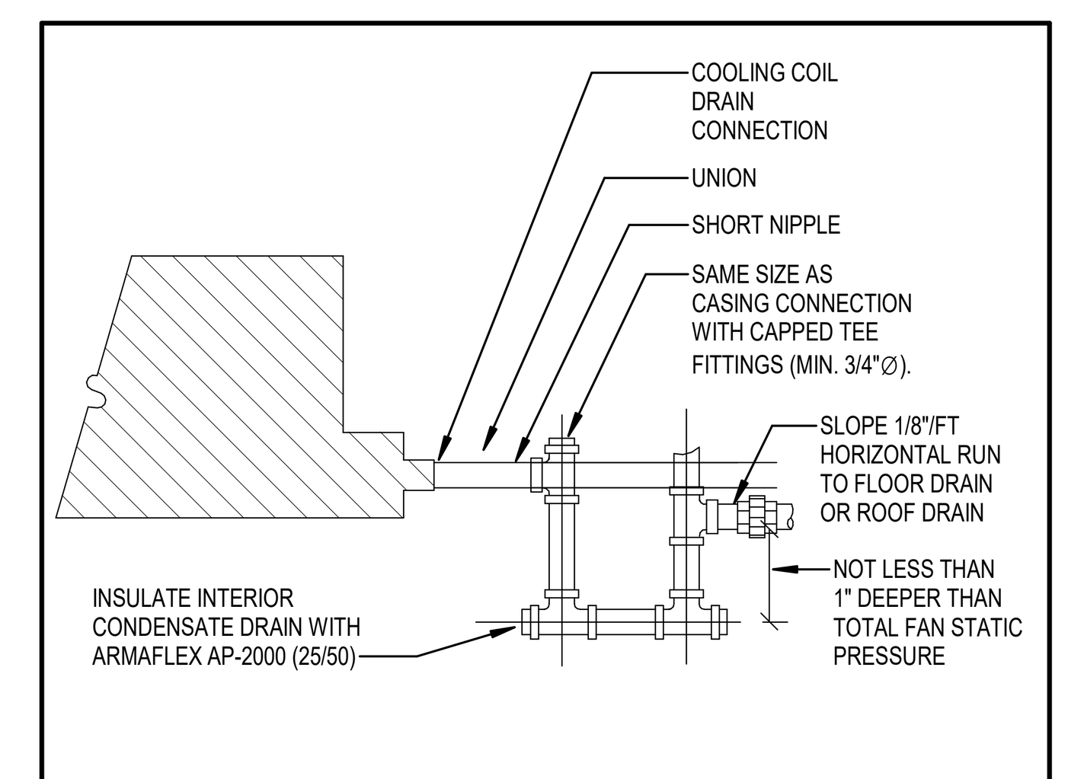


25 PIPE ENTRY THRU EXTERIOR WALL
NOT TO SCALE



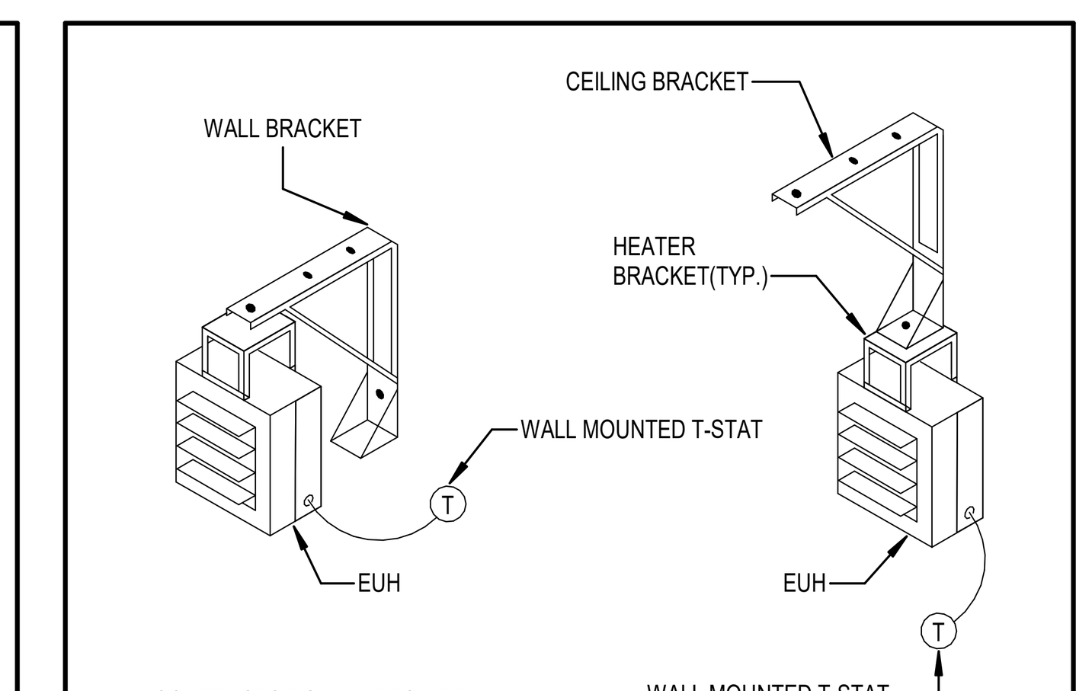
NOTE:
CONTRACTOR SHALL SECURE STRUCT. ENGR. APPROVAL FOR ANY AND ALL PIPE MOUNTING DETAILS TO CONCRETE OR STEEL STRUCTURE. CONTRACTOR SHALL CONFORM TO ALL MAXIMUM SPAN DISTANCES PER SPECIFICATIONS FOR HANGER SPACING. RE: 230529

24 PIPE HANGER DETAIL (1-PIPE)
NOT TO SCALE



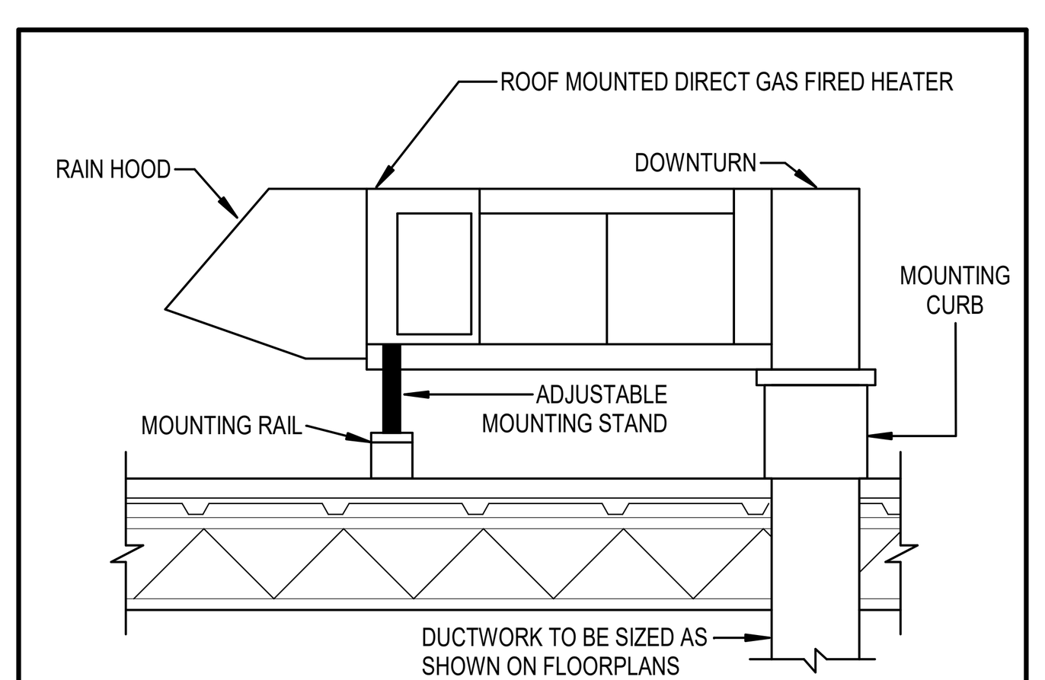
NOTE:
1. MAINTAIN MINIMUM 1" AIR GAP AT FLOOR DRAIN OR ROOF DRAIN.
2. ALL CONDENSATE DRAIN PIPING SHALL BE SCHEDULE 40 GALVANIZED STEEL WITH MALLEABLE IRON SCREWED FITTINGS.

23 COOLING COIL CONDENSATE DRAIN
NOT TO SCALE



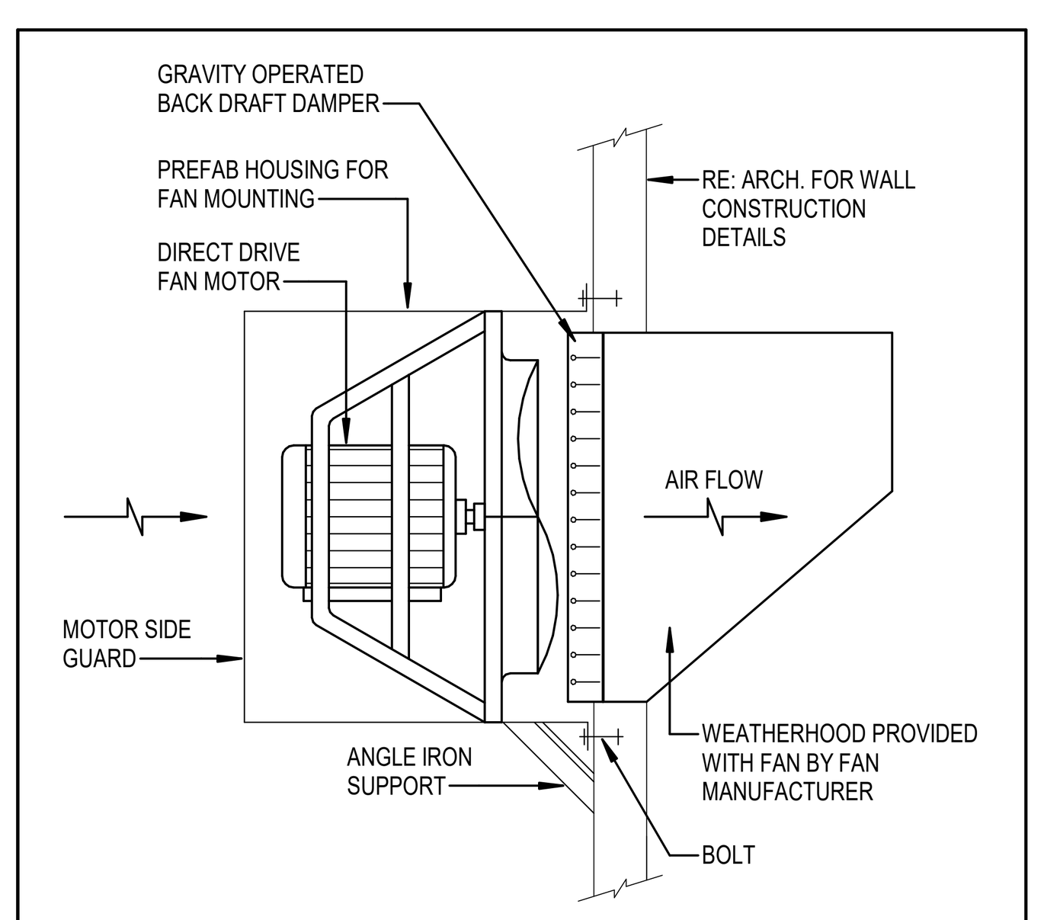
CONTRACTOR SHALL PROVIDE:
- WALL-MOUNTED THERMOSTAT
- LOW VOLTAGE CONTROL TRANSFORMER
- UNIVERSAL WALL AND CEILING-MOUNTED BRACKET
- AUTOMATIC RESET THERMAL CUT-OUT
- ADJUSTABLE DISCHARGE
- REMOTE SUMMER FAN SWITCH

22 ELECTRIC UNIT HEATER DETAIL
NOT TO SCALE

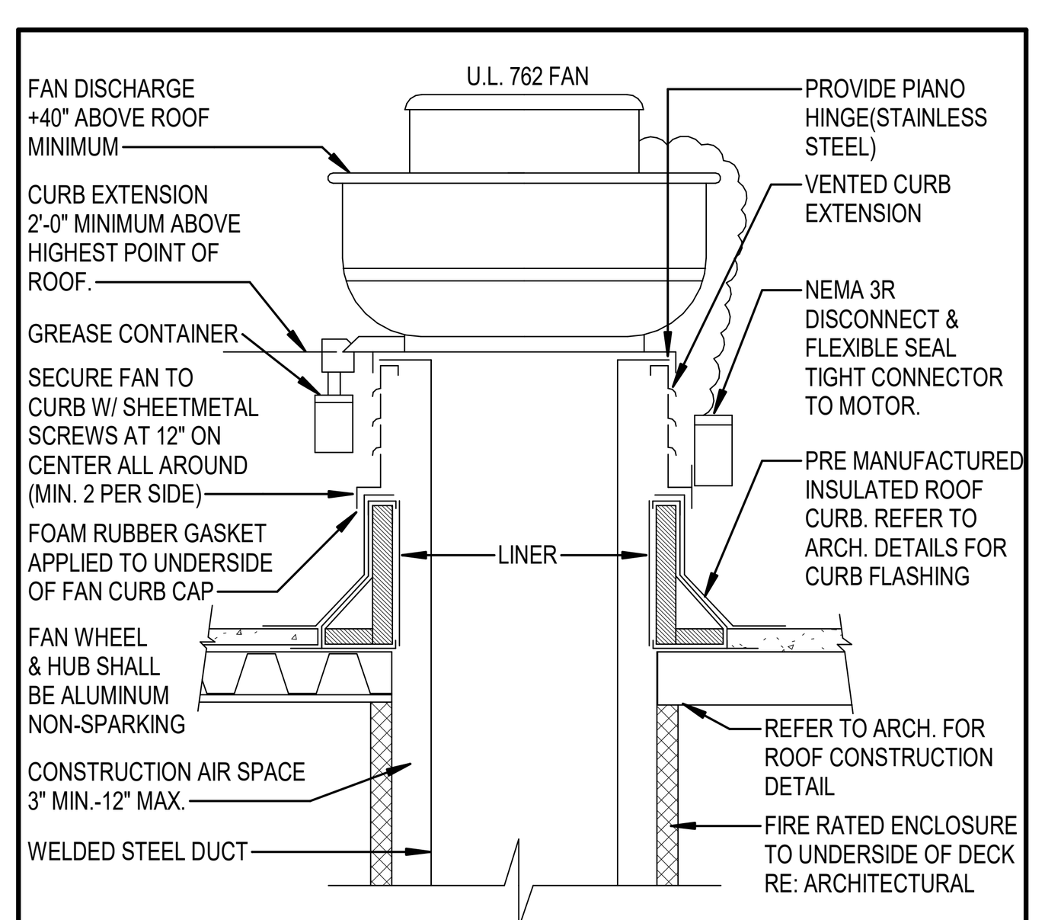


UNIT SHALL INCLUDE:
- RAIN HOOD FOR ROOF MOUNTING WITH INSECT INLET SCREEN.
- A 90° ELBOW WITH TURNING VANES. THERMAL/ACOUSTICAL INSULATION TO BE FACTORY INSTALLED.
- AN INSULATED 24" MOUNTING CURB WITH COUNTER FLASHING. TO SUPPORT THE DISCHARGE END.
- A ROOF RAIL WITH COUNTER FLASHING. TO SUPPORT THE REAR HEATER.

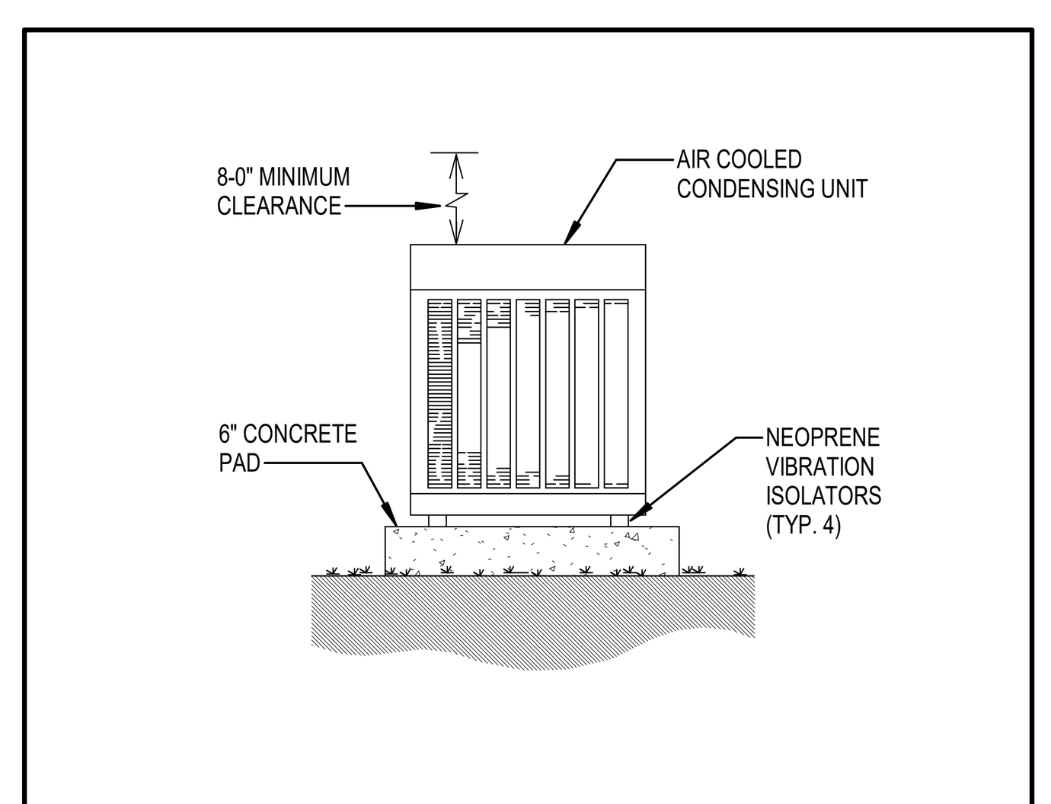
35 ROOF MOUNTED MAKE UP AIR UNIT
NOT TO SCALE



34 PROPELLER EXHAUST FAN DIRECT DRIVE W/ LOUVER
NOT TO SCALE

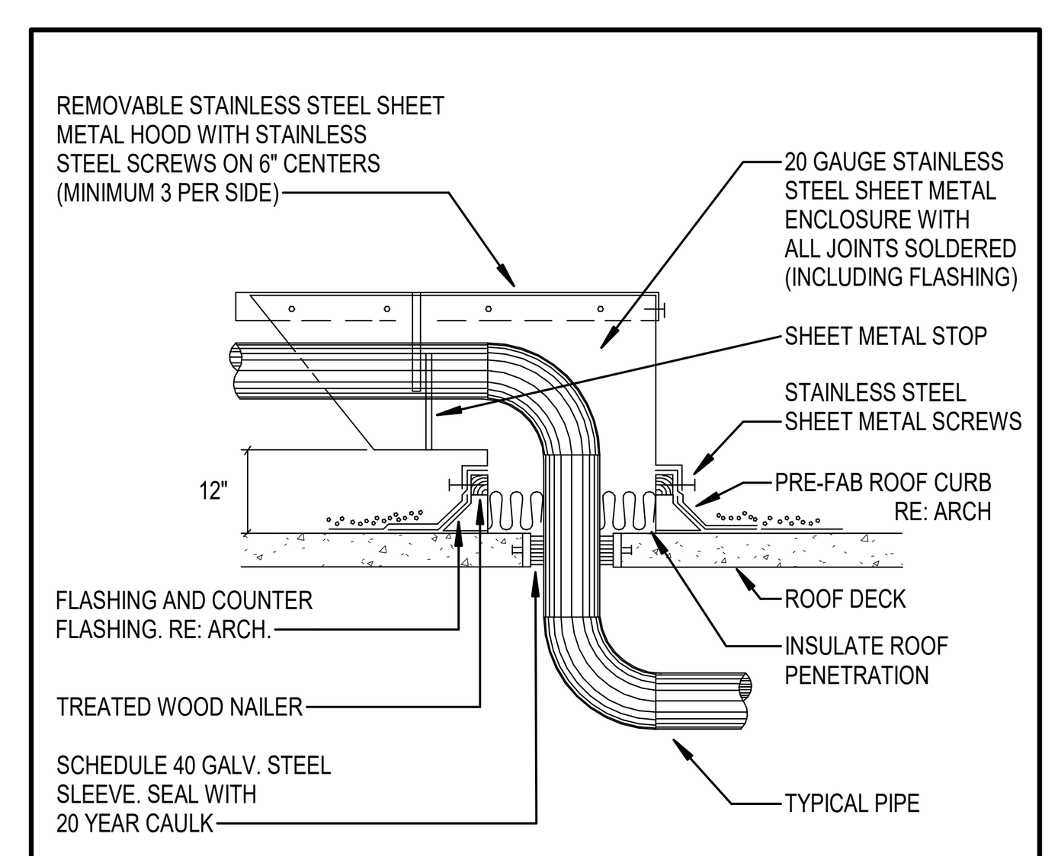


33 RANGE HOOD CENTRIFUGAL UPBLAST EXHAUST FAN
NOT TO SCALE



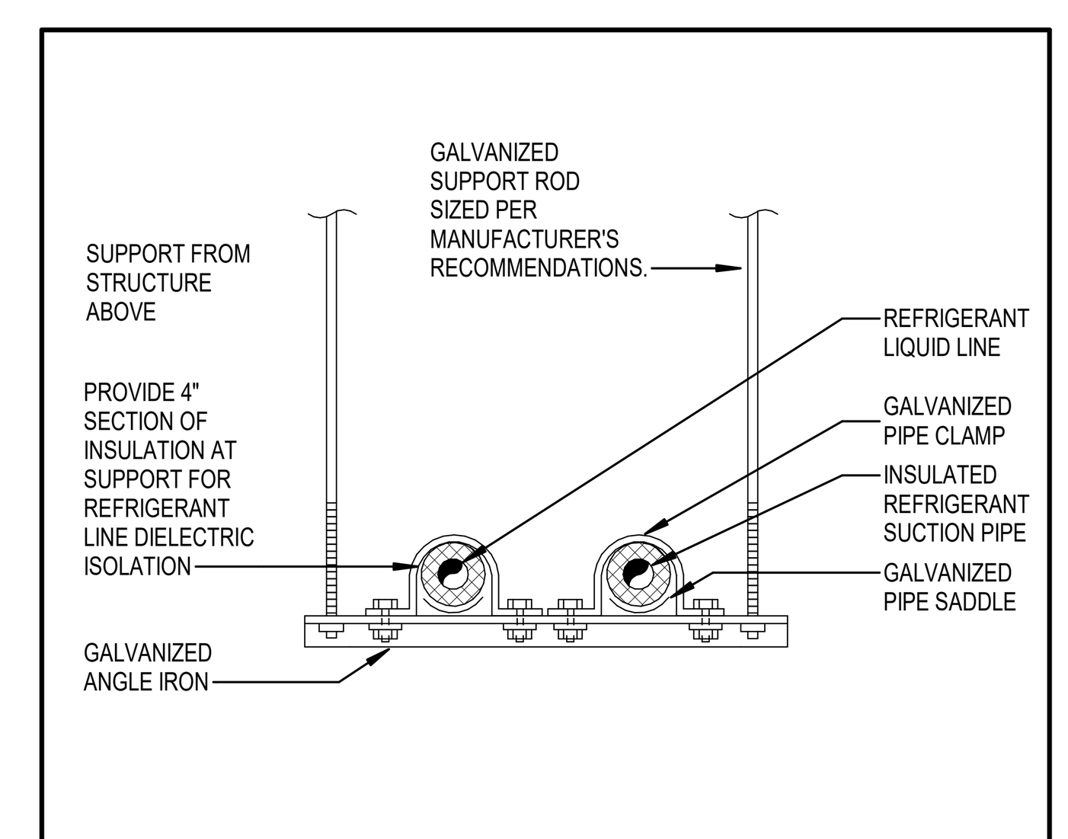
NOTE:
PROVIDE CLEARANCE AROUND UNIT FOR AIR FLOW AND SERVICE PER MANUFACTURER'S INSTALLATION INSTRUCTIONS.

32 CONDENSING UNIT MOUNTING ON GRADE
NOT TO SCALE



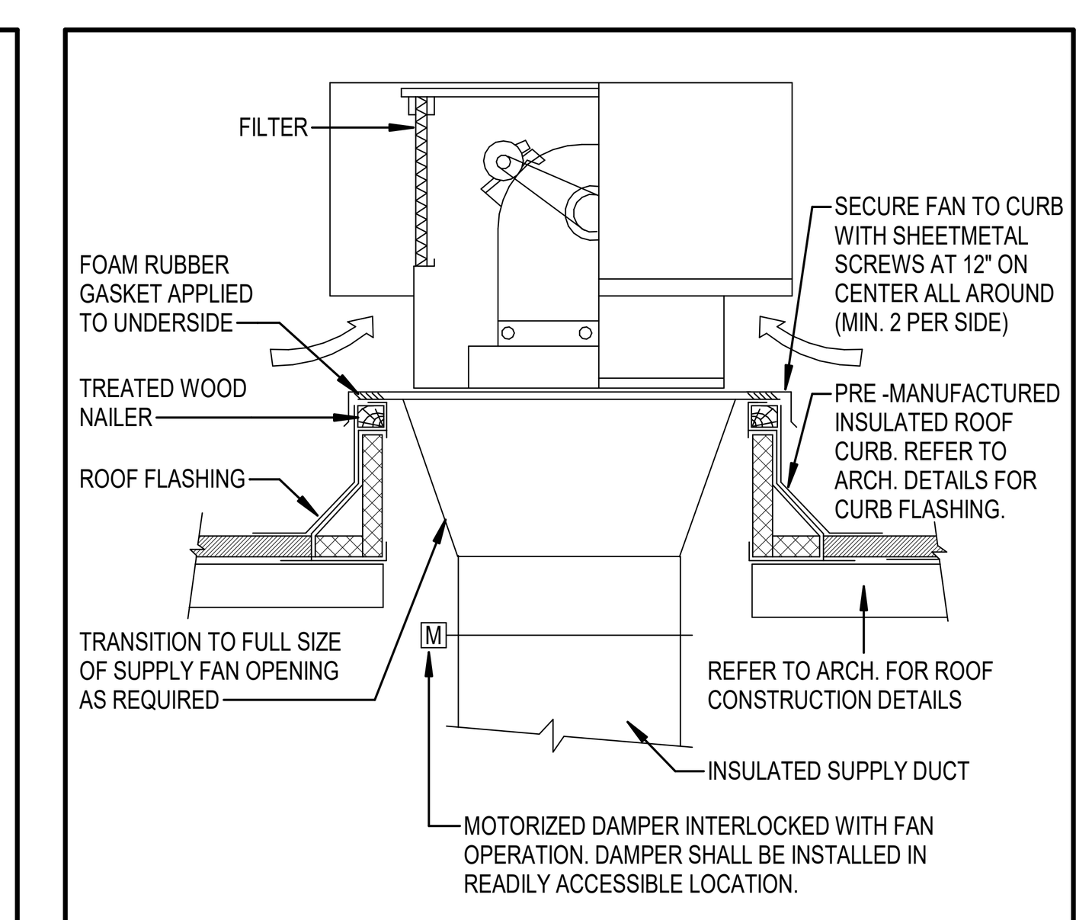
NOTE: REFER TO ARCHITECTURAL DRAWINGS FOR ROOF CONSTRUCTION AND FLASHING DETAILS.

31 PIPING ROOF PENETRATION
NOT TO SCALE



NOTE: PROVIDE SUPPORTS AT 3'-0" ON CENTER MAX. AND WITHIN 1'-0" OF ALL CHANGES IN PIPE DIRECTION.

30 REFRIGERANT PIPE HANGER
NOT TO SCALE



29 CENTRIFUGAL ROOF SUPPLY FAN
NOT TO SCALE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRW ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4309 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project # 24400.00
SW | JG | JB | AR | -

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

M6.1
MECHANICAL DETAILS

(NOT ALL ITEMS INDICATED APPLY TO THIS PROJECT)

ABBREVIATIONS

A

A	AIR (COMPRESSED)
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AL	ALUMINUM
AP	ACCESS PANEL
ARCH	ARCHITECT, ARCHITECTURAL
AS	AIR SEPARATOR
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASTM	AMERICAN SOCIETY OF TESTING AND MATERIALS
AV	ACID VENT
AW	ACID WASTE
AUX	AUXILIARY

B

B	BOILER
BFF	BELOW FINISH FLOOR
BFV	BUTTERFLY VALVE
BM	BENCHMARK
BOF	BOTTOM OF FOOTING
BOS	BOTTOM OF STRUCTURE
BT	BATH TUB
BTU	BRITISH THERMAL UNIT
BV	BALL VALVE
BWV	BACK WATER VALVE

C

C	CELSIUS
CAB	CABINET
CB	CATCH BASIN
CD	CONDENSATE DRAIN LINE
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CH	CHILLER
CP	CIRCULATING PUMP
CI	CAST IRON
CIRC	CIRCULATING
CL	CENTERLINE
CMU	CONCRETE MASONRY UNIT
CPI	CAST IRON PIPE INSTITUTE
CPVC	CHLORINATED POLYVINYL CHLORIDE
CO	CLEAN OUT
COL	COLUMN
CONC	CONCRETE, CONCENTRIC
CONN	CONNECTION
CRAC	COMPUTER ROOM A/C UNIT
CW	COLD WATER

D

DF	DRINKING FOUNTAIN
DIA	DIAMETER
DIM	DIMENSION
DISC	DISCONNECT
DN	DOWN
DS	DOWNSPOUT
DW	DISHWASHER
DWG	DRAWING
DWH	DOMESTIC WATER HEATER
DBP	DOMESTIC BOOSTER PUMP

E

ECC	ECCENTRIC
EDF	ELECTRIC DRINKING FOUNTAIN
ET	EXPANSION TANK
ETR	EXISTING TO REMAIN

F

F	FARENHEIT, FIRE
FBO	FURNISHED BY OTHERS
FCO	FLOOR CLEAN OUT
FCS	FLOOR CONTROL STATON
FD	FLOOR DRAIN, FIRE DAMPER
FDC	FIRE DEPARTMENT CONNECTION
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FHR	FIRE HOSE RACK
FHV	FIRE HOSE VALVE
FIXT	FIXTURE
FLEX	FLEXIBLE
FL	FLOW LINES
FLR	FLOOR
FP	FIRE PUMP
FS	FLOW SWITCH, FIRE SPRINKLER
FS	FLOOR SINK
FT	FOOT, FEET
FW	FORCE WASTE

G

G	GAS
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GCO	GRADE CLEANOUT
GLV	GLOBE VALVE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GV	GATE VALVE

H

HB	HOSE BIBB
HD	HEAD, HUB DRAIN
HP	HORSEPOWER
HKP	HOUSEKEEPING PAD
HSC	HORIZONTAL SPLIT CASE
HT	HEIGHT
HTR	HEATER
HW	HOT WATER
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
HZ	HERTZ

I

ID	INSIDE DIAMETER
IE	INVERT ELEVATION
IN	INCH
INSUL	INSULATION
IW	INDIRECT WASTE

J

JP	JOCKEY PUMP

K

KEC	KITCHEN EQUIPTMENT CONTRACTOR
KVA	KILOVOLT- AMPS
KW	KILOWATT

L

L	LENGTH, LAVATORY
LAV	LAVATORY
LF	LINEAR FEET
LT	LINT
LP	LOW PRESSURE
LRA	LOCKED ROTOR AMPS
LVL	LEVEL

M

MAX	MAXIMUM
MBTUH	THOUSAND OF BTU'S
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MI	MALLEABLE IRON
MS	MOP SINK
MTD	MOUNTED
MUW	MAKE-UP WATER

N

N.C.	NORMALLY CLOSED
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE

O

OC	ON CENTER
OD	OUTSIDE DIAMETER, OVERFLOW DRAIN
OS&Y	OPEN STEM AND YOLK
O	MEDICAL OXYGEN

P

PC	PLUMBING CONTRACTOR
PH	PHASE
PIV	POST INDICATOR VALVE
PNEU	PNEUMATIC
PNL	PANEL
PP	POLYPROPYLENE
PPM	PART PER MILLION
PRS	PRESSURE REDUCING STATION
PRV	PRESSURE REDUCING VALVE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PVC	POLYVINYL CHLORIDE

Q

QTY	QUANTITY

R

RCP	REFLECTED CEILING PLAN, REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RE	REFERENCE /REFER
RECIRC	RECIRCULATE
REFR	REFRIGERATOR
REINF	REININGFORCING
RM	ROOM
RPM	REVOLUTIONS PER MINUTE ROOF TOP UNIT
RTU	ROOFTOP UNIT
RV	RELIEF VALVE

S

SD	STORM DRAIN
SEC	SECONDARY
SECT	SECTION
SF	SQUARE FEET
SH	SHOWER
SIM	SIMILAR
SK	SINK
SP	SUMP PUMP, STATIC PRESSURE
SPEC	SPECIFICATION
SPR	SPRINKLER
SQ	SQUARE
SS	SERVICE SINK
SSD	SUBSURFACE DRAIN
STD	STANDARD
STL	STEEL
STR	STRAINER
SV	SANITARY VENT
SW	SOFT WATER
SOV	SHUT-OFF VALVE

T

TD	TRENCH DRAIN
TDH	TOTAL DYNAMIC HEAD
TDL	TOTAL DEVELOPED LENGTH
TP	TRAP PRIMER
TPD	TRAP PRIMER DEVICE
TYP	TYPICAL

U

U	URINAL
UCD	
UG	UNDERGROUND
UH	UNIT HEATER
UL	UNDERWRITERS LABORATORIES, INC.
UNO	UNLESS NOTED OTHERWISE
UF	UNDERFLOOR
US	UNDERSLAB

V

V	VOLT, VENT
VAC	VACUUM(MEDICAL)
VB	VALVE BOX, VACUUM BREAKER
VCP	VITRIFIED CLAY PIPE
VEL	VELOCITY
VP	VACUUM PUMP
VTR	VENT THRU ROOF

W

W	WATT, WASTE, WIDTH, WASHER
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WCO	WALL CLEANOUT
WH	WALL HYDRANT
WM	WATER METER
WP	WEATHERPROOF
WPD	WATER PRESSURE DROP
WWF	WELDED WIRE FABRIC
WT	WATERTIGHT, WEIGHT

Y

Y	YARD HYDRANT

Z

Z	ZONE

SYMBOLS

PLUMBING SYSTEMS

- SANITARY DRAIN BELOW FLOOR
- S(E) — EXISTING SOIL OR WASTE PIPING B.G. - S(E)
- SANITARY DRAIN ABOVE FLOOR
- S(E) — EXISTING SOIL OR WASTE PIPING A.G. - S(E)
- PIPE DEMO
- V — SANITARY VENT
- V(E) — EXISTING VENT PIPING - V(E)
- GW — GREASE WASTE(ABOVE CEILING)
- GW — GREASE WASTE(BELOW FLOOR)
- OW — OIL WASTE(BELOW FLOOR)
- SD — STORM DRAIN(ABOVE CEILING)
- SD — STORM DRAIN(BELOW FLOOR)
- OD — OVERFLOW DRAIN(ABOVE CEILING)
- OD — OVERFLOW DRAIN(BELOW FLOOR)
- AW — ACID WASTE(ABOVE CEILING)
- AW(E) — EXISTING ACID WASTE PIPING A.G. - AW(E)
- AW — ACID WASTE(BELOW FLOOR)
- AW(E) — EXISTING ACID WASTE PIPING B.G. - AW(E)
- AV — ACID VENT(ABOVE CEILING OR BELOW FLOOR)
- AV(E) — EXISTING ACID VENT PIPING - AV(E)
- CW — COLD WATER CW
- NP-CW — NON-POTABLE - COLD WATER
- CW(E) — EXISTING DOMESTIC COLD WATER - CW(E)
- HW — HOT WATER HW
- EXISTING DOMESTIC HOT WATER
- HWR — HOT WATER RECIRCULATION
- EXISTING DOMESTIC HOT WATER RETURN HWR
- G (4oz) — NATURAL GAS (LOW PRESSURE)
- G (2 PSI) — NATURAL GAS (MEDIUM PRESSURE)
- G (5 PSI) — NATURAL GAS (HIGH PRESSURE)
- T — TEMPERED WATER
- CA — COMPRESSED AIR
- A — MEDICAL AIR
- O — MEDICAL OXYGEN
- V — MEDICAL VACUUM
- F — FIRE STANDPIPE, FIRE LINE
- FS — WET AUTOMATIC FIRE SPRINKLER
- FW — FORCE WASTE
- TP — TRAP PRIMER
- D — DRAIN LINE
- SW — SOFT WATER
- LT — LINT WASTE

PIPING FITTINGS

- CAP ON END OF PIPE
- ELBOW UP
- ELBOW DOWN
- VALVE IN DROP
- VALVE IN RISE
- DIRECTION OF FLOW
- DIRECTION OF SLOPE DOWN
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- TEE OUTLET UP
- TEE OUTLET DOWN
- UNION
- FLANGE
- STRAINER WITH BLOWDOWN VALVE
- GATE VALVE, HVAC BALANCING/STOP VALVE
- GLOBE VALVE
- BALL VALVE
- BALANCING VALVE WITH DIFFERENTIAL PRESSURE TAPS
- OS&Y VALVE
- CHECK VALVE
- BUTTERFLY VALVE
- TWO-WAY MODULATING CONTROL VALVE
- THREE-WAY MODULATING CONTROL VALVE
- SOLENOID VALVE
- PRESSURE REDUCING VALVE
- GAS REGULATOR
- GAS COCK
- SPRINKLER FLOOR CONTROL STATION
- MANUAL AIR VENT
- AUTOMATIC AIR VENT
- T&P RELIEF VALVE
- LINE CLEANOUT/ WALL CLEANOUT
- FLOOR CLEANOUT
- GRADE CLEANOUT
- PRESSURE GAUGE WITH GAUGE COCK
- THERMOMETER
- FLOW VENTURI
- VACUUM BREAKER
- VACUUM RELIEF VALVE
- BACKFLOW PREVENTOR
- CIRCULATING PUMP
- WATER SUB-METER

MISCELLANEOUS

- DRAIN(TYPE AND SIZE AS NOTED ON PLANS)
- ROOF DRAIN OR OVERFLOW DRAIN
- ROOF DRAIN OR OVERFLOW DRAIN(FROM ABOVE)
- HOSE BIBB
- WALL HYDRANT
- PLUMBING FIXTURES
- EXISTING PLUMBING FIXTURES
- POINT OF NEW CONNECTION TO EXISTING PIPING
- P.X.X — PLUMBING DRAWING NOTE REFERENCE
- 2 / P2.1 — DETAIL NUMBER OR PLAN / SHEET WHERE DETAIL OR PLAN IS SHOWN
- FS — FLOW SWITCH
- TS — TAMPER SWITCH
- ACCESS PANEL (AP)
- FIRE DEPARTMENT SIAMESE CONNECTION(WALL MOUNTED)
- FIRE DEPARTMENT SIAMESE CONNECTION(FREE STANDING)
- 2 / P7.1 — PLUMBING RISER DIAGRAM NUMBER / SHEET WHERE PLUMBING RISER DIAGRAM IS SHOWN

GENERAL PLUMBING NOTES

1. UNLESS NOTED OTHERWISE, GRAVITY DRAINAGE PIPING 3" AND SMALLER SHALL BE PROVIDED AT NO LESS THAN 1/4" PER FOOT UNIFORM SLOPE AND GRAVITY DRAINAGE PIPING 4" AND LARGER SHALL BE PROVIDED AT NO LESS 1/8" PER FOOT UNIFORM SLOPE.
2. WHERE THE PREVAILING CODE ALLOWS FOR A SHALLOWER SLOPE FOR GRAVITY DRAINAGE PIPING THAN INDICATED ABOVE, THIS SHALL BE ALLOWED IF REQUIRED PER PROJECT CONDITIONS.
3. WHERE THE PREVAILING CODE REQUIRES A STEEPER SLOPE FOR GRAVITY DRAINAGE PIPING THAN INDICATED ABOVE (SUCH AS FOR GREASE WASTE PIPING) THEN SUCH REQUIREMENT(S) SHALL CONTROL.
4. UNLESS NOTED OTHERWISE, GRAVITY STORM DRAINAGE AND SECONDARY (OVERFLOW) PIPING SHALL BE PROVIDED AT NO LESS THAN 1/8" PER FOOT UNIFORM SLOPE.
5. FUEL GAS PIPING SHALL BE PROVIDED IN ACCORDANCE WITH THE PREVAILING GAS CODE OR NFPA 54. WHICHEVER REQUIREMENTS ARE MORE STRINGENT.
6. THE INSTALLATION OF THE BUILDING PLUMBING SYSTEMS SHALL BE COORDINATED ACCORDINGLY WITH THE WORK OF ALL OTHER TRADES.

GENERAL FIRE PROTECTION NOTE

AN APPROPRIATELY STATE REGISTERED FIRE PROTECTION COMPANY SHALL PROVIDE A FULLY COMPLIANT AND FUNCTIONAL AUTOMATIC FIRE SPRINKLER SYSTEM TO PROTECT THE BUILDING IN ACCORDANCE WITH NFPA 13. THE PROJECT SPECIFICATIONS, AND THE REQUIREMENTS OF THE OWNER AND THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ). THE MOST STRINGENT REQUIREMENTS SHALL GOVERN.

PLUMBING CODES

2018	IPC	INTERNATIONAL PLUMBING CODE
2018	IFC	INTERNATIONAL FIRE CODE
2018	IFGC	INTERNATIONAL FUEL GAS CODE
2018	IECC	INTERNATIONAL ENERGY CONSERVATION CODE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.1583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
1504 Fortview Road, Austin, TX 78704

SW	JG	JB	AR	-

TN PN

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

P0.1

PLUMBING SYMBOL LEGEND

PLUMBING GENERAL NOTES

A. UNDERGROUND PLUMBING DESIGN IS BASED ON CARTON FORM FOUNDATION AND THEREFORE ALL PIPING BELOW SLAB SHALL BE SUPPORTED BY AN APPROVED SUSPENDED SYSTEM IN ACCORDANCE WITH SPECIFICATION SECTION 22 10 00 - PLUMBING PIPING.
B. WALL BOX, WB-1, IN KITCHEN SHALL BE INSTALLED BELOW COUNTER IN CABINET SPACE.

PLUMBING KEYED NOTES

P1.1 SANITARY BUILDING DRAIN, SIZE AS NOTED, REFER TO CIVIL UTILITY DRAWINGS FOR CONTINUATION BEYOND 5' OF THE BUILDING LINE.

P1.3 DOMESTIC WATER SERVICE, SIZE AND PEAK FLOW RATE AS NOTED.

P1.4 FIRE PROTECTION WATER SERVICE, SIZE AS NOTED.

P1.6 STORM, SIZE AND DEPTH AS NOTED.

P2.8 4" SANITARY WASTE DOWN TO LEVEL BELOW.

P2.9 2" SANITARY VENT OFF TOP OF DRAIN LINE BELOW ROOF LEVEL WITH SLOPING VENT TO RISER AS SHOWN.

P2.10 2" SANITARY VENT UP FROM BELOW FLOOR. PROVIDE WALL CLEANOUT ON RISER.

P2.11 4" SANITARY WASTE DOWN FROM LEVEL ABOVE.

P2.12 SANITARY VENT FROM LEVEL BELOW. SIZE AS NOTED.

P2.13 3" SANITARY VENT OFF TOP OF DRAIN LINE BELOW FLOOR WITH SLOPING VENT TO RISER AS SHOWN.

P2.14 3" SANITARY VENT UP TO LEVEL ABOVE.

P2.15 3" SANITARY VENT FROM BELOW FLOOR SLAB. PROVIDE WALL CLEANOUT ON RISER.

P3.4 DROP AND EXTEND 3/4" HOT AND COLD WATER TO SERVE FIXTURE(S).

P3.6 DROP AND EXTEND 3/4" COLD WATER TO SERVE FIXTURE(S).

P3.7 DROP AND EXTEND MINIMUM 1-1/2" COLD WATER TO SERVE FIXTURE.

P3.10 HOT WATER DROP DOWN TO, RISE UP FROM, AND CIRCULATED HOT WATER LINE INSIDE WALL/CHASE AND WITHIN 2'-0" OF HOT WATER ROUGH-IN TO LAVATORY FOR 2015 IECC COMPLIANCE. SIZE AS NOTED.

PLUMBING KEYED NOTES

P3.12 3/4" COLD WATER UP FROM LEVEL BELOW.

P3.13 3/4" COLD WATER UP TO LEVEL ABOVE.

P3.14 1" HOT WATER AND 1-1/4" COLD WATER DOWN TO COMMERCIAL WASHER EXTRACTOR MACHINE. REFER TO MANUFACTURERS RECOMMENDATIONS FOR ROUGH-IN INFORMATION PRIOR TO INSTALLATION. ENSURE WATER LINES ARE OFFSET AS REQUIRED AND ACCESSIBLE FOR MAINTENANCE PURPOSES THROUGH DOOR DIRECTLY BEHIND EXTRACTOR.

P3.15 DISHWASHER. PROVIDE HOT WATER SUPPLY AND STOP. PROVIDE AIR GAP FITTING AND DRAIN TO ADJACENT SINK TAILPIECE.

P3.16 3/4" HOT AND COLD WATER DROPS TO BELOW FLOOR FOR SERVICE TO ISLAND SINK. RUN INSIDE PVC SLEEVE. USE SOFT ANNEALED TYPE K COPPER FOR PIPES BELOW SLAB (INSTALL WITH NO FITTINGS BELOW SLAB).

P3.22 HOT WATER RETURN BALANCING VALVE.

P5.1 STORM DOWN FROM ROOF DRAIN ABOVE, SIZE AS NOTED.

P5.4 STORM DOWN TO BELOW GRADE, SIZE AS NOTED.

P6.1 1" (4 OZ) GAS PIPING THRU WALL SLEEVED WATER TIGHT. PROVIDE CAP AND SHUT-OFF VALVE. CONTRACTOR SHALL INSTALL GAS CONNECTION BEHIND GRILL.

P6.5 GAS PIPE THRU EXTERIOR WALL. PROVIDE SLEEVES AND WATER TIGHT WALL PENETRATIONS.

P6.6 CONNECT GAS PIPING TO EQUIPMENT. PROVIDE SHUT-OFF VALVES AND DRIP LEGS. SIZE AS NOTED.

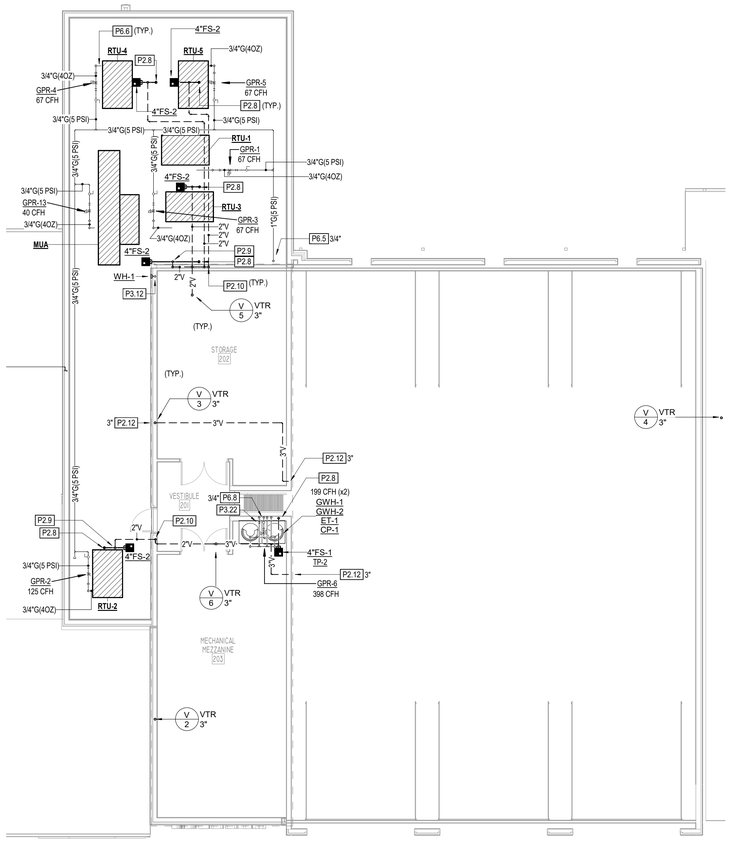
P6.7 GAS UP TO LEVEL ABOVE SIZE AS NOTED.

P6.8 GAS UP FROM LEVEL BELOW. SIZE AS NOTED.

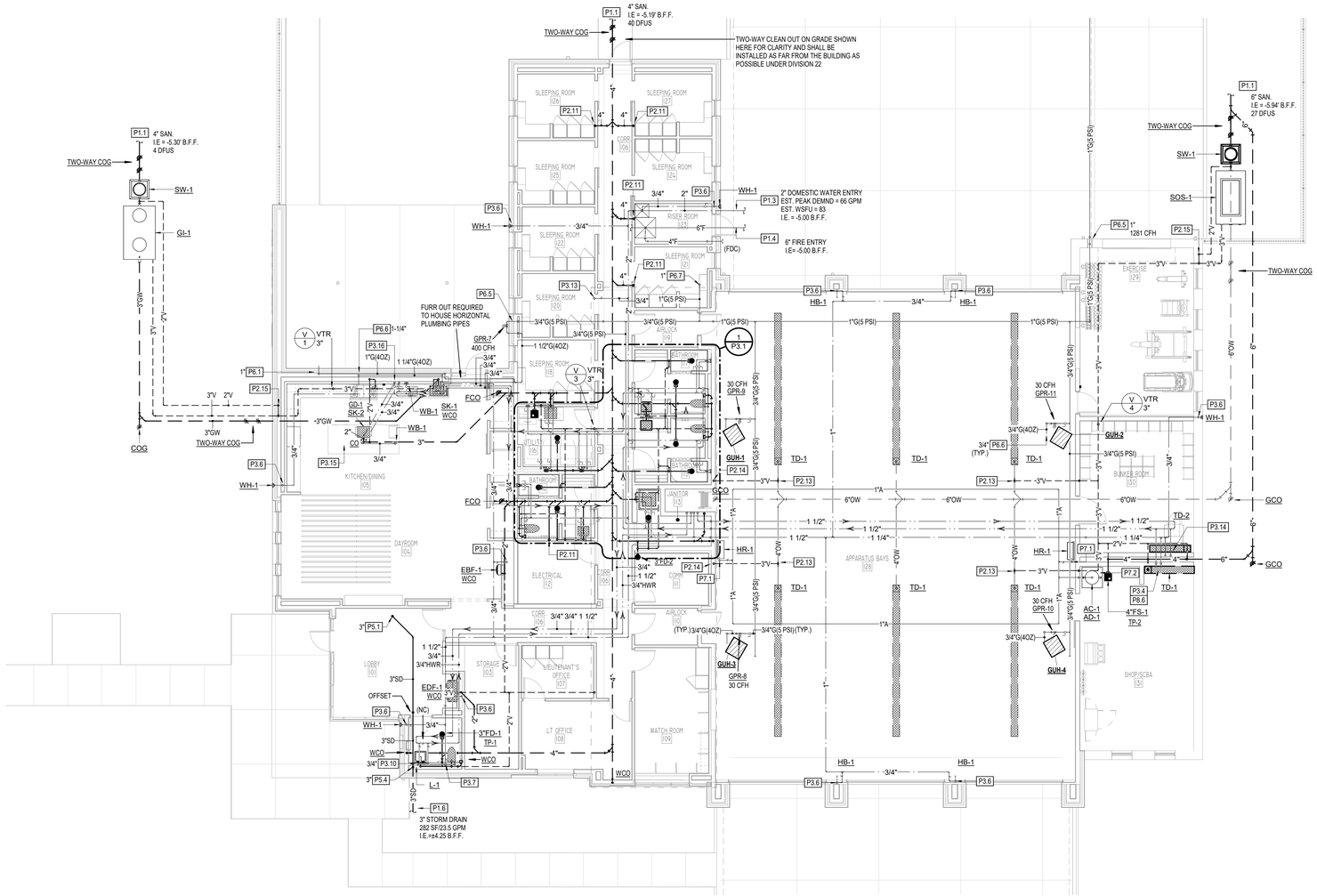
P7.1 3/4" AIR PIPING TO HOSE REEL, HR-1. CONTRACTOR TO COORDINATE WITH ARCHITECT/OWNER FOR EXACT LOCATION. RE:9/P6.2.

P7.2 AIR COMPRESSOR/AIR DRYER, AC-1/AD-1. ALL INSTALLATIONS TO COMPLY WITH MANUFACTURERS DETAILS AND RECOMMENDATIONS. RE:8/P6.2.

P8.6 PROVIDE MS-1 FAUCET FOR BUILT IN PLACE MOP SINK WITH TRENCH DRAIN ROUTED ALONG BACKSIDE. RE: ARCHITECTURAL AND STRUCTURAL DWGS. FOR MORE INFORMATION.



2 PLUMBING PLAN LEVEL 2
P2.1 1/8" = 1'-0"



1 PLUMBING PLAN LEVEL 1
P2.1 1/8" = 1'-0"

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 150
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
TBPLS Firm Registration No. 10194697

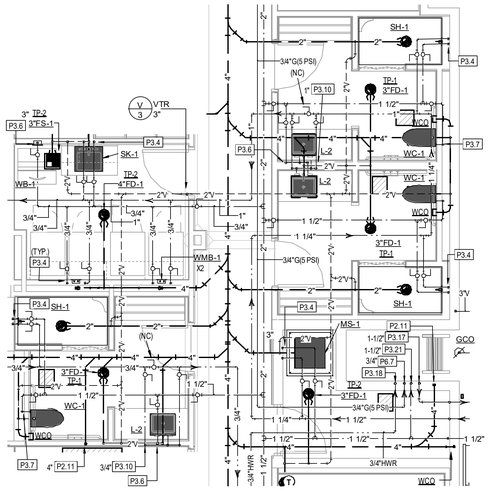
NO.	REVISION	DATE
SW	JCS	JB	AR	-

TN PN

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

P2.1
PLUMBING PLANS



1 P3.1 PLUMBING PLAN LEVEL 1 - ENLARGED

1/4" = 1'-0"

PLUMBING KEYED NOTES

P2.11 4" SANITARY WASTE DOWN FROM LEVEL ABOVE.

P3.4 DROP AND EXTEND 3/4" HOT AND COLD WATER TO SERVE FIXTURE(S).

P3.6 DROP AND EXTEND 3/4" COLD WATER TO SERVE FIXTURE(S).

P3.7 DROP AND EXTEND MINIMUM 1-1/2" COLD WATER TO SERVE FIXTURE.

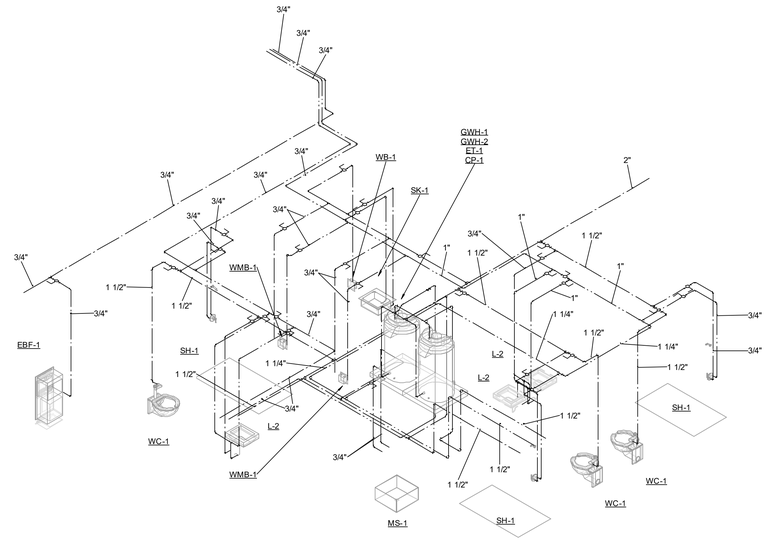
P3.10 HOT WATER DROP DOWN TO, RISE UP FROM, AND CIRCULATED HOT WATER LINE. INSIDE WALL/CHASE AND WITHIN 2'-0" OF HOT WATER ROUGH-IN TO LAVATORY FOR 2015 IECC COMPLIANCE. SIZE AS NOTED.

P3.17 HOT WATER DOWN FROM LEVEL ABOVE. SIZE AS NOTED.

P3.18 3/4" HOT WATER RETURN UP TO LEVEL ABOVE.

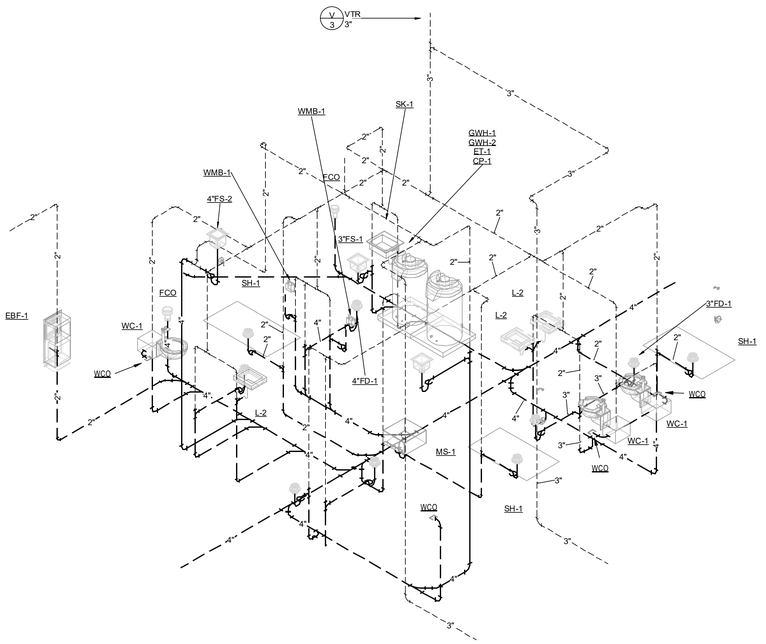
P3.21 COLD WATER UP TO LEVEL ABOVE. SIZE AS NOTED.

P6.7 GAS UP TO LEVEL ABOVE SIZE AS NOTED.



2 P3.1 RISER - WATER - ENLARGED AREA

NOT TO SCALE



3 P3.1 RISER - SANITARY & VENT - ENLARGED AREA

NOT TO SCALE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.637.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2241
8900 Shoal Creek Blvd. Austin, TX 78757
SW | JG | JB | AR | -

TN PN

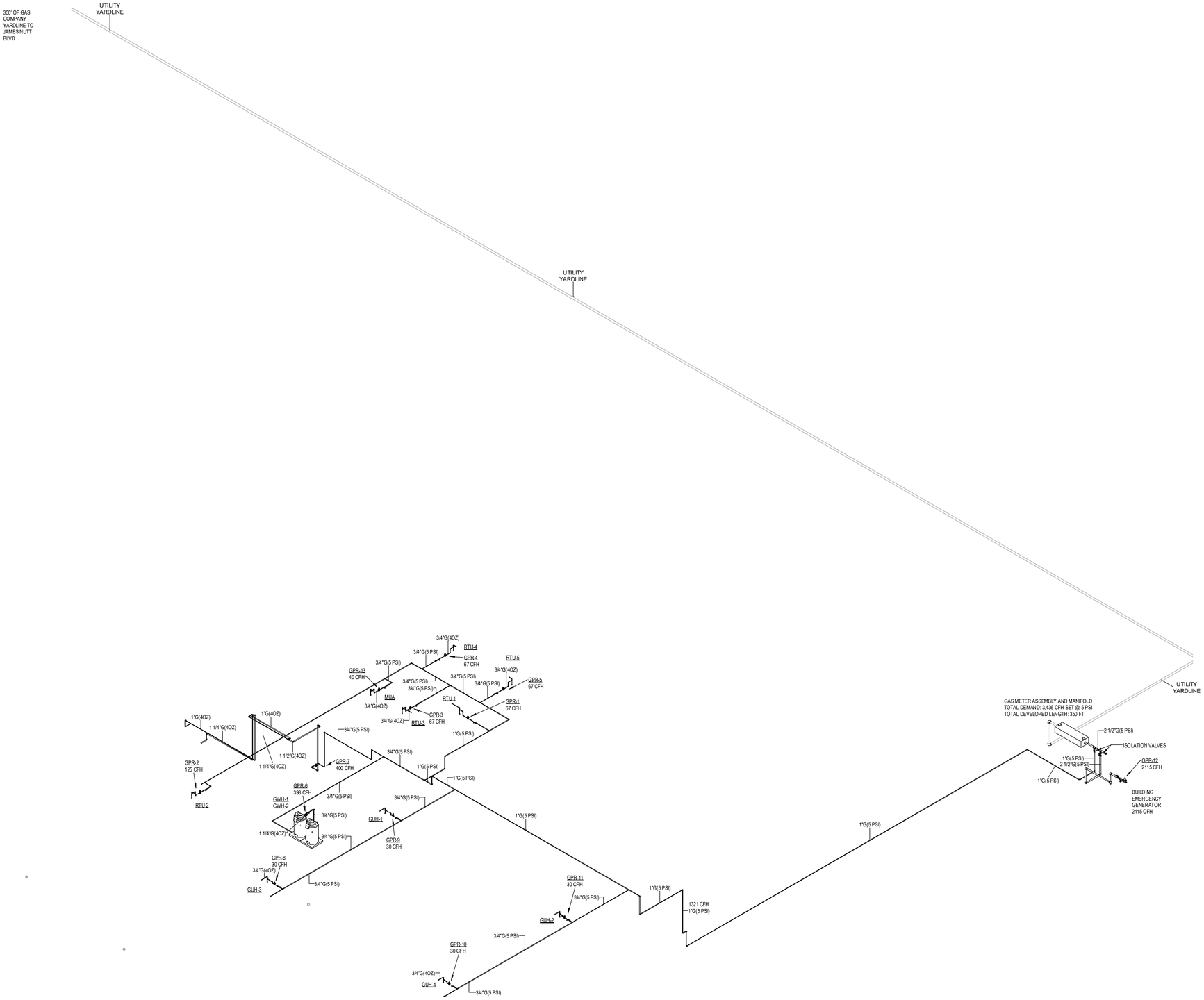
DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

P3.1

PLUMBING ENLARGED PLAN



1 P4.1 **RISER - GAS**

PLUMBING GENERAL NOTES

A. ISOMETRIC DIAGRAMS ARE FOR SIZING PURPOSES ONLY AND SHALL NOT BE USED FOR MATERIAL TAKE-OFFS, OR BE CONSTRUED TO INDICATE ACTUAL SITE INSTALLATION. CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF PIPING, DEVICES AND EQUIPMENT WITH BUILDING ELEMENTS AND THE WORK OF OTHER TRADES.

B. CONTRACTOR TO PROVIDE GAS PRESSURE REGULATORS, PLUG VALVES, UNIONS, STRAINERS, AND DIRT LEGS PRIOR TO MECHANICAL EQUIPMENT TIE-INS. CONTRACTOR TO SET GAS PRESSURE REGULATORS PER MANUFACTURERS RECOMMENDATIONS.

GAS PRESSURE REGULATORS

PLAN MARK	GAS QUANTITY C.F.H.	PRESSURE INLET/OUTLET	LOCATION	MANUFACTURER/MODEL NUMBER
GPR-1	67	5PSIG/7" W.C.	ADJACENT TO RTU-1	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-2	125	5PSIG/7" W.C.	ADJACENT TO RTU-2	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-3	67	5PSIG/7" W.C.	ADJACENT TO RTU-3	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-4	67	5PSIG/7" W.C.	ADJACENT TO RTU-4	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-5	67	5PSIG/7" W.C.	ADJACENT TO RTU-5	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-6	398	5PSIG/7" W.C.	ADJACENT TO WATER HEATER	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-7	400	5PSIG/7" W.C.	EXTERIOR WALL	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-8	30	5PSIG/7" W.C.	ADJACENT TO UNIT HEATER	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-9	30	5PSIG/7" W.C.	ADJACENT TO UNIT HEATER	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-10	30	5PSIG/7" W.C.	ADJACENT TO UNIT HEATER	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-11	30	5PSIG/7" W.C.	ADJACENT TO UNIT HEATER	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-12	2115	5PSIG/7"-11" W.C.	10' MIN FROM GENSET	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL
GPR-13	40	5PSIG/7"-11" W.C.	ADJACENT TO MUA	ITRON B31 SERIES LIGHT COMMERCIAL-INDUSTRIAL

GENERAL NOTES:

1. COORDINATE FINAL REGULATOR SELECTIONS WITH FINAL EQUIPMENT BEING PROVIDED. MAKE ADJUSTMENTS AS REQUIRED.

2. PROVIDE MAXITROL 325 SERIES (OR EQUAL PER SPEC 22 11 21) GAS PRESSURE REGULATOR TO REGULATE PRESSURES FROM 5 PSI (OUTLET) TO 4 OZ (INLET) OR PER MANUFACTURE RECOMMENDATION.

3. ALL GAS PRESSURE REGULATORS SHALL MEET THE REQUIREMENTS OF ANSI Z21.80 (NFPA 54:5.8.2).

4. PROVIDE REGULATOR VENT LINE FOR EACH REGULATOR INDEPENDENTLY AND ROUTE EACH LINE FULL SIZE TO THE OUTDOORS.

5. TERMINATE REGULATOR VENT LINES A MINIMUM OF 20'-0" FROM ANY FRESH AIR INTAKES.

6. REGULATORS LOCATED INDOORS SHALL NOT BE INSTALLED CONCEALED OR ABOVE A CEILING. ALL INDOOR REGULATORS MUST BE LOCATED BELOW FINISHED CEILINGS OR IN EXPOSED AREAS.

7. GAS REGULATORS SHALL BE EQUIPPED WITH SCREENED VENT OPENINGS ORIENTED TO PREVENT THE ENTRANCE OF WATER OR OTHER FOULING MATERIALS. WHEN LOCATED INSIDE THE BUILDING VENTS SHALL BE PIPED TO THE BUILDING EXTERIOR AND TERMINATED WITH A SCREENED OUTLET 90 ELL FITTING POINTED DOWNWARD. PROVIDE LINE SIZE PLUG OR BALL VALVE AND UNION ON INLET; AND TEE WITH TEST COCK DOWNSTREAM OF ALL REGULATOR ASSEMBLIES.

8. NATURAL GAS PIPING BELOW GRADE AND OUTSIDE THE BUILDING SHALL BE YELLOW POLYETHYLENE WITH SOCKET HEAT FUSION WELD FITTINGS.

9. NATURAL GAS PIPING ABOVE GRADE SHALL BE SEAMLESS SCHEDULE 40 BLACK IRON.

EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
STATE OF TEXAS
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 203
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.637.4383 p
https://www.dbinc.com
TBPE Firm Registration No. 224
TBPLS Firm Registration No. 10194000
SW | JG | JB | AR | -

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

P4.1
PLUMBING RISERS

PLUMBING FIXTURE SCHEDULE

PLAN MARK	MINIMUM ROUGH-IN SIZES: WASTE & VENT		DRAIN	CW	HW	DESCRIPTION
WATER CLOSET WC-1 FLOOR MOUNT - ADA	4"	2"	4"	1-1/2"	---	KOHLER No. K-96053-SSL WHITE V.C. ELONGATED FLOOR MOUNT (1.28GPF) BOWL WITH TOP SPUD.
FLUSH VALVE						SLOAN REGAL No.111-1.28 FLUSH VALVE LOW CONSUMPTION (MANUAL) VALVE. POLISHED CHROME FINISH.
ACCESSORIES						GEMLINE GL212SSCWH ELONGATED, HEAVY-DUTY, WHITE, OPEN FRONT TOILET SEAT, LESS COVER WITH SELF-SUSTAINING STAINLESS STEEL CHECK HINGE. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CARRIER. FOR FULL DESCRIPTION REFER TO PROJECT SPECIFICATIONS. REFER TO ARCHITECTS PLANS FOR ADA MOUNTING HEIGHT.
LAVATORY L-1 WALL MOUNT - ADA	2"	2"	1-1/4"	3/4" 1/2"TW (90°)	3/4"	KOHLER No. K-12643 20-3/4" X 18" V.C. WALL HUNG LAVATORY WITH 4" CENTER FAUCET HOLE. PROVIDED WITH HANGER PLATE AND HOLES FOR CONCEALED ARM CARRIER.
FAUCET MATTE BLACK						KOHLER No. K-97060-4 (1.2 GPM) CENTERSET SINGLE LEVER HANDLE FAUCET.
ACCESSORIES						REFER TO PLUMBING SUPPLIES AND TRIM SCHEDULE. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CONCEALED ARM CARRIER, REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHTS. PROVIDE TMV-1 SET TEMPERATURE TO 90°.
LAVATORY L-2 DROP IN - ADA	2"	2"	1-1/4"	3/4" 1/2"TW (90°)	3/4"	KOHLER No. K-2882 19-3/4" UNDERMOUNT RECTANGLE WHITE V.C. LAVATORY WITH REAR OVERFLOW AND FAUCET HOLES DRILLED ON 8" CENTER FAUCET HOLES.
FAUCET MATTE BLACK						KOHLER No. K-97093-4 (1.2 GPM) 8" CENTERSET FAUCET WITH LEVER HANDLES.
ACCESSORIES						REFER TO PLUMBING SUPPLIES AND TRIM SCHEDULE. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CONCEALED ARM CARRIER, REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHTS. PROVIDE TMV-1 SET TEMPERATURE TO 90°.
SINK SK-1	2"	2"	1-1/2"	3/4"	3/4"	ELKAY No. ELUHAD211555 "LUSTERTONE" SINGLE COMPARTMENT SINK, 6" DEEP WITH OFF CENTER REAR DRAIN OPENING.
FAUCET MATTE BLACK						KOHLER No. K-22972 (1.5 GPM) FAUCET WITH BRASS SWIVEL SPOUT WITH PULL DOWN HEAD.
ACCESSORIES						ELKAY No.LK-18 GRID DRAIN STRAINER, OFFSET TAILPIECE, CAST BRASS P-TRAP WITH CO, SUPPLY STOPS. ADA INSULATION KIT WHERE TRIM IS EXPOSED. REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHT. PROVIDE TMV-1 SET TEMPERATURE TO 90°.
SINK SK-2	2"	2"	1-1/2"	3/4"	3/4"	ELKAY No. ELUH281610 "LUSTERTONE" SINGLE COMPARTMENT SINK, 10" DEEP WITH OFF CENTER REAR DRAIN OPENING.
FAUCET MATTE BLACK						KOHLER No. K-22972 (1.5 GPM) FAUCET WITH BRASS SWIVEL SPOUT WITH PULL DOWN HEAD.
ACCESSORIES						ELKAY No.LK-18 GRID DRAIN STRAINER, OFFSET TAILPIECE, CAST BRASS P-TRAP WITH CO, SUPPLY STOPS, PROVIDE INSULATION KIT WHERE TRIM IS EXPOSED. REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHT. PROVIDE TMV-1 SET TEMPERATURE TO 90°.
ELECTRIC DRINKING FOUNTAIN EDF-1 ADA	2"	2"	1-1/4"	3/4"	---	ELKAY No. LZSTL8SC VERSATILE WALL MOUNT BI-LEVEL ADA COOLER FILTERED REFRIGERATED STAINLESS, 8.0 GPH CAPACITY COOLED TO 50° F WITH 80° F AMBIENT TEMP. PROVIDE ZURN OR EQUAL FLOOR MOUNTED PLATE TYPE CARRIER AND TRAP AND SUPPLY AS NOTED BELOW. PROVIDE WITH ALL STAINLESS STEEL CABINET.
ELECTRICAL REQUIREMENTS						1/5 HP, 4.0 FL. AMPS. WIRED FOR POWER AS SCHEDULED ON ELECTRICAL DRAWINGS.
ACCESSORIES						REFER TO PLUMBING SUPPLY AND TRIM SCHEDULE. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CONCEALED ARM CARRIER, REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHTS.
ELECTRIC BOTTLE FILLER EBF-1 ADA	2"	2"	1-1/4"	1/2"	---	ELKAY No. LZWSM8K IN-WALL BOTTLE FILLING STATION WITH MOUNTING FRAME FILTERED REFRIGERATED STAINLESS. 8.0 GPH CAPACITY, COOLED TO 50° F WITH 90° F AMBIENT TEMP, 1FL. AMPS. WIRED FOR 115V/60/1 POWER. PROVIDE MOUNTING FRAME; TRAP AND SUPPLY. PROVIDE WITH ALL STAINLESS STEEL CABINET.
ELECTRICAL REQUIREMENTS						1/5 HP, 4.0 FL. AMPS. WIRED FOR POWER AS SCHEDULED ON ELECTRICAL DRAWINGS.
ACCESSORIES						REFER TO PLUMBING SUPPLY AND TRIM SCHEDULE. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CONCEALED ARM CARRIER, REFER TO ARCHITECTS PLANS FOR MOUNTING HEIGHTS.
SHOWER SH-1 ADA MATTE BLACK	2"	2"	2"	3/4"	3/4"	KOHLER MODEL No. K-2972-KS THERMOSTATIC MIXING VALVE, K-T14488-4 THERMOSTATIC VALVE TRIM, K-2974-K VOLUME CONTROL VALVE, K-T14490-4 VOLUME CONTROL VALVE TRIM, K-7397 SHOWER ARM AND FLANGE, AND K-72417 SINGLE FUNCTION SHOWER HEAD @ 1.75 GPM FLOW PROVIDE CHECK STOPS.
ACCESSORIES						2" FD-1 FOR DRAINAGE AND MINIMUM 4 P.S.F. LEAD, OR 40 MIL. VINYL SHOWER PAN. RE: ARCHITECTURAL PLANS.
MOP SINK MS-1	3"	2"	3"	3/4"	3/4"	FIAT MODEL No. TSB3000 FLOOR MOUNTED 36 X 36 X 12 TERRAZZO MOLDED BASIN.
FAUCET						MOEN MODEL No. 8230 SERVICE SINK FAUCET WITH VACUUM BREAKER HOSE END SPOUT.
ACCESSORIES						MOP BRACKET AND HOSE WITH S.S. CAPS AND SPLASH CATCHER PANELS.

* - REFER TO DRAWINGS FOR SIZING.
GENERAL NOTES:
1. FOR ALL SUPPLY STOPS AND TRIM REFER TO THE PLUMBING FIXTURE SUPPLIES AND TRIM SCHEDULE.
2. FOR MOUNTING HEIGHTS OF INDIVIDUAL FIXTURES, REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATION.
3. CONTRACTOR TO COORDINATE LOCATION OF DRAINS AND FLOOR SINKS WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS.

PLUMBING FIXTURE SCHEDULE

PLAN MARK	MINIMUM ROUGH-IN SIZES: WASTE & VENT		DRAIN	CW	HW	DESCRIPTION
THERMOSTATIC MIXING VALVE TMV-1	---	---	---	1/2"	1/2"	LEONARD MODEL: 270-LF ADJUSTABLE POINT-OF-USE LEAD FREE THERMOSTATIC MIXING VALVE, ASSE 1070 WITH INLET CHECK STOPS TO LIMIT HOT WATER TEMPERATURE. SET TEMPERATURE AT 110°. PROVIDE WITH MOUNTING BRACKET.
FLOOR DRAIN FD-1	3"	2"	3"	---	---	ZURN No. ZN-415 CAST IRON DRAIN WITH 6" DIAMETER TYPE 'B' STRAINER AND 1/2" IPS TRAP PRIMER CONNECTION. FOR FLOOR DRAIN BODY POURED IN CONCRETE SLAB PROVIDE ZURN Z1023 TRAP PRIMER EXTENSION.
FLOOR DRAIN FD-2	3"	2"	3"	---	---	ZURN No. ZN-415 CAST IRON DRAIN WITH 7" DIAMETER TYPE 'E' STRAINER, TRAP PRIMER CONNECTION AND 4" DIAMETER FUNNEL GRATE. FOR FLOOR DRAIN BODY POURED IN CONCRETE SLAB PROVIDE ZURN Z1023 TRAP PRIMER EXTENSION.
FLOOR SINK FS-1	4"	2"	4"	---	---	ZURN No. ZN-1902-2-25-K, 12" SQUARE, 8" DEEP CAST IRON DRAIN WITH ENAMELED INTERIOR, SEDIMENT BUCKET STRAINER AND SECURED HALF NICKEL BRONZE GRATE. FOR FLOOR DRAIN BODY POURED IN CONCRETE SLAB.
FLOOR SINK FS-2	4"	2"	4"	---	---	ZURN No.Z-566 CAST IRON DRAIN, 12"x12"x9" DEEP WITH TOP GRATE, SEDIMENT BUCKET AND ACID RESISTING EPOXY COATED CAST IRON. SET ON 24"X24"X4" CONCRETE PAD 4" ABOVE FINISH MECHANICAL YARD SLAB TO PREVENT RAIN WATER ENTRY. PROVIDE WITH PROSET OR EQUAL TRAP GUARD.
TRENCH DRAIN TD-1 BAY AREA	---	---	---	---	---	REFER TO DETAIL 2/P6.02.
TRENCH DRAIN TD-2 LAUNDRY	3"	2"	3"	---	---	REFER TO DETAIL 3/P6.02.
TRAP PRIMER TP-1	---	---	---	1/2"	---	PRECISION PLUMBING PRODUCTS, INC. FLUSH VALVE PRIMER No. FVP-1VB WITH VACUUM BREAKER TRAP REFILL SUPPLY. CONTRACTOR TO INSTALL PRIMER ON NEAREST WATER CLOSET TO FLOOR DRAIN SUPPLIED. ALL EXPOSED PIPING SHALL BE CHROME PLATED AND CONCEALED SUPPLY TUBING SHALL BE 1/2" TYPE "K" SOFT COPPER.
TRAP PRIMER TP-2	---	---	---	1/2"	---	PRECISION PLUMBING PRODUCTS, INC. No. PO-500 AUTOMATIC PRESSURE DROP TRAP PRIMER VALVE. INSTALL CONCEALED IN ACCESSIBLE LOCATION, BEHIND APPROVED ACCESS PANEL OR EXPOSED IN MECHANICAL EQUIPMENT AREAS WITH TRAP PRIMER DISTRIBUTION UNIT. INSTALL AT MINIMUM 15" A.F.F.
HOSE BIBB HB-1	---	---	---	3/4"	---	PRIER No. C-534 FAUCET WITH NON-REMOVABLE VACUUM BREAKER AND WHEEL OPERATING HANDLE. MOUNTING HEIGHT FOR 36" A.F.F.
WALL HYDRANT WH-1	---	---	---	3/4"	---	ZURN NO. Z-1300 RECESSED NON-FREEZE BRONZE ALL BOX, ANTI-SIPHON HYDRANT, WITH LOOSE KEY OPERATOR AND POLISHED NICKEL BRONZE LOCKING COVER. INSTALL WITH FACE FLUSH AND SQUARE TO FINISHED WALL. SECURE WITH WALL CLAMP AND SETSCREW. PROVIDE EXTENSION AS REQUIRED TO PLACE VALVE SEAT IN HEATED ROOM SPACE.
ROOF DRAIN RD-1	---	---	---	---	---	ZURN NO. ZC-100-E-R-C 15" CAST IRON DRAIN AND DOME STRAINER WITH FLASHING CLAMPING COLLAR, UNDERDECK CLAMP ROOF SUMP RECEIVER, CAULKED OR NO-HUB OUTLET. DRAIN TO BE INSTALLED WITH MINIMUM OF 36" ADJACENT ROOF DRAIN.
WALL BOX WB-1	---	---	---	3/4"	---	GUY GRAY NO. MIB1HAAB 1/2"x1/2" O.D. TUBE ICE MAKER WITH HAMMER ARRESTER VALVE. LEAVE 60" COIL OF 1/4"O.DS. TYPE "K" SOFT COPPER FOR EQUIPMENT CONNECTION. FOR FREE STANDING REFRIGERATOR WITH ICE MAKER. INSTALL BOX AT 54" A.F.F. FOR UNDER COUNTER REFRIGERATOR ICE MAKER: INSTALL BOX AT 18" A.F.F. FOR COFFEE MACHINE: INSTALL BOX AT 24" A.F.F. BELOW COUNTER OR ABOVE COUNTER BACKSPLASH; COORDINATE WITH ARCHITECT FOR EXACT LOCATION. FOR ICE/COFFEE MAKER PROVIDE WITH CUNO NO. AP717 FILTER BRACKETED TO WALL AND WATTS SD-3 IN-LINE BACKFLOW PREVENTER.
WASHER MACHINE BOX WMB-1	2"	2"	2"	1/2"	1/2"	GUY GRAY MODEL: MWB26 WITH TRIM RING AND HAMMER ARRESTERS WITH 1/2" QTR. TURN VALVE ASSEMBLY.
BACKFLOW PREVENTOR BFP-1	---	---	---	---	---	WATTS No.909-S-LF REDUCED PRESS. PRINCIPLE DOUBLE CHECK VALVE WITH INTERMEDIATE ATMOSPHERIC VENT. PROVIDE AIR GAP AND FULL SIZE INDIRECT DRAIN PIPED TO FLOOR DRAIN. INSTALL ON PIPE STAND AT 42" AFF WITH CLEARANCE FOR SERVICE AND PIPING BRACKETED TO WALL. PROVIDE SHUT OFF VALVE & FULL SIZE STRAINER ON INLET AND SHUT OFF VALVE ON OUTLET RISER. TEST AND CERTIFY PER...
WALL CLEANOUT WCO	---	---	---	---	---	JAY R SMITH MODEL: 4435-NB-U DURO-COATED CAST IRON CLEANOUT WITH COUNTER-SUNK GASKET, WATERTIGHT THREADED PLUG AND SQUARE SMOOTH NICKEL BRONZE ACCESS COVER WITH VANDAL PROOF SCREWS.
FLOOR CLEANOUT FCO	---	---	---	---	---	ZURN No.ZN-1400 CAST IRON CLEANOUT WITH COUNTER-SUNK PLUG AND ROUND SCORIATED TOP FOR GENERAL PURPOSE AREAS. PROVIDE VARIATION AS REQUIRED FOR FLOOR FINISH WHERE INSTALLED. SEE ARCHITECT DWG'S FOR FLOOR TYPES.
GRADE CLEANOUT GCO	---	---	---	---	---	ZURN No. Z-1402 DURO-COATED CAST IRON CLEANOUT WITH WATERTIGHT COUNTER-SUNK PLUG AND SCORIATED SECURED TOP WITH FRAME. INSTALL IN 18"x18"x6" THICK CONCRETE PAD.

* - REFER TO DRAWINGS FOR SIZING.
GENERAL NOTES:
1. FOR ALL SUPPLY STOPS AND TRIM REFER TO THE PLUMBING FIXTURE SUPPLIES AND TRIM SCHEDULE.
2. FOR MOUNTING HEIGHTS OF INDIVIDUAL FIXTURES, REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATION.
3. CONTRACTOR TO COORDINATE LOCATION OF DRAINS AND FLOOR SINKS WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS.

PLUMBING FIXTURE SUPPLIES AND TRIM

FIXTURE	MANUFACTURER	STRAINER	P-TRAP	SIZE	ANGLE STOP AND SUPPLY RISER
LAVATORY	McGUIRE	HD155A	8872	1-1/4"	LFBV2165-LK, 1/2" I.P.S. X 3/8" O.D.
DRINKING FOUNTAIN	McGUIRE	HD155A	8872	1-1/4"	LFBV2165-LK, 1/2" I.P.S. X 3/8" O.D.
SINK	McGUIRE	152N	8912	1-1/2"	LFBV2165-LK, 1/2" I.P.S. X 3/8" O.D.
2 COMPARTMENT SINK, NO DISPENSER	McGUIRE	(2) 152N WITH CONTINUOUS WASTE 111C16G17	8912	1-1/2"	LFBV2165-LK, 1/2" I.P.S. X 3/8" O.D.

NOTE:

1. STRAINERS SHALL BE HEAVY CAST BRASS CHROME PLATED WITH MATCHING GRID TYPE STRAINER, WITH OR WITHOUT OVERFLOW AS REQUIRED. 17 GAUGE SEAMLESS BRASS TAILPIECE OF LENGTH DETERMINED BY INSTALLATION REQUIREMENTS. PROVIDE COMPLETE WITH WASHERS AND BRASS LOCKNUT.
2. P-TRAPS SHALL BE 17 GAUGE SEAMLESS CHROME-PLATED BRASS, ADJUSTABLE TYPE. PROVIDE COMPLETE WITH CLEANOUT PLUG, CHROME-PLATED BRASS SLIP NUTS, WALL BEND, AND WROUGHT BRASS ESCUTCHEON OF DEPTH DETERMINED BY INSTALLATION REQUIREMENTS.
3. ANGLE STOPS SHALL BE LEAD-FREE COMMERCIAL PATTERN CHROME-PLATED BRASS, QUARTER-TURN BALL TYPE WITH LOOSE KEY HANDLES. PROVIDE COMPLETE WITH CHROME-PLATED COPPER SUPPLY RISERS AND WROUGHT BRASS ESCUTCHEON OF DEPTH DETERMINED BY INSTALLATION REQUIREMENTS.
4. PIPE TRIM INSULATION SHALL BE COMPLIANT, WHITE MOLDED VINYL, FADE/DISCOLORATION-RESISTANT, BACTERIA/FUNGAL-RESISTANT INSULATION.
5. PROVIDE ZURN OR EQUAL FLOOR MOUNTED CARRIER.

COMPRESSED AIR SCHEDULE

PLAN MARK	DESCRIPTION
AIR COMPRESSOR AC-1	INGERSOLL RAND No. 2475N7.5-P 80 GALLON VERTICAL RECEIVER, TWO STAGE AIR COMPRESSOR. 7.5 HP, 208V, 3Φ AND 24.3 CFM AT 175 PSI MAXIMUM PRESSURE. PROVIDE WITH INGERSOLL RAND MOTOR STARTER KIT. COORDINATE POWER REQUIREMENTS WITH ELECTRICAL CONTRACTOR. COMPLETE WITH CONDENSATE NEUTRALIZATION KIT.
AIR DRYER AD-1	INGERSOLL RAND No.D72IN AIR DRYER (0.37 KW) CAPABLE OF 42 CFM AT 100 PSI. COORDINATE 120V/1Φ POWER WITH ELECTRICAL CONTRACTOR.
HOSE REEL HR-1	GRACO MODEL SDX SERIES HOSE REEL ASSEMBLY WITH SPRING RETRACTABLE 50 FOOT 1/2" AIR HOSE, RATED FOR 300 PSI MAXIMUM PRESSURE. ARM POSITIONED TO ACCOMMODATE OVERHEAD MOUNTING FROM VERTICAL SUPPORT, AS DETAILED. PROVIDE PER MANUFACTURER'S RECOMMENDATIONS, COMPLETE WITH RECOMMENDED HOSE INLET KIT AND INLET REDUCER AS REQUIRED. PROVIDE FINAL QUICK CONNECT PER OWNER'S DIRECTIVE. GRACO SDL6H#

GAS WATER HEATER SCHEDULE

PLAN MARK	MANUFACTURER	MODEL #	TYPE	FUEL	GALLONS	HEATING LOAD (BTU/hr)	CW INLET	HW OUTLET	GPH RECOVERY @ 80° TEMP RISE	WATER HEATER EFFICIENCY	EXHAUST VENT (in Ø)	ELECTRICAL REQUIREMENTS: VOLTS (V)	PHASE	kW	AMPS
GAS WATER HEATER GWH-1	A.O. SMITH	BTH-199	STORAGE TANK	NATURAL GAS	100	199,000	1-1/2"	1-1/2"	288	97%	4	120	SINGLE	n/a	5.0
GAS WATER HEATER GWH-2	A.O. SMITH	BTH-199	STORAGE TANK	NATURAL GAS	100	199,000	1-1/2"	1-1/2"	288	97%	4	120	SINGLE	n/a	5.0

GENERAL NOTES:
1. PROVIDE WITH 4" CONCRETE PAD. REFER TO PLUMBING DETAIL FOR FURTHER CLARIFICATION
2. PROVIDE ASME TEMPERATURE AND PRESSURE RELIEF VALVE, AND DIAL THERMOMETER IN HW OUTLET PIPING
3. FOR POWER AS SCHEDULED ON ELECTRICAL DRAWINGS, VERIFY WITH ELECTRICAL CONTRACTOR PRIOR TO ORDERING EQUIPMENT.

PLAN MARK	MANUFACTURER	MODEL #	DESCRIPTION	ELECTRICAL REQUIREMENTS: VOLTS (V)	PHASE	W	HP
CIRCULATION PUMP CP-1	GRUNDFOS	MAGNA3	ALL STAINLESS STEEL FLANGED PUMP, 1/25 HP WIRED FOR POWER AS SCHEDULED ON ELECTRICAL DRAWINGS AND FITTED WITH REMOTE HEAT SENSING AQUASTAT CONTROLLER. CONTROLLED BY ELECTRICAL CONTRACTOR, DESIGNED AT 15 FT HEAD LOSS.	115	1	85	0.04
THERMAL EXPANSION TANK ET-1	AMTROL	THERM-X-TROL MODEL ST-12-C	ASME THERMAL EXPANSION ABSORBERS, SAFETY RELIEF VALVE, MAXIMUM WORKING PRESSURE 150 PSIG, TOTAL VOLUME 4.4 GALLONS.	--	--	--	--

PLUMBING GENERAL PLAN NOTES

A. ALL WORK, METHODS AND INSTALLATIONS INVOLVED IN THE PLUMBING DESIGN SHALL BE IN ACCORDANCE WITH THE PREVAILING BUILDING CODESAND INSPECTION REGULATIONS AND ALL OTHER OFFICIALS HAVING JURISDICTION.

B. PRIOR TO CONSTRUCTION, THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING A COPY OF THE OWNER'S MOST RECENT STANDARDS AND REQUIREMENTS FOR CONSTRUCTION. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH SUCH REQUIREMENTS, UNLESS THE PREVAILING CODE OR THESE DOCUMENTSINDICATE A HIGHER STANDARD, WHICH SHALL GOVERN.

C. COORDINATE ROUTING OF PIPING IN CEILING SPACES WITH MECHANICAL AND ELECTRICAL EQUIPMENT, DUCTWORK AND CONDUIT. NOTIFY THE ARCHITECT/ENGINEER OF ANY CONFLICTS PRIOR TO INSTALLING AN ALTERNATE PIPING PLAN.

D. DO NOT ROUGH-IN FOR FIXTURES FROM THESE DRAWINGS. REFER TO LATEST ARCHITECTURAL DRAWINGS FOR DIMENSIONED LOCATIONS.

E. ALL PLUMBING FIXTURE AND DEVICE LOCATIONS AND MOUNTING HEIGHTS SHALL BE COORDINATED IN ADVANCE WITH CASEWORK, MILLWORK, ETC.

F. COORDINATE FIXTURE AND EQUIPMENT LOCATIONS AND CONNECTION REQUIREMENTS WITH LATEST ARCHITECTURAL DRAWINGS, SPECIFICATIONS, AND MANUFACTURER RECOMMENDATIONS PRIOR TO ANY ROUGH-INS.

G. PROVIDE CLEANOUTS, POINT OF USE WATER HEATERS, WATER FILTERS, ETC. IN ACCESSIBLE, BUT NOT IMMEDIATELY VISIBLE LOCATIONS. REFER TO AND COORDINATE WITH ARCHITECTURAL DRAWINGS FOR DIMENSIONS AND DETAILS OF SINK SKIRTS, ADA PANELS, AND MILLWORK.

H. ALL PIPING SHALL BE ROUTED CONCEALED FROM PUBLIC VIEW.

I. ENSURE THAT PIPING ROUTED IN CEILING SPACE IS AT AN ELEVATION ABOVE THE TOP OF WINDOW FRAME HEADS. ENSURE THAT PIPING ROUTED LOW INSIDE WALLS IS BELOW THE ELEVATION OF WINDOW SILLS. PROVIDE OFFSETS IN PIPING AS REQUIRED.

J. ALL VALVES, EQUIPMENT, AND OPERABLE APPURTENANCES SHALL BE LOCATED FREE FROM OBSTRUCTIONS FOR FULL OPERABILITY AND MAINTENANCE ACCESS.

K. ALL PIPING PROVIDED WITHIN RETURN AIR CEILING SPACES SHALL BE PLENUM RATED.

L. INSTALLATIONS WHICH DO NOT ADHERE TO THE REQUIREMENTS INDICATED WITHIN THE CONTRACT DOCUMENTS OR WHICH ARE INCORECT DUE TO LACK OF FIELD COORDINATION, ETC. SHALL BE CORRECTED SOLELY AT THE CONTRACTOR'S EXPENSE, WITH NO EXCEPTIONS.

M. PROVIDE BALL VALVE SHUT-OFFS ON ALL DOMESTIC WATER BRANCH LINES WITHIN 24"OF THE CORRESPONDING MAIN, WHETHER INDICATED ON PLAN DRAWINGS OR NOT.

N. ALL DOMESTIC WATER AND SANITARY VENT LINES SERVING FIXTURE GROUPS SHALL HAVE A FULL SIZE HEADER THAT RUNS THE LENGTH OF THE CHASE/WALL SPACE FOR CONNECTION TO ALL FIXTURES. REFER TO PLANS FOR HEADER SIZES, WHICH MAY BE INDICATED BY THE VERTICAL DROP DOWN OR RISE UP FROMTHE CHASE. REFER TO PLUMBING FIXTURE SCHEDULE FOR INDIVIDUAL FIXTURE ROUGH-IN CONNECTION SIZES TO HEADER.

O. VENT HEADERS WITHIN WALLS AND CHASES FOR MULTIPLE FIXTURES SHALL BE PROVIDED AT NO LESS THAN 42"ABOVE FINISHED FLOOR.

P. FOR EACH FIXTURE INTENDED TO DRAIN INDIRECTLY, PROVIDE THE CODE REQUIRED INDIRECT WASTE PIPE (AND TRAP OR TRAP AND VENT, AS NECESSARY) TO ROUTE THE DRAIN LINE TO THE NEAREST APPROVED INDIRECT WASTE RECEPTOR WITHOUT POSING A TRIP HAZARD. IN FINISHED AREAS ALL SUCH DRAIN LINES SHALL BE CHROME PLATED CAST BRASS.

Q. PROVIDE AN ACCESSIBLE WALL CLEANOUT AT THE BASE OF EACH SANITARY RISER, WHETHER INDICATED ON PLAN DRAWINGS OR NOT.

R. FOR FLOOR MOUNTED WATER HEATERS AND SIMILAR EQUIPMENT, PROVIDE A RECTANGULAR SHAPED 4"THICK CONCRETE HOUSEKEEPING PAD EXTENDING TO BEYOND THE LIMITS OF THE EQUIPMENT FOOTPRINT.

S. COORDINATE ROUTING OF PIPING BELOW SLAB ON GRADE WITH COLUMN FOOTINGS, GRADE BEAMS, UNDERGROUND PLUMBING AND ELECTRICAL UTILITIES, AND ANY OTHER SUB-SURFACE BUILDING ELEMENTS. MAKE ADJUSTMENTS AS REQUIRED.

T. COORDINATE IN FIELD TO ENSURE NO LESS THAN 6 INCHES OF EARTHEN COVER FROM TOPS OF PIPES TO BOTTOMS OF GRADE BEAMS, FOUNDATIONWALLS, OR SIMILAR ELEMENTS. IN LOCATIONS WHERE SUCH MINIMUM COVER CANNOT BE PROVIDED DUE TO LIMITATIONS OF AVAILABLE PIPE INVERTS, PROVIDE CASTIRON SLEEVES THROUGH THE FOUNDATION ELEMENTS. SLEEVES SHALL BE NO SMALLER THAN TWO PIPE SIZES GREATER THAN THE PIPE PASSING THROUGH THE GRADE BEAM/FOUNDATION WALL. COORDINATE WITH AND ADHERE TO ALL RELATED REQUIREMENTS INDICATED BY THE STRUCTURAL ENGINEER.

U. PROVIDE ISOLATION VALVES FOR ALL BRANCHES OFF DOMESTIC WATER MAINS. ALL PLUMBING SYSTEM VALVES SHALL BE INSTALLED IN ACCESSIBLE CEILING SPACES.

V. WHERE CEILING IS NOT ACCESSIBLE, OR SPACE IS CONFLICTING, VALVES SHALL BE INSTALLED IN PARTITIONS OR PIPE CHASES. PROVIDE APPROVED PAINTED STEEL HINGED ACCESS PANELS IN LOCATIONS PRE-APPROVED BY THE ARCHITECT. PROVIDE MARKINGS ON CEILING TILES ON LOCATIONS OF ISOLATION VALVES.

W. COORDINATE IN FIELD TO ENSURE THAT ALL INDIRECT WASTE RECEPTORS ARE PROPERLY POSITIONED WITH REGARD TO THE FIXTURES AND/OR EQUIPMENT THEY ARE INTENDED TO SERVE. MAKE ADJUSTMENTS AS REQUIRED. INSTALLATIONS WHERE SUPPORT FEET/CASTERS FOR APPLIANCES, EQUIPMENT, COUNTERTOPS, ETC., REST UPON DRAIN STRAINERS, GRATES, OR RIMS SHALL BE CONSIDERED UNACCEPTABLE. SUCH INSTALLATIONS SHALL BE CORRECTED SOLELY AT THE CONTRACTOR'S EXPENSE.

X. COORDINATE IN FIELD TO ENSURE THAT ALL DRAINS TO BE LOCATED IN AREAS OF SLOPED OR DEPRESSED SLABS ARE PROPERLY POSITIONED FOR THE INTENDED DRAINAGE. MAKE ADJUSTMENTS AS REQUIRED.

Y. NORMALLY CLOSED (NC) VALVE(S) SHOULD BE FIELD INSTALLED AS CLOSE AS POSSIBLE TO NORMAL PATH OF HOT WATER TRAVEL AS SHOWN ON PLAN. THE REMAINING LEG OF BY-PASS PIPING WILL BE IN DIRECT COMMUNICATION WITH THE CIRCULATING WATER.

Z. NORMALLY OPEN (NO) VALVE(S) ON HOT WATER LINES SHALL BE INSTALLED AS SHOWN ON THE PLAN.

AA. ALL DOMESTIC WATER LINES ROUTED BELOW SLAB SHALL BE SOFT TYPE K COPPER WATER TUBE CONTINUOUS WITH NO JOINTS BELOW SLAB PER SPECIFICATION SECTION 22 10 00. PROVIDE CORROSION PROTECTION PER SPECIFICATIONS FOR ALL BURIED TUBE AND EXTEND PROTECTION UP TO 6 INCHES ABOVE FINISHED SLAB IN A PVC SLEEVE.

FIRE PROTECTION GENERAL NOTES

A. THE BUILDING SHALL BE FULLY FIRE SPRINKLERED. THE SCOPE OF WORK INCLUDES THE INSTALLATION OF SPRINKLER HEADS, PIPE, FITTINGS,HANGERS, AND ACCESSORIES.

B. FIRE SPRINKLER SYSTEM SHALL PROVIDE COMPLETE AUTOMATIC PROTECTION AND COVERAGE REQUIRED BY THE LOCAL, STATE, JURISDICTIONAL, GOVERNMENTAL AGENCIES AND NFPA 13 (PREVAILING EDITION). THE WORK SHALL INCLUDE, BUT NOT BE LIMITED TO, THE FOLLOWING: VALVE SUPERVISORY SWITCHES, FLOW SWITCHES AND COORDINATION WITH THE FIRE ALARM SYSTEM.

C. FIRE SPRINKLER SYSTEM SHALL BE DESIGNED AND INSTALLED BY A STATE LICENSED FIRE PROTECTION CONTRACTOR IN ACCORDANCE WITH ALL LOCAL, STATE, JURISDICTIONAL, GOVERNMENTAL AGENCIES AND NFPA 13 (PREVAILING EDITION). SPRINKLER SYSTEM MUST ALSO BE APPROVED BY OWNER AND OWNER'S FIRE INSURANCE UNDERWRITER.

D. FIRE SPRINKLER CONTRACTOR SHALL COORDINATE SPRINKLER HEAD LOCATIONS WITH CEILING TILES AND ARCHITECTURAL FINISHES. ALL SPRINKLER HEADS SHALL BE INSTALLED IN CENTER OF CEILING TILES REGARDLESS OF ANY NECESSITY TO INSTALL ADDITIONAL HEADS TO ACCOMPLISH UNIFORM APPEARANCES OF THE COMPLETED INSTALLATION BY THIS REQUIREMENT. CONTRACTOR SHALL MAKE ADJUSTMENTS AS NECESSARY DURING SHOP DRAWING PROCESS TO MEET ARCHITECTURAL REVIEW REQUIREMENTS WHILE STILL ENSURING COMPLETE AND COMPLIANT COVERAGE.

E. COMPLETE SHOP DRAWINGS AND CALCULATIONS SHALL BE SUBMITTED BY THE CONTRACTOR FOR OWNER, OWNER'S FIRE INSURANCE UNDERWRITER, AND FIRE MARSHAL APPROVAL.

F. SPRINKLER SYSTEM SHALL CONTAIN NO VALVES DOWNSTREAM OF CONTROL STATION.

G. CONTRACTOR TO DESIGN SPRINKLER SYSTEM AS REQUIRED TO ACCOMMODATE FIXTURES, PARTITIONS, SOFFITS, FURR DOWNS, CEILING HEIGHTS, OBSTRUCTIONS, ETC.

H. THE SPRINKLER SYSTEM SHALL BE FULLY CHARGED AND OPERATIONAL WHEN THE CONTRACTOR IS OFF THE SITE.

I. REFER TO OWNER'S CRITERIA/CONSTRUCTION REQUIREMENTS FOR ADDITIONAL INFORMATION.

J. REFER TO ARCHITECTURAL CODE ANALYSIS FOR ANY SPECIAL REQUIREMENTS.

K. UPON COMPLETION OF THE WORK, THE CONTRACTOR SHALL MAKE AND PAY FOR ALL TESTS AS MAY BE REQUIRED BY THE AUTHORITIES HAVING JURISDICTION AND SHALL CORRECT ANY DEFECTS INDICATED BY TESTS TO THE SATISFACTION OF THE AUTHORITIES.

L. ENSURE TO LOCATE INSPECTOR'S TEST CONNECTION AT THE END OF THE MOST REMOTE BRANCH LINE FOR EACH SYSTEM.

M. PROVIDE AND ADJUST ALL TAPER SWITCHES AND WATER FLOW SWITCHES.

PLUMBING FIXTURE GENERAL NOTES

A. MOUNTING HEIGHT ELEVATION OF ALL WALL HUNG OR COUNTER MOUNTED FIXTURES SHALL BE COORDINATED WITH ARCHITECTURAL DRAWINGS PRIOR TO INSTALLATION OF ROUGH-IN WORK.

B. FOR ALL FIXTURES AND EQUIPMENT WITH ASSOCIATED TRIM OR COMPONENTACCESSORIES PROVIDED UNDER SEPARATE DIVISIONS AND REQUIRING PLUMBING CONNECTIONS; THIS CONTRACTOR SHALL FIELD COORDINATE EXACT REQUIREMENTS OF, MAKE PROVISIONS FOR, AND SUPPLY ALL MATERIALS AND LABOR FOR MAKING FINAL CONNECTIONS.

C. CONTRACTOR SHALL REFER TO SHOP DRAWINGS OF EQUIPMENT TO BE SUPPLIED FOR FINAL COORDINATION OF ALL ROUGH-IN OPENINGS BEFORE BEGINNING WORK.

D. ALL FIXTURE AND EQUIPMENT STUB-OUTS SHALL BE PROVIDED WITH A STOP VALVE. ALL FIXTURE STOPS SHALL BE SOLID BRASS, LOOSE KEY OPERATED, CHROME PLATED (WHERE EXPOSED), AND FITTED TIGHT TO CHROME PLATED BRASS WALL ESCUTCHEON PLATES. SUPPLY RISERS SHALL BE STAINLESS STEEL FLEXIBLE CONNECTORS.

E. ALL P-TRAPS WITHIN THE BUILDING, ABOVE GRADE AND EXPOSED TO INSPECTION SHALL BE C.P. ADJUSTABLE, CAST BRASS WITH CLEANOUT PLUG.PROVIDE CAST BRASS SLIP NUTS AND WASHERS, 17 GAGE SEAMLESS TUBULAR BRASS DRAIN TO WALL AND WALL FLANGE. PROVIDE MCGUIRE NO. 8872C, 1-1/4" P-TRAP FOR ALL LAVATORIES AND SIMILAR FIXTURES PROVIDE MCGUIRE NO. 8912C, 1-1/2" P-TRAP FOR ALL SINKS AND SIMILAR FIXTURES.

F. PROVIDE DEEP SEAL P-TRAP FOR ALL DRAINS OF INFREQUENT USE OR REQUIRING TRAP PRIMER.

G. ALL ROUGH IN OPENINGS SHALL BE FITTED WITH CHROME PLATED, WROUGHT BRASS DEEP BELL OR BOX ESCUTCHEON PLATES FITTED TIGHT TO THE PIPE AND FLUSH TO THE WALL. STEEL ESCUTCHEON PLATES ARE NOT ACCEPTED.

H. ALL EXPOSED BRASS SHALL BE CHROME PLATED.

I. ALL HANDICAPPED ACCESSIBLE FIXTURES INDICATED WITH SHALL BE PROVIDED OF APPROVED TYPES AND WITH REQUIRED CONTROLS AND INSTALLED TO HEIGHTS AND CLEARANCES, AS PRESCRIBED BY AMERICANS WITH DISABILITIES ACT (ADA). FIXTURES SHALL COMPLY WITH ALL FEDERAL, STATE, AND LOCAL ACCESSIBILITY CODE REQUIREMENTS. REFER TO ARCHITECTURAL DRAWINGS FOR DIMENSIONED MOUNTING HEIGHTS AND SPECIFIED CLEARANCE REQUIREMENTS. PROVIDE FIXTURES WITH DEPTHS AT MAXIMUM PERMITTED AND AVAILABLE FOR INTENDED FIXTURE USE.

J. ALL WHEELCHAIR LAVATORY AND SINK PIPING WHERE EXPOSED SHALL BE INSULATED. PROVIDEOFFSET DRAIN FITTINGS WHERE REQUIRED TO PROVIDE MINIMUM CLEARANCES.

K. ALL SINKS FOR HANDICAPPED USE SHALL BE STAMPED WITH DRAIN OUTLETAT REAR OF BOWL.

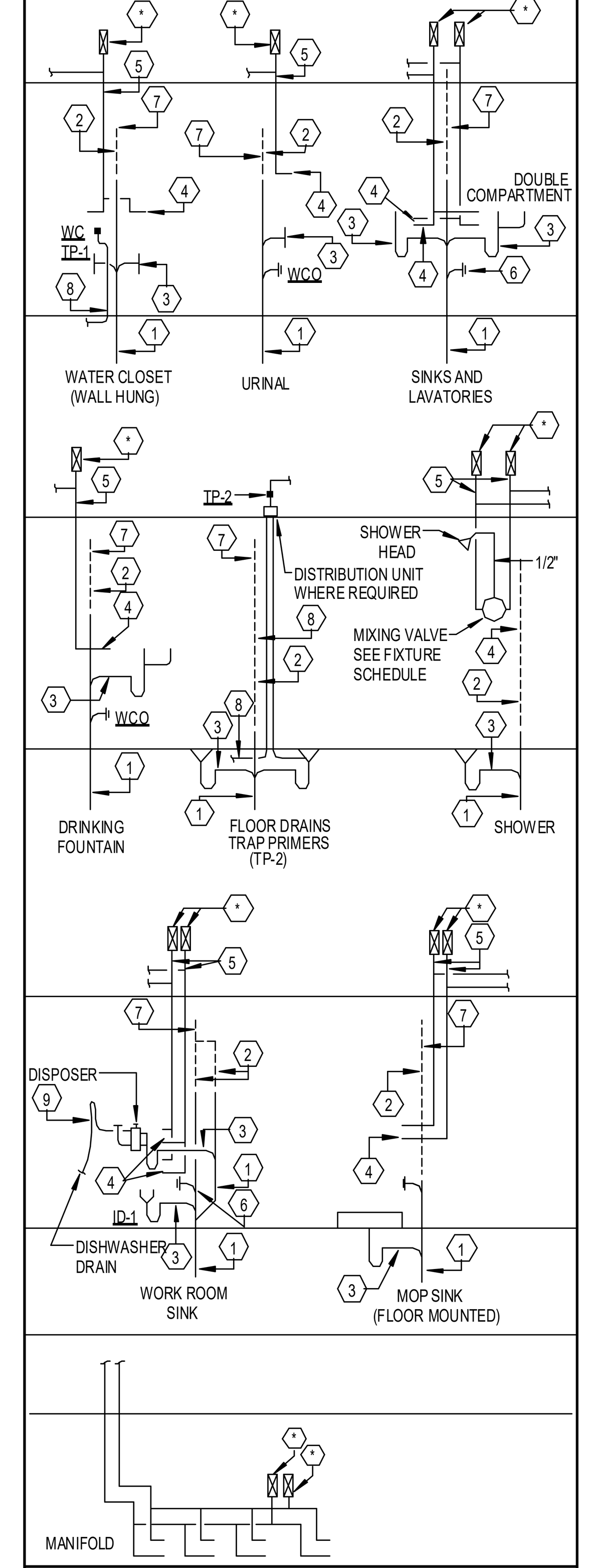
L. PLUMBING FIXTURES SHALL BE OF WATER CONSERVATION TYPE IN ACCORDANCE WITH PLUMBING CODEREQUIREMENTS FOR WATER SAVING PERFORMANCE.

M. ORIENT ADA WATER CLOSET FLUSH VALVE WITH OPERATOR ON WIDE SIDE OF ENCLOSURE.

N. SEAL ALL SPACES BETWEEN PLUMBING FIXTURES AND MOUNTING SURFACES WITH WHITE LATEX CAULKWIPED SMOOTH AND FLUSH WITH FIXTURE.

O. FLOOR DRAINS SHALL BE INSTALLED AT LOW POINTS OF UNIFORMLY SLOPED FLOOR. CONTRACTOR SHALL FIELD COORDINATE WITH STRUCTURAL TO INSURE FLOORS ARE SLOPED UNIFORMLY ACROSS ENTIRE TOILET ROOMS OR OVER AS WIDE AN AREA AS PRACTICAL FOR OPEN AREA FLOOR DRAINS.CONVEX FLOOR SLOPE IN THE IMMEDIATE VICINITY OF THE FLOOR DRAIN IS NOT ACCEPTABLE.

TYPICAL PLUMBING RISER DETAILS



KEYED NOTES - TYPICAL RISER DIAGRAM DETAILS:
(NOT ALL RISERS USED IN EVERY PROJECT.)

1. REFER TO PLUMBING FIXTURE SCHEDULE FOR SOIL OR WASTE ROUGH-IN PIPE SIZE. MINIMUM SOIL OR WASTE DRAIN LINE SIZE (EXCEPT AS NOTED) FOR THIS FIXTURE.
2. REFER TO PLUMBING FIXTURE SCHEDULE FOR SANITARY VENT ROUGH-IN PIPE SIZE. MINIMUM SANITARY VENT BRANCH SIZE (EXCEPT AS NOTED) FOR THIS FIXTURE
3. REFER TO PLUMBING FIXTURE SCHEDULE FOR FIXTURE DRAIN ROUGH-IN PIPE SIZE. MINIMUM FIXTURE DRAIN AND TRAP SIZE (EXCEPT AS NOTED) FOR THIS FIXTURE
4. REFER TO PLUMBING FIXTURE SCHEDULE FOR WATER PIPING ROUGH-IN PIPE SIZE. MINIMUM WATER SUPPLY BRANCH SIZE (EXCEPT AS NOTED) FOR THIS FIXTURE.
5. / * WATER HAMMER ARRESTOR INLET; REFER TO ARRESTOR SCHEDULE FOR SIZE. LOCATION SHOWN HERE FOR INDIVIDUAL FIXTURE WILL VARY WHERE INCLUDED AS PART OF PLUMBING CHASE BATTERY OF PIPING. REFER TO RISER DIAGRAMS FOR MANIFOLD LOCATIONS. ARRANGE ALL WATER LINES TO GRAVITY DRAIN.
6. WALL CLEANOUTS SHALL BE PROVIDED AT ALL END OF BATTERY OR END OF BRANCH LINE FIXTURES AND WHERE REQUIRED BY PLUMBING CODE OFFICIALS TO ASSURE COMPLETE ACCESS TO ALL PORTIONS OF DRAIN.
7. SANITARY VENT PIPES SHALL CONTINUE TO CEILING OR HEADER TOGETHER AT MINIMUM 42" ABOVE FINISHED FLOOR.
8. TRAP PRIMER LINE; SEE PLUMBING DETAILS SHEET. EXTEND AND CONNECT TO FLOOR DRAIN TRAP AS SHOWN.
9. AIR GAP FITTING; PROVIDE WHERE REQUIRED BY CODE.

WATER HAMMER ARRESTOR SCHEDULE

* P.D.I. SYMBOL	FIXTURE UNITS	SIZE
A	1-11	1/2" NPT
B	12-32	3/4" NPT
C	33-60	1" NPT
D	61-113	1 1/4" NPT
E	114-154	1 1/2" NPT
F	155-330	2" NPT

PIPING RISER DIAGRAMS/TYPICAL RISER DETAILS ILLUSTRATE WATER HAMMER ARRESTORS FOR FIXTURE WATER PIPE OPENINGS. ALL ARRESTORS SHALL BE SIZED AS INDICATED ON DRAWINGS OR IN ACCORDANCE WITH THIS SCHEDULE, WHICHEVER PLACES THE MOST STRINGENT REQUIREMENT.

PROVIDE ARRESTORS IN ACCORDANCE WITH THE REQUIREMENTS OF PLUMBING DRAINAGE INSTITUTE (PDI) STANDARD PDI-WH-201. THE USE OF AIR CHAMBERS SHALL NOT BE ACCEPTABLE.

WATER HAMMER ARRESTORS SHALL HAVE LIFETIME WARRANTY AND SHALL BE CERTIFIED BY THE MANUFACTURER AS SUITABLE FOR INSTALLATION WITHOUT A REQUIREMENT FOR ACCESS PANELS. NONETHELESS, ACCESS PANELS SHALL BE PROVIDED IF AND AS REQUIRED BY THE LOCAL AUTHORITY HAVING JURISDICTION (AHJ).

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005

SW	JG	JB	AR	-

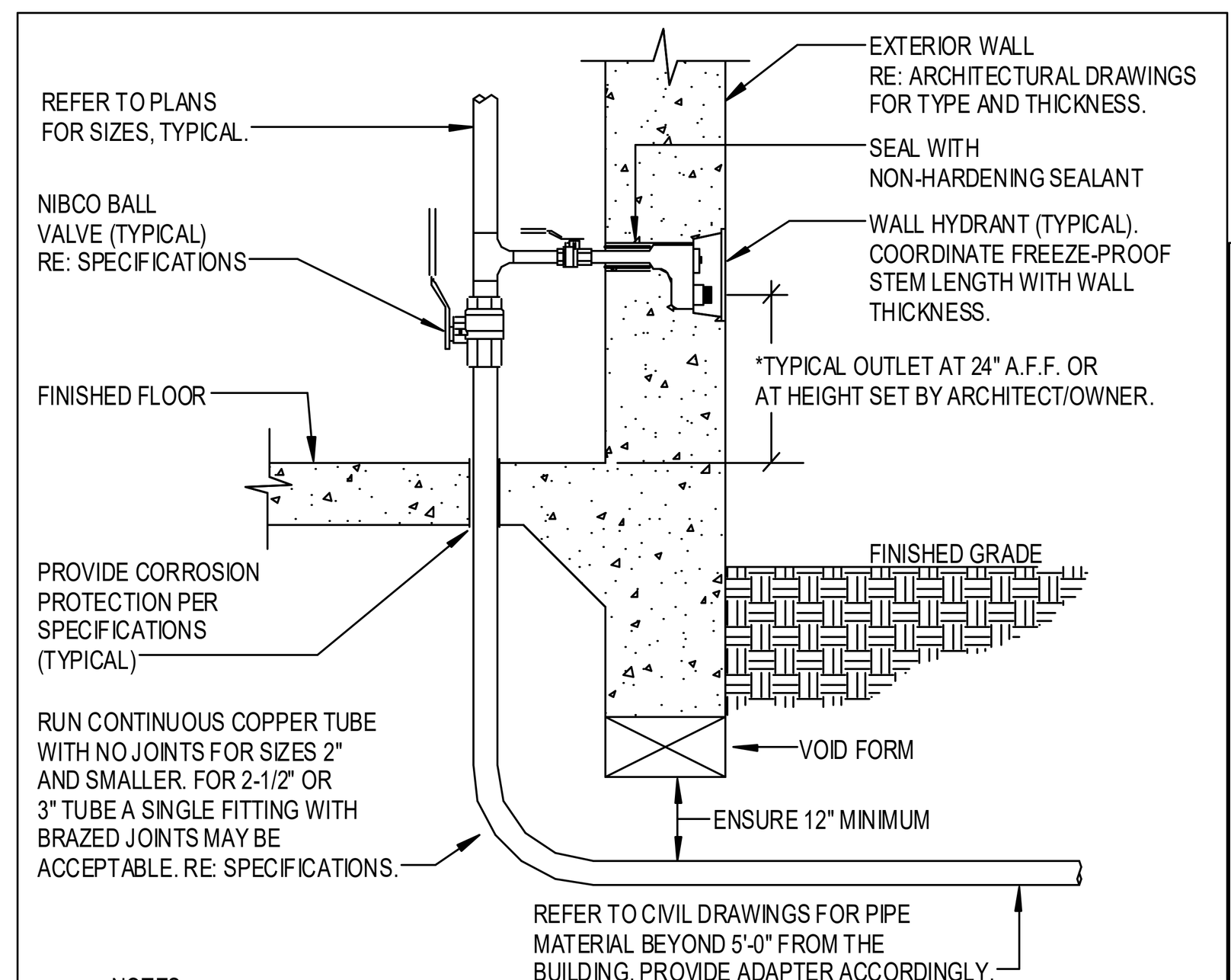
DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

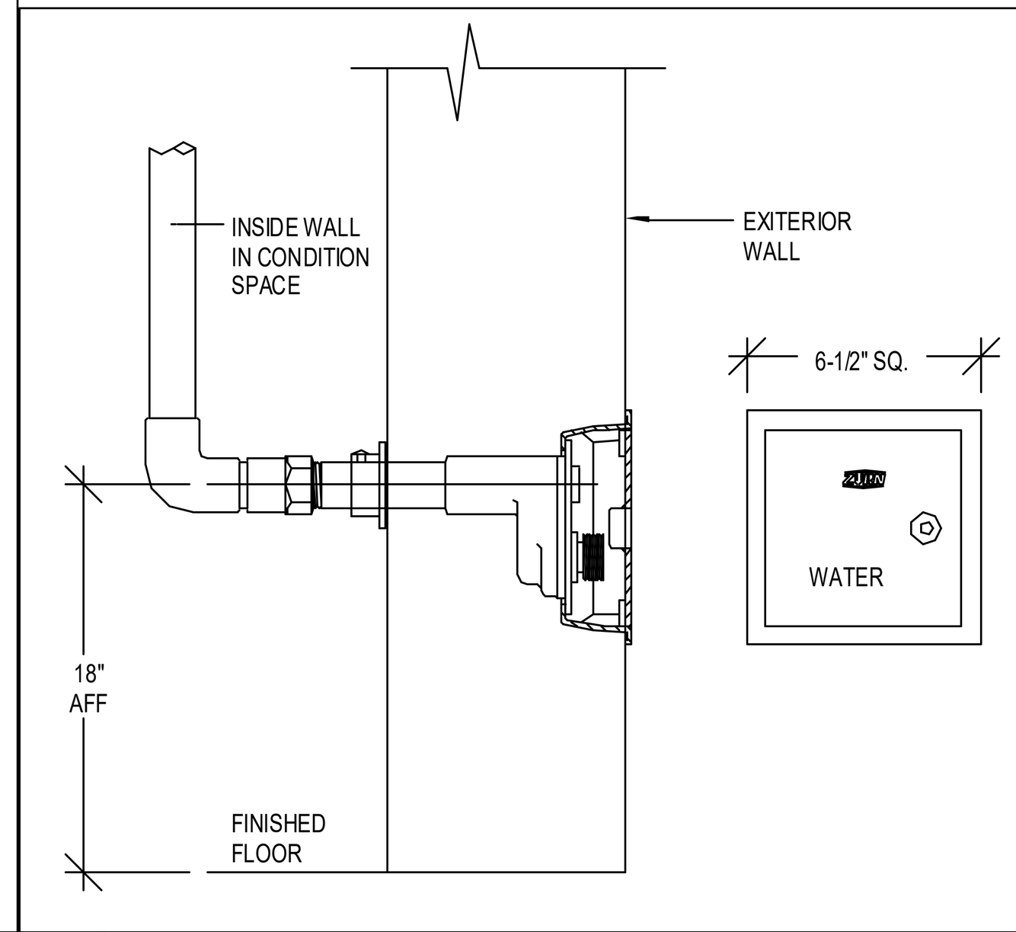
P5.1

PLUMBING SCHEDULES

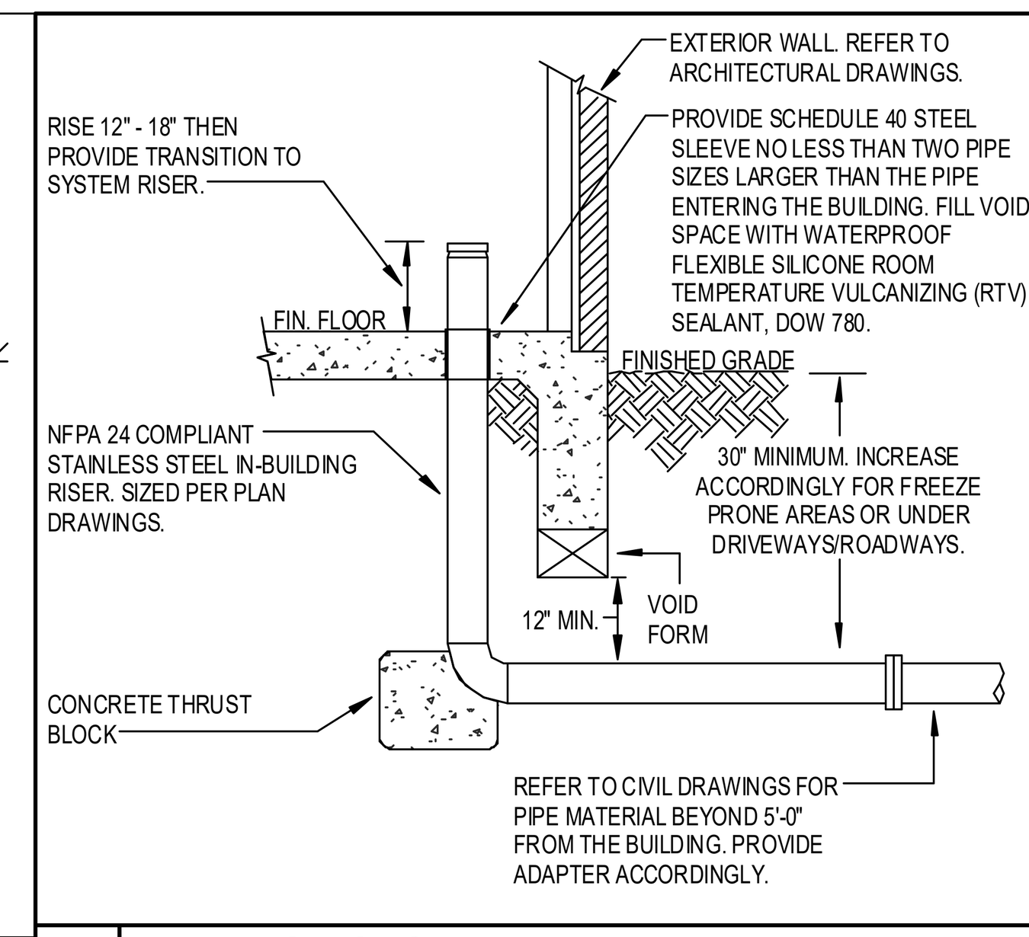


NOTES:
IF INCLUDED IN THE SPECIFICATIONS, A ONE PIECE STAINLESS STEEL RISER MAY BE PROVIDED IN LIEU OF COPPER. PROVIDE IN SIMILAR FASHION AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
*FOR ELEVATED SLABS, HEIGHT AND INSTALLATION MUST BE COORDINATED WITH THE ADJACENT GRADE/PAVING ELEVATION.

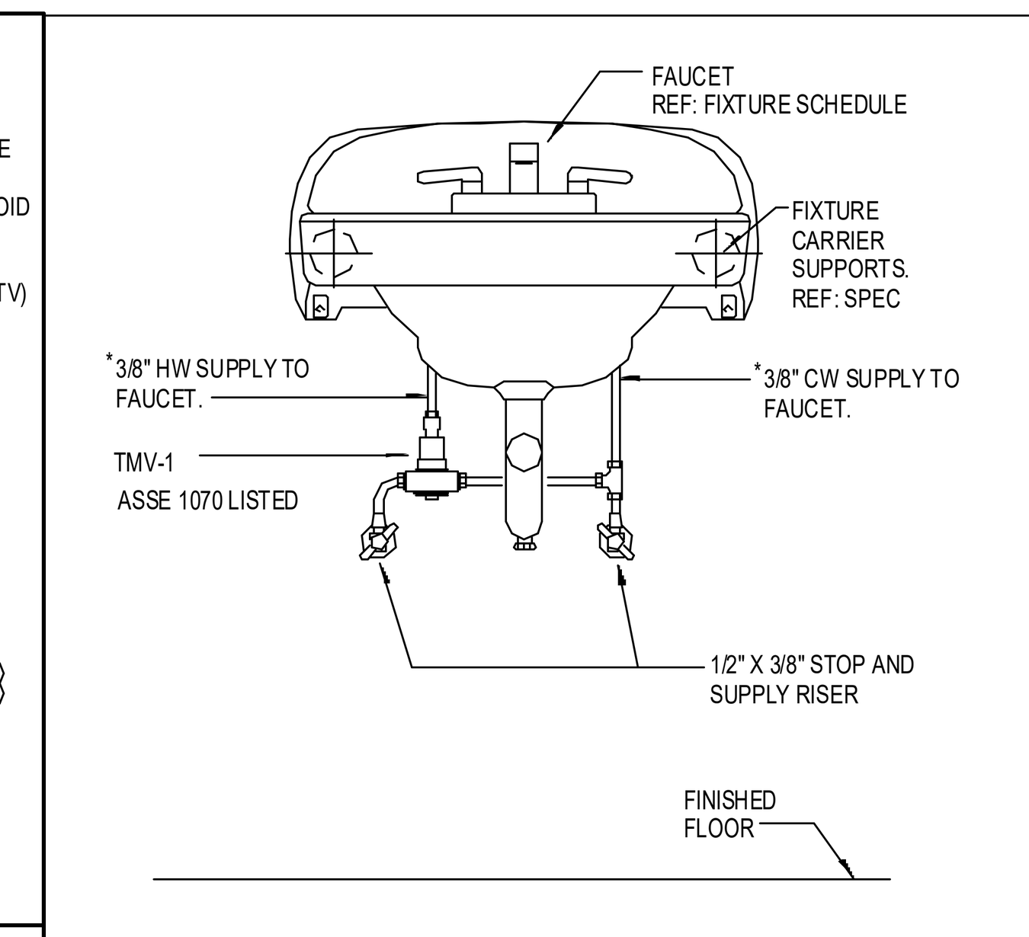
1 TYPICAL DOMESTIC WATER ENTRY
NOT TO SCALE



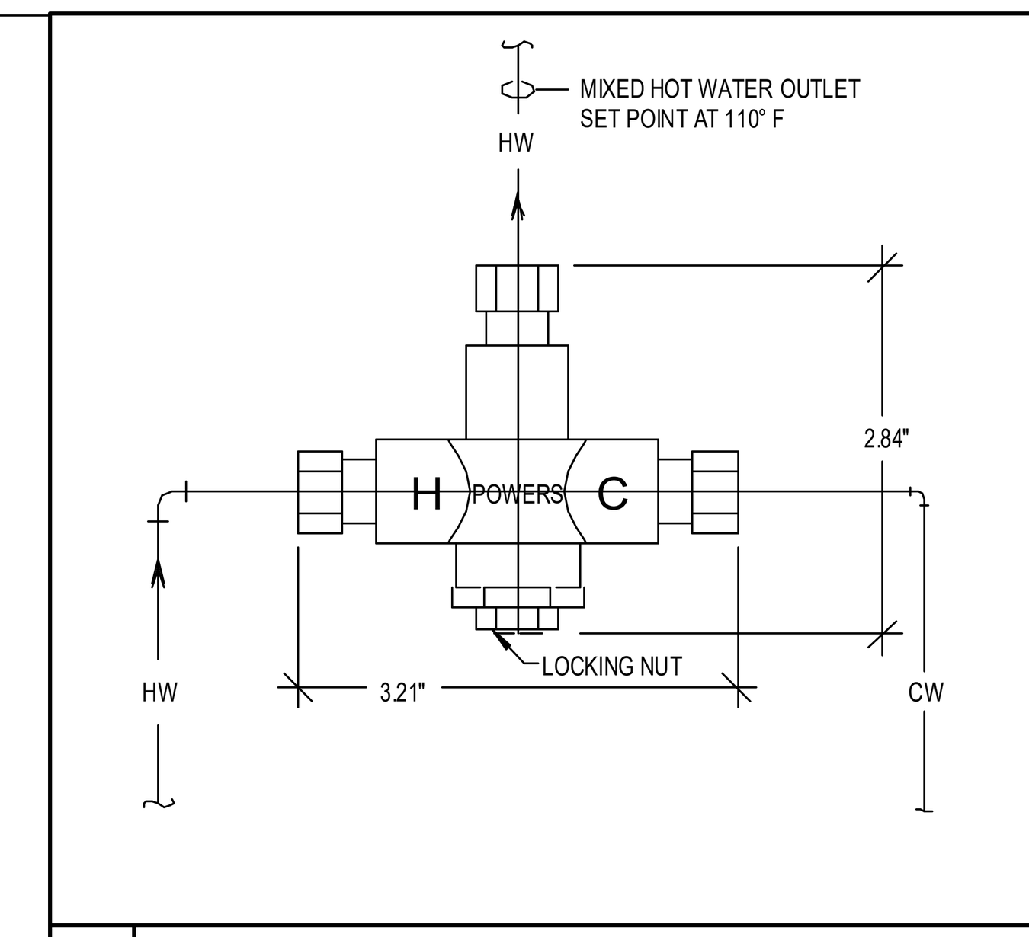
2 WALL HYDRANT DETAIL
NOT TO SCALE



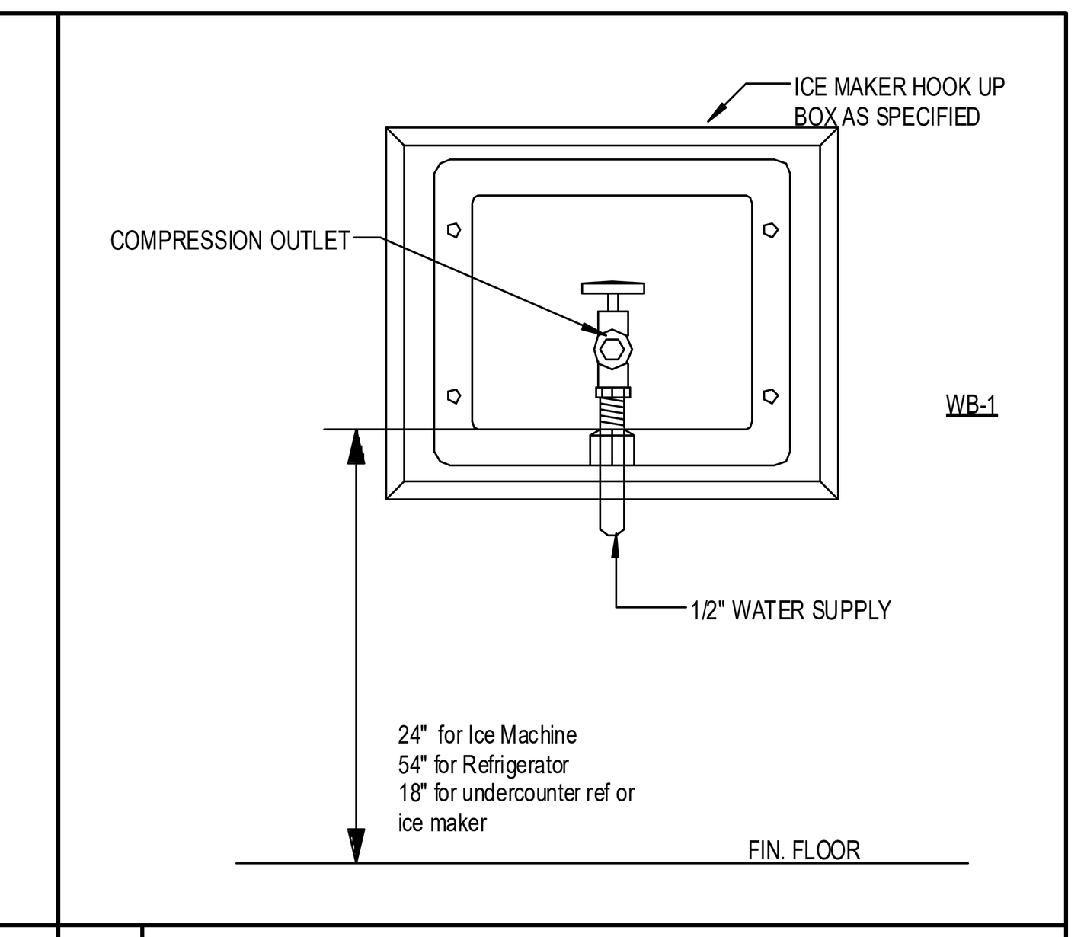
3 FIRE PROTECTION WATER ENTRY DETAIL
NOT TO SCALE



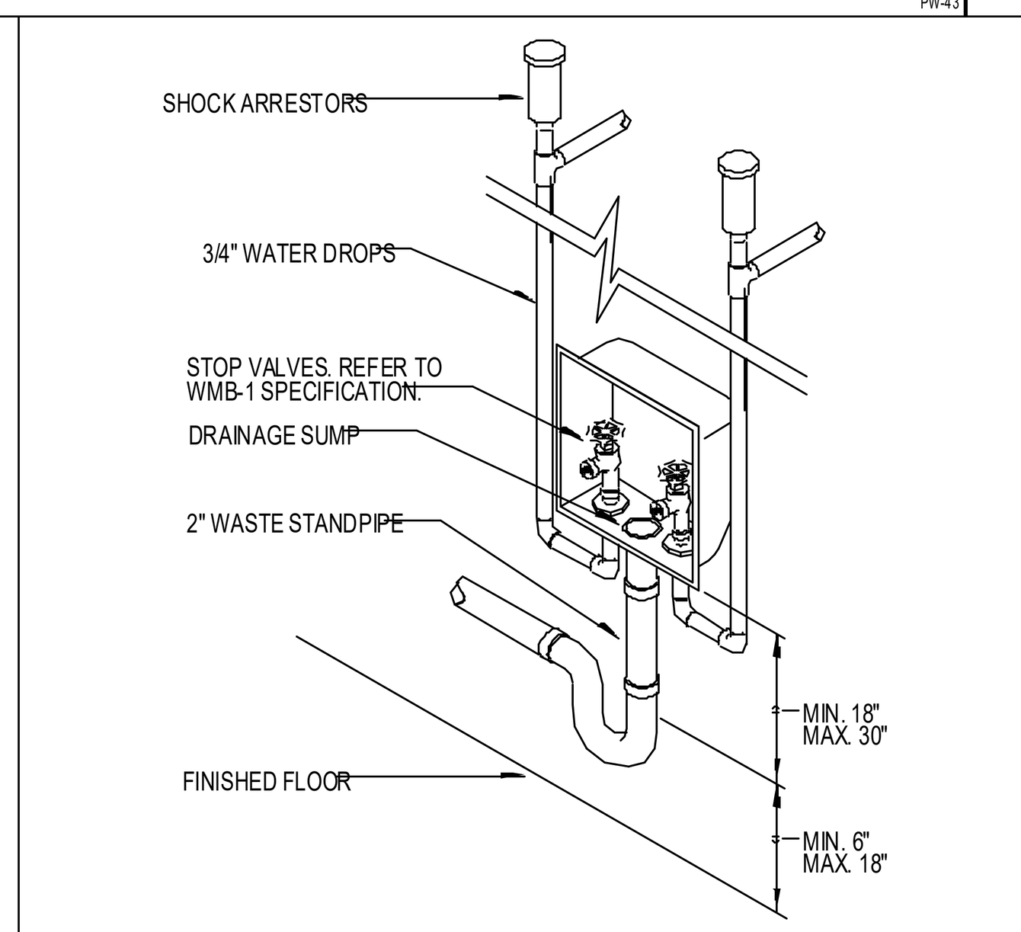
4 TMV-1 INSTALLATION DETAIL
NOT TO SCALE



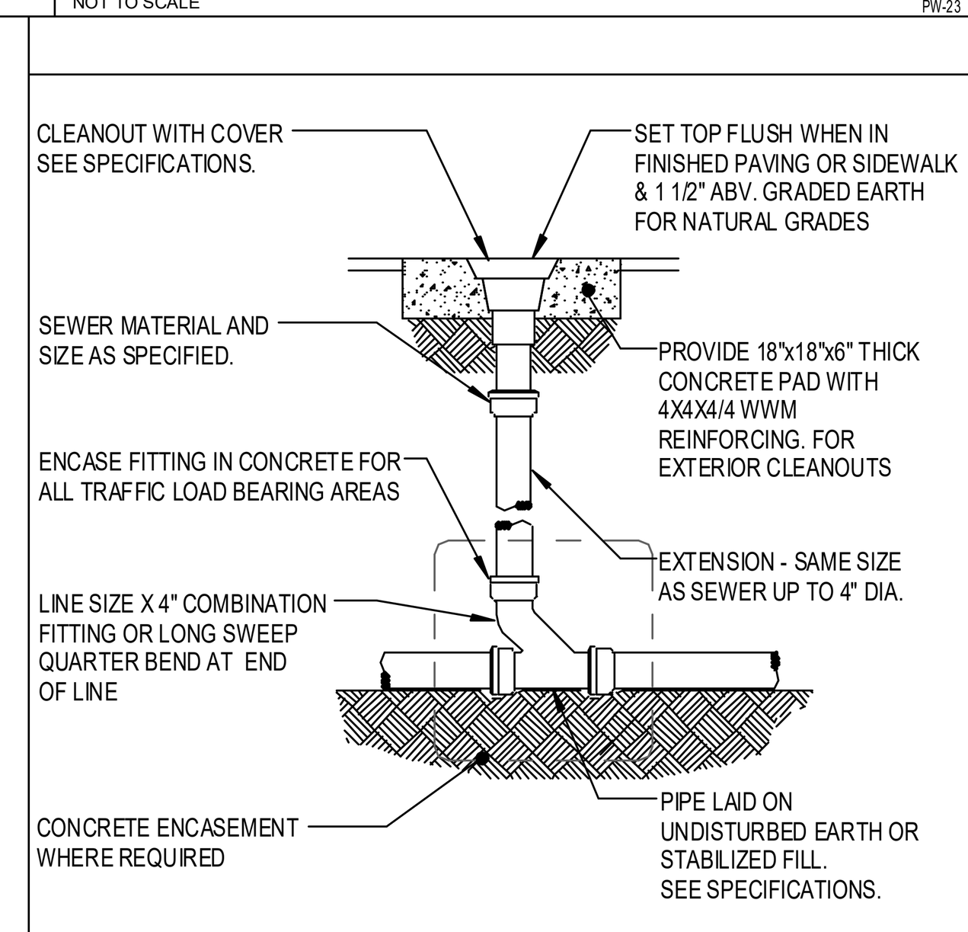
5 THERMOSTATIC MIXING VAVLE
NOT TO SCALE



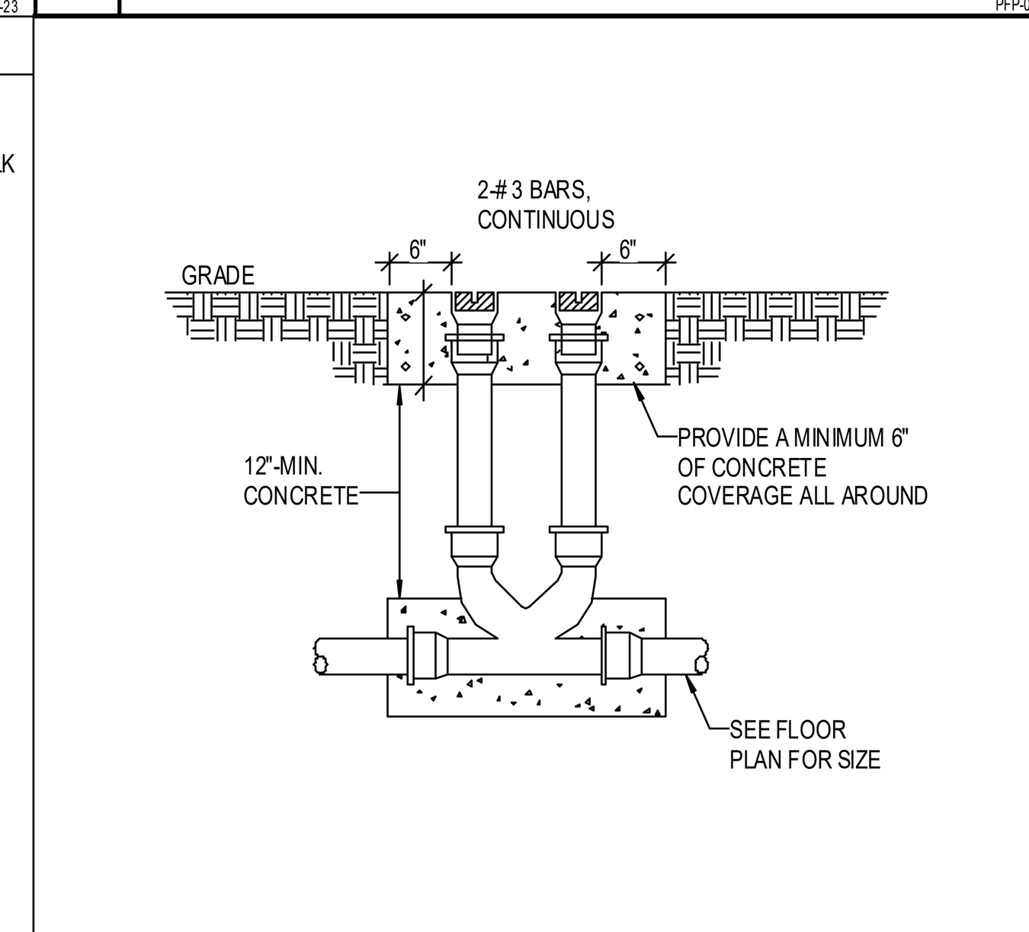
6 ICE MAKER SUPPLY BOX
NOT TO SCALE



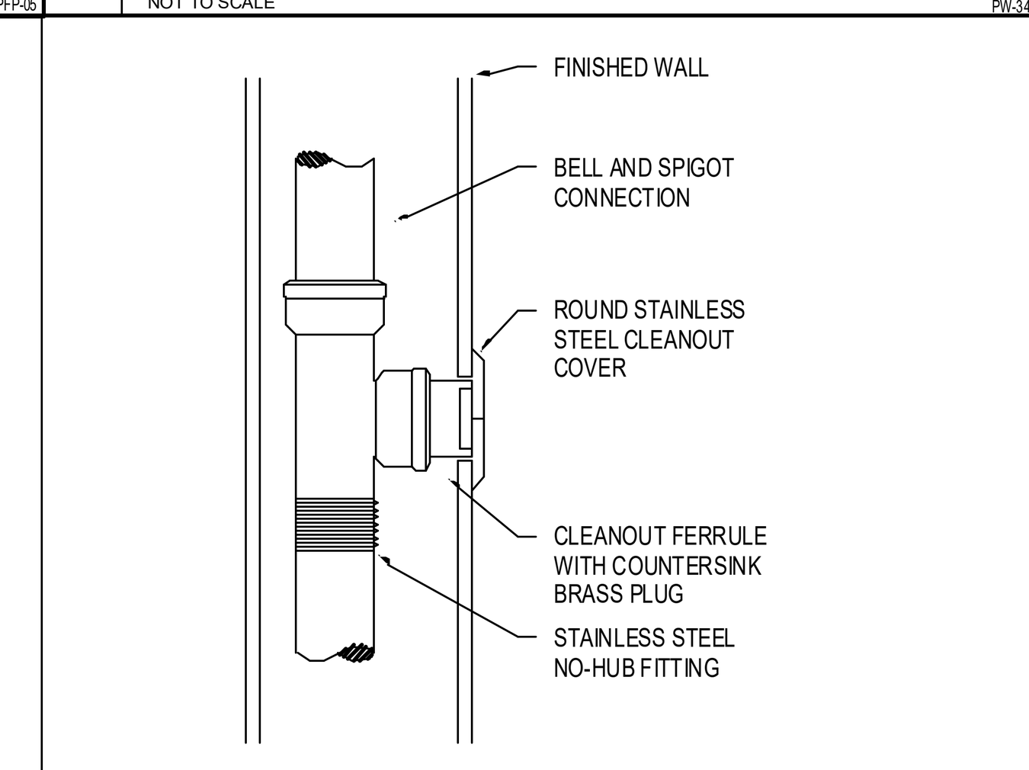
7 WASHING MACHINE DRAIN BOX
NOT TO SCALE



8 CLEANOUT DETAIL
NOT TO SCALE

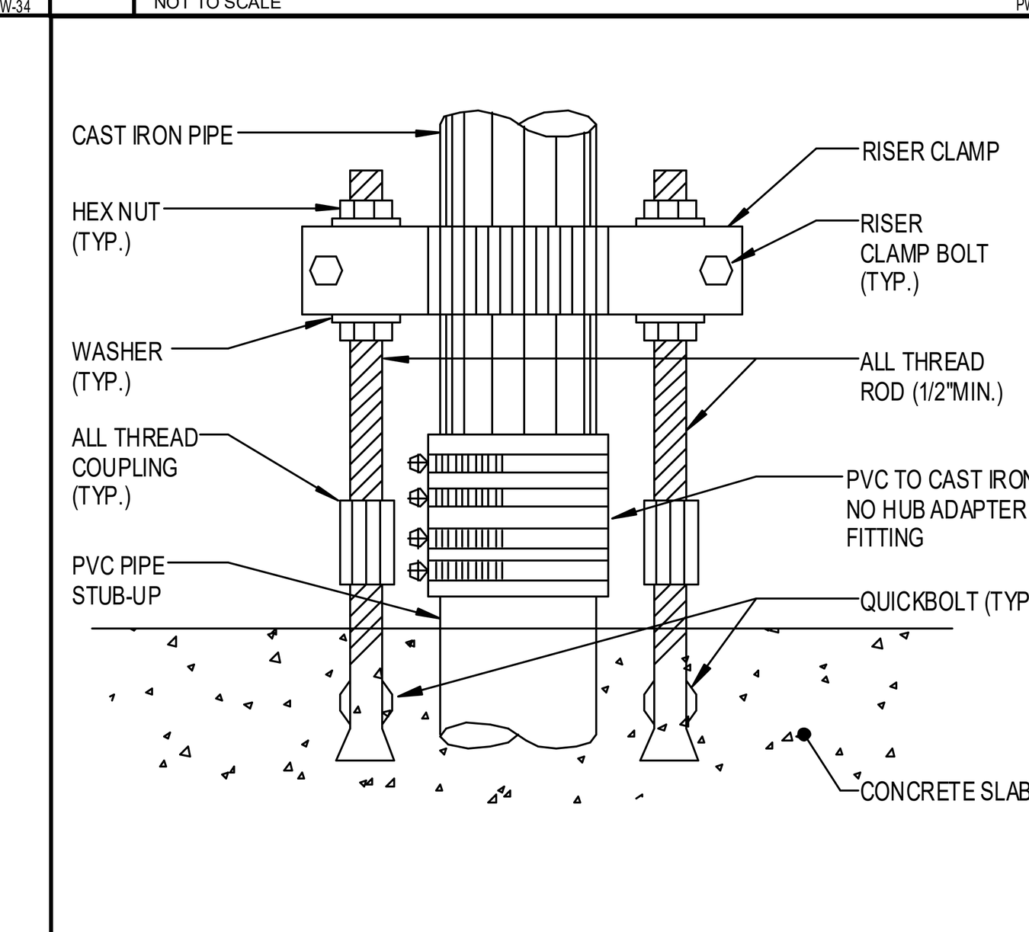


9 TWO WAY GRADE CLEANOUT
NOT TO SCALE

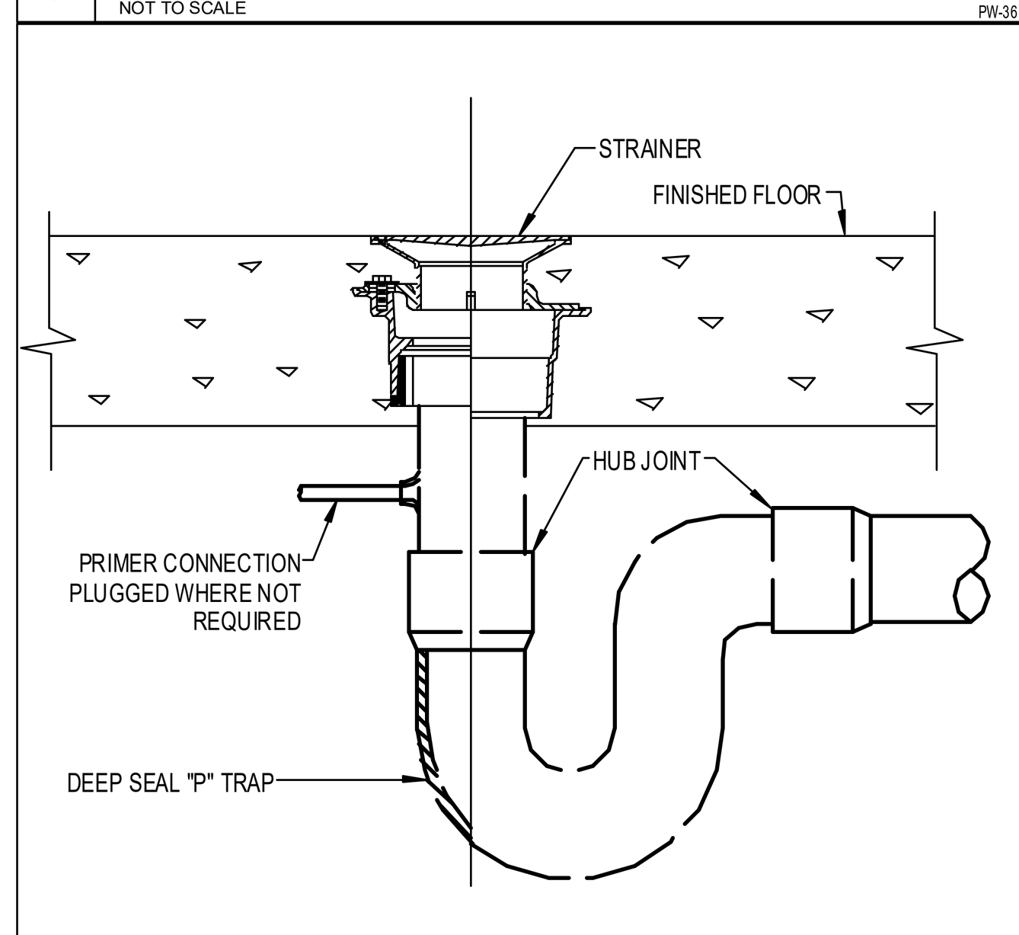


NOTE:
1. CONTRACTOR TO COORDINATE TYPE OF WALL.
2. CLEANOUT SHALL BE FLUSH WITH FINISHED WALL
3. THE ACTUAL INSTALLATION MAY VARY TO MEET THE INTENT.

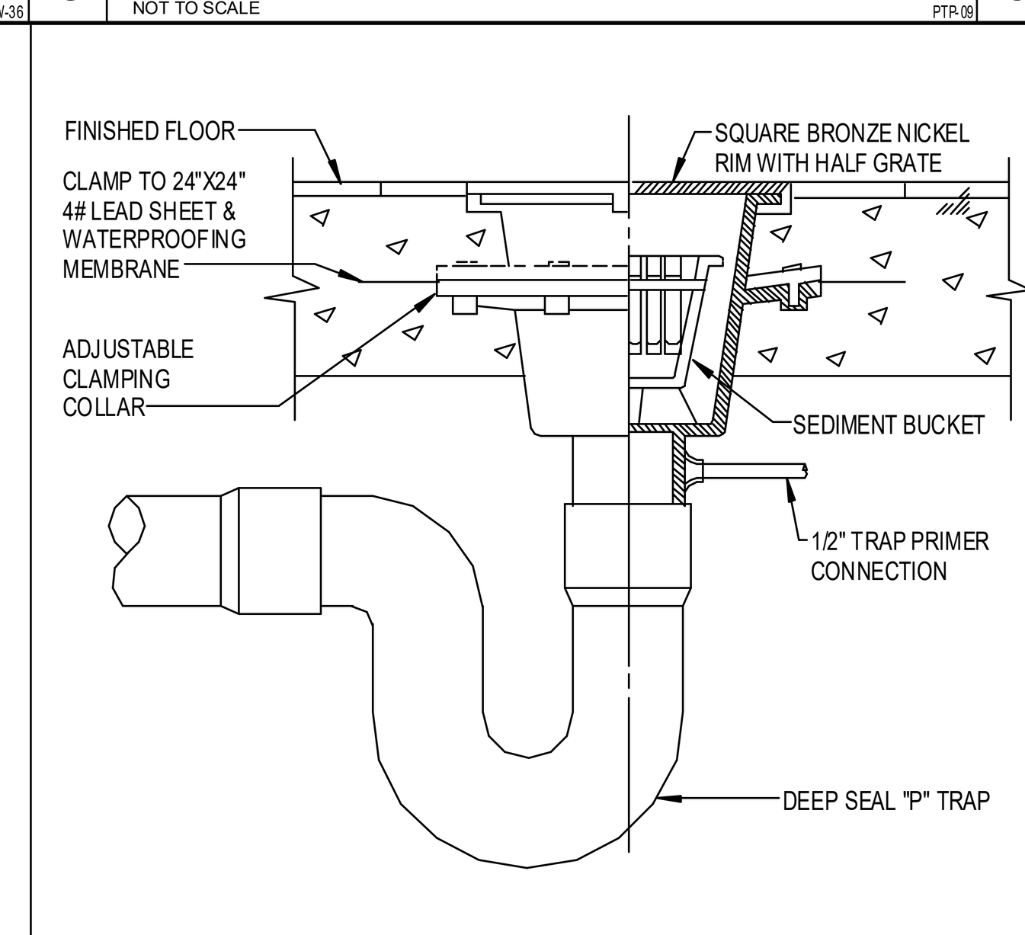
10 WALL CLEANOUT DETAIL
NOT TO SCALE



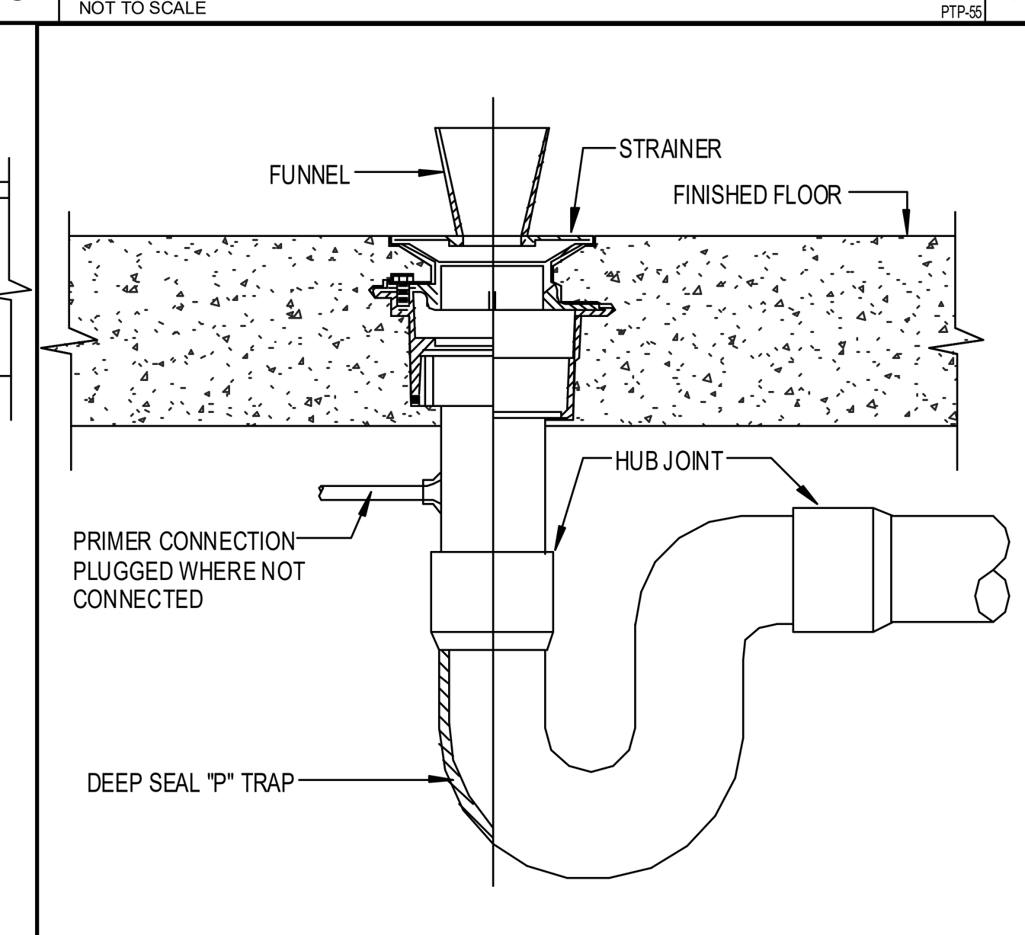
11 PVC TO CAST IRON SUPPORT
NOT TO SCALE



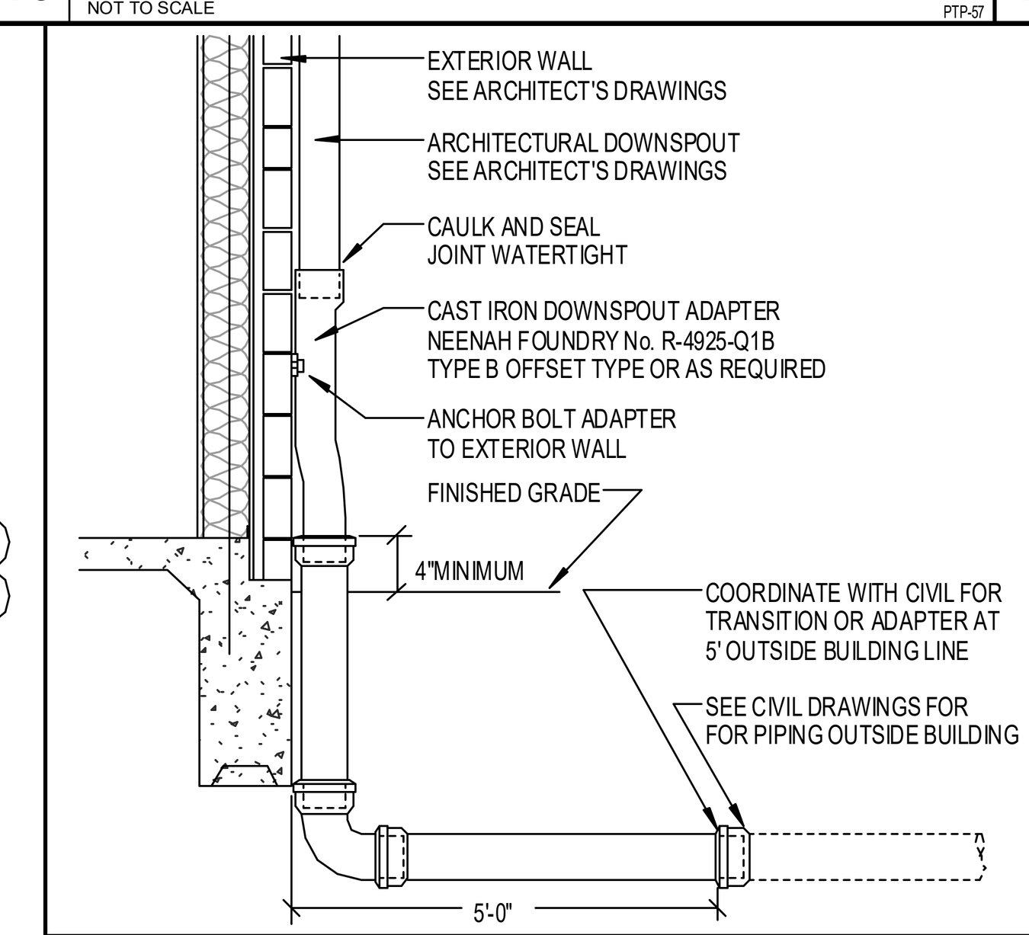
12 FLOOR DRAIN DETAIL
NOT TO SCALE



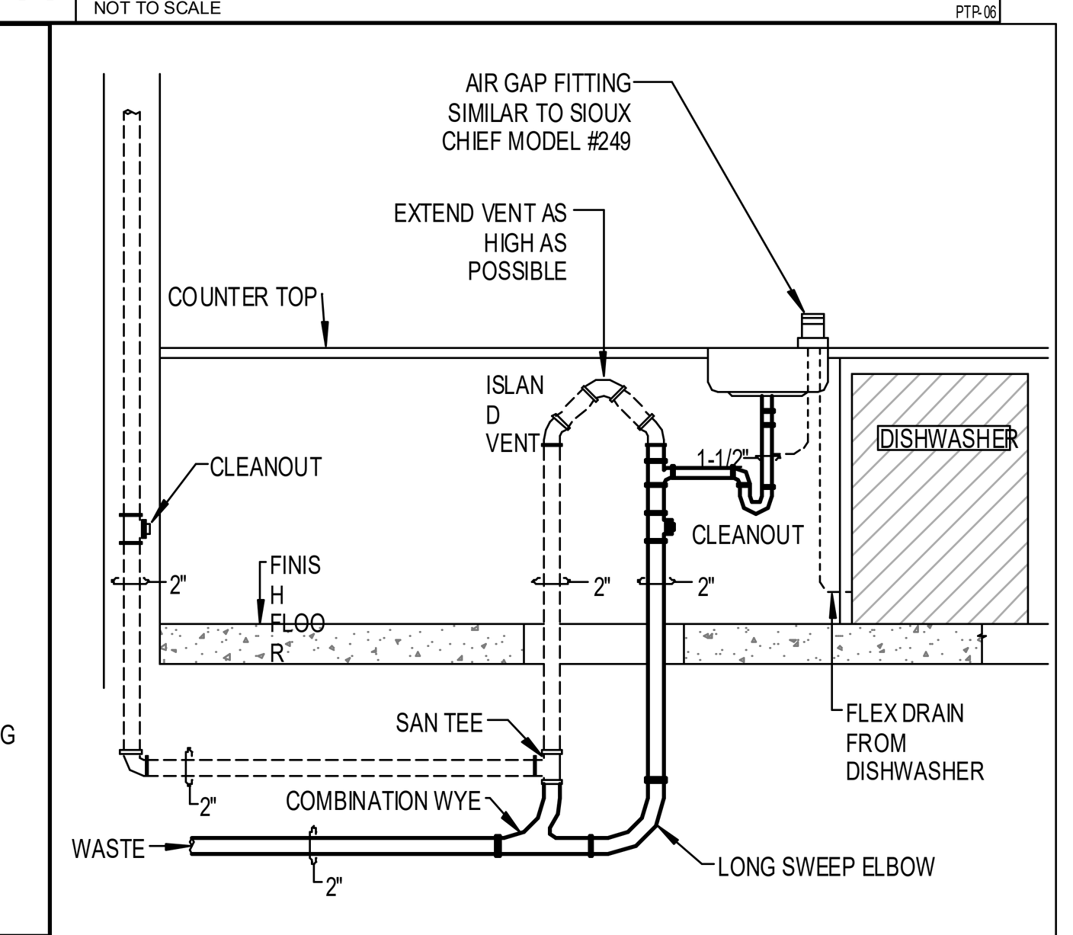
13 FLOOR SINK DRAIN DETAIL
NOT TO SCALE



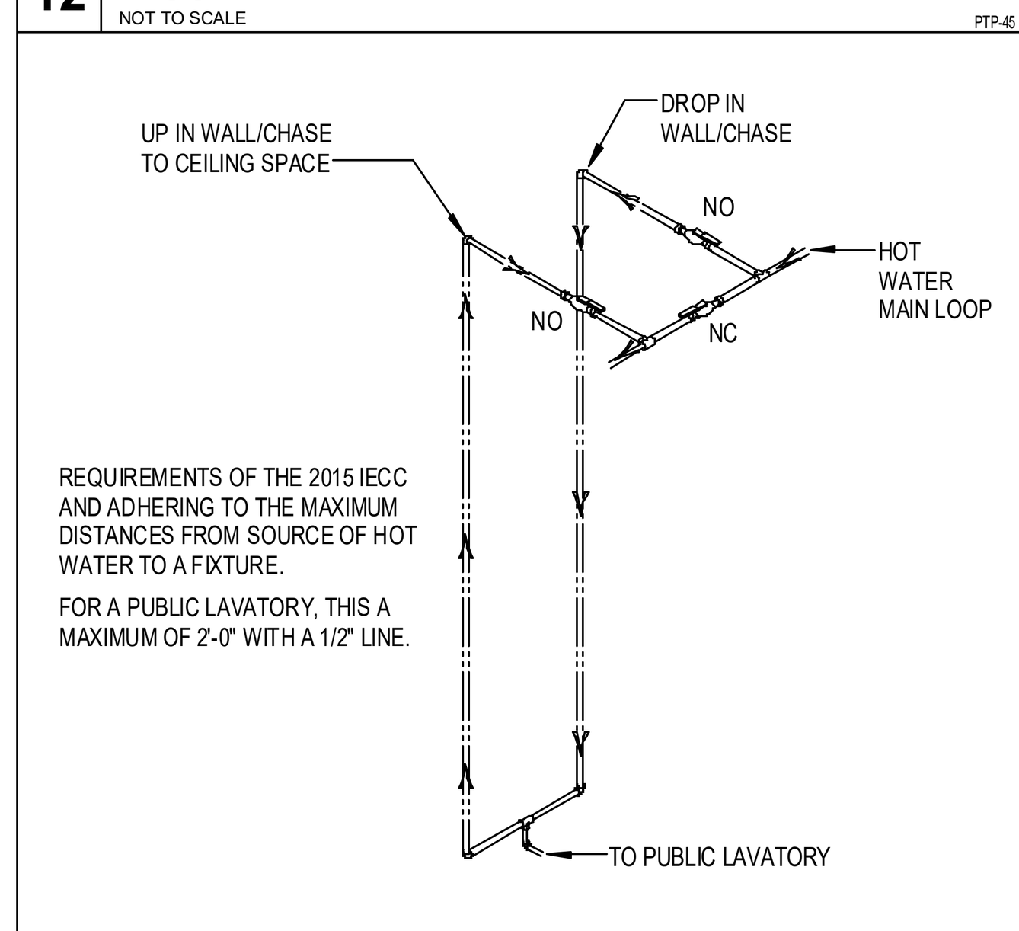
14 FLOOR DRAIN DETAIL
NOT TO SCALE



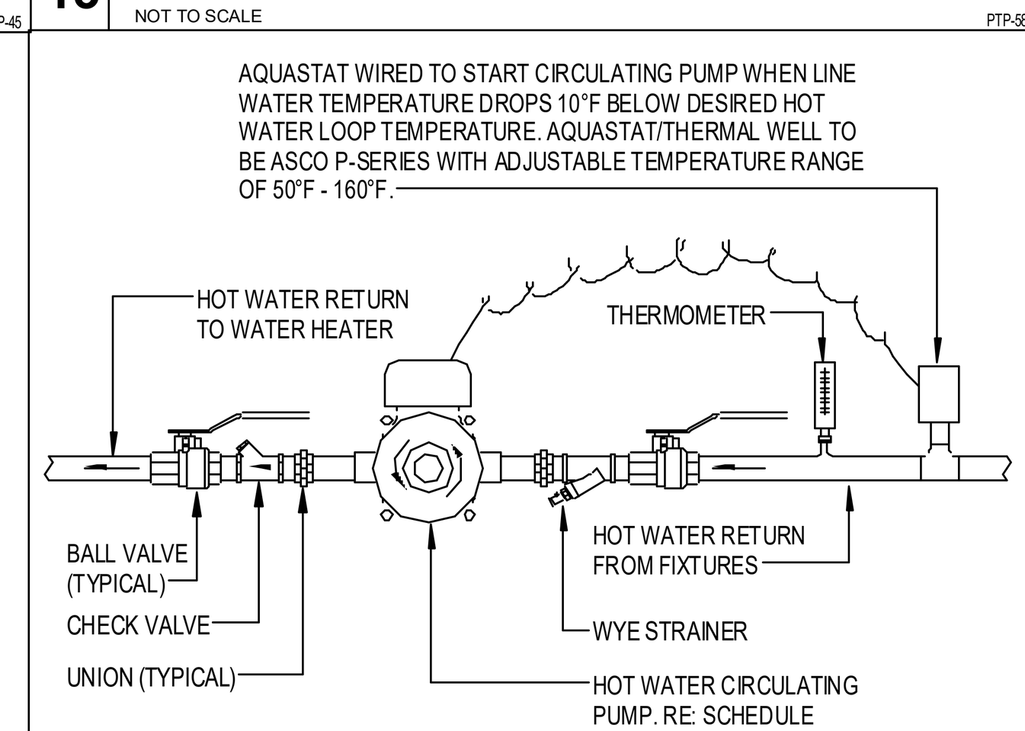
15 DOWNSPOUT ADAPTOR
NOT TO SCALE



16 TYPICAL ISLAND SINK VENTING DETAIL
NOT TO SCALE

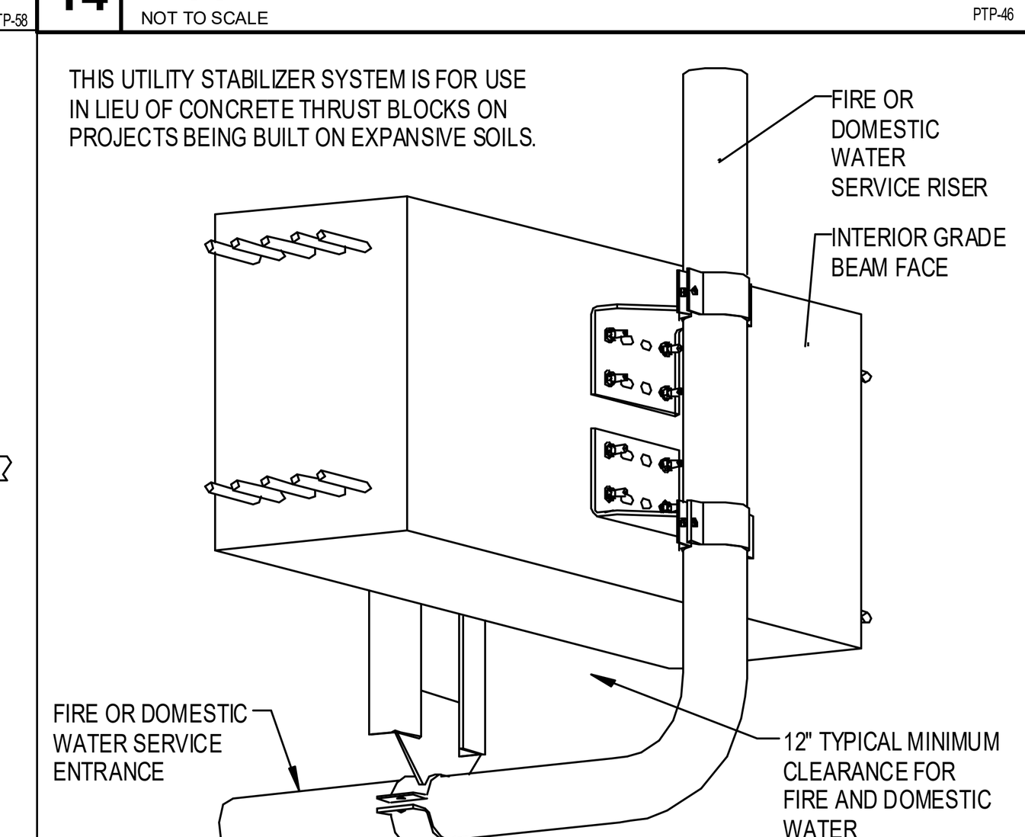


17 HOT WATER LOOP DETAIL W/BYPASS
NOT TO SCALE



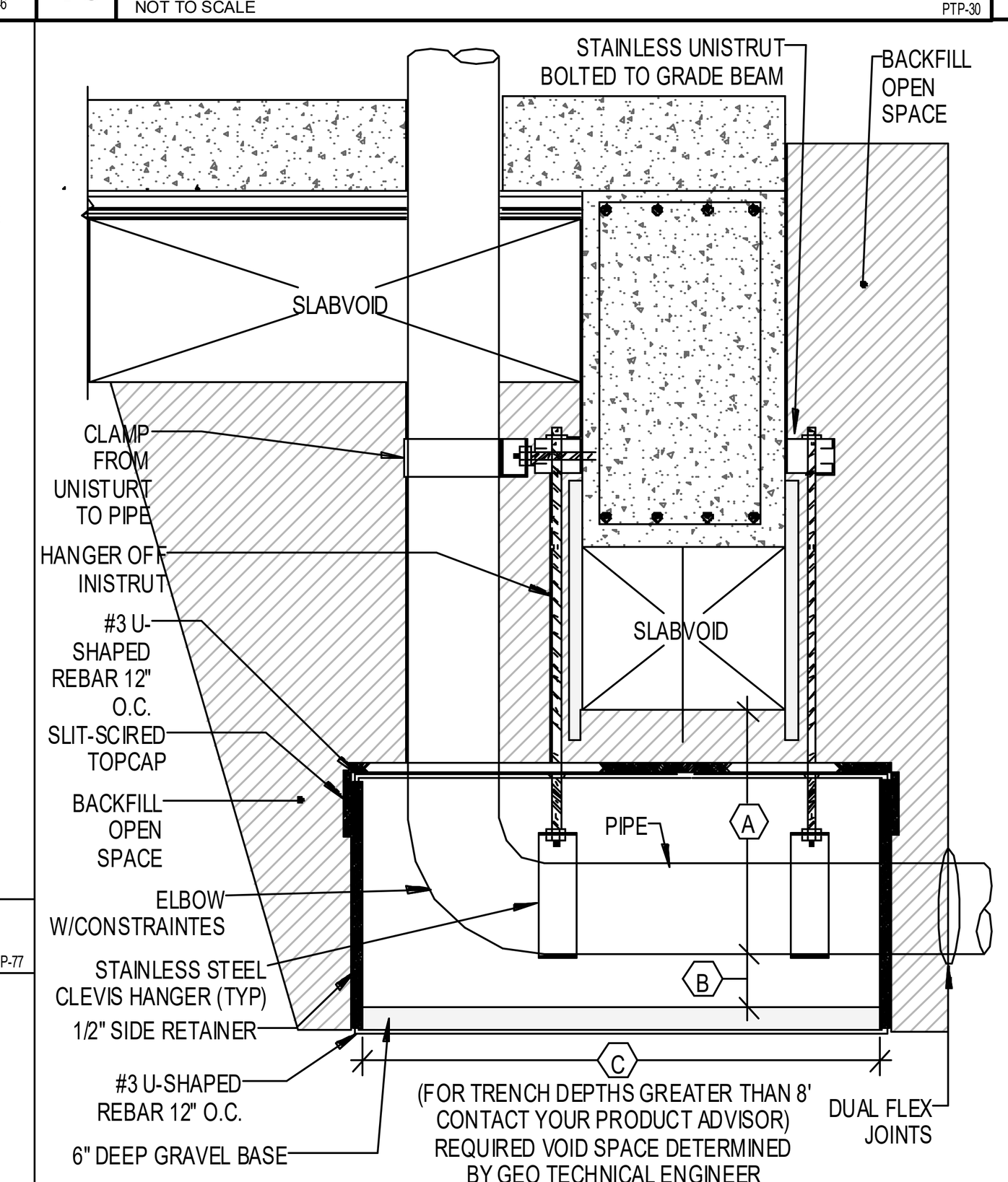
NOTES:
1. MOUNT SECURELY IN AN ACCESSIBLE LOCATION 48" A.F.F.
2. PROVIDE AQUASTAT ON HOT WATER RETURN LINE, WIRED TO START CIRCULATING PUMP WHEN LINE WATER TEMPERATURE DROPS 10°F BELOW DESIRED HOT WATER LOOP TEMPERATURE.

18 INLINE CIRC PUMP DETAIL
NOT TO SCALE



CONTACT SUPERVOID SYSTEMS, LLC FOR PRICING AND ENGINEERING
DAVID PRIMM, P.E.: 334-221-5761 PRIMMD@SUPERVOID.COM
LARRY PRIMM: 334-750-3614 LPRIMM@SUPERVOID.COM

19 UTILITY SERVICE ENTRANCE STABLIZER SYSTEM
NOT TO SCALE

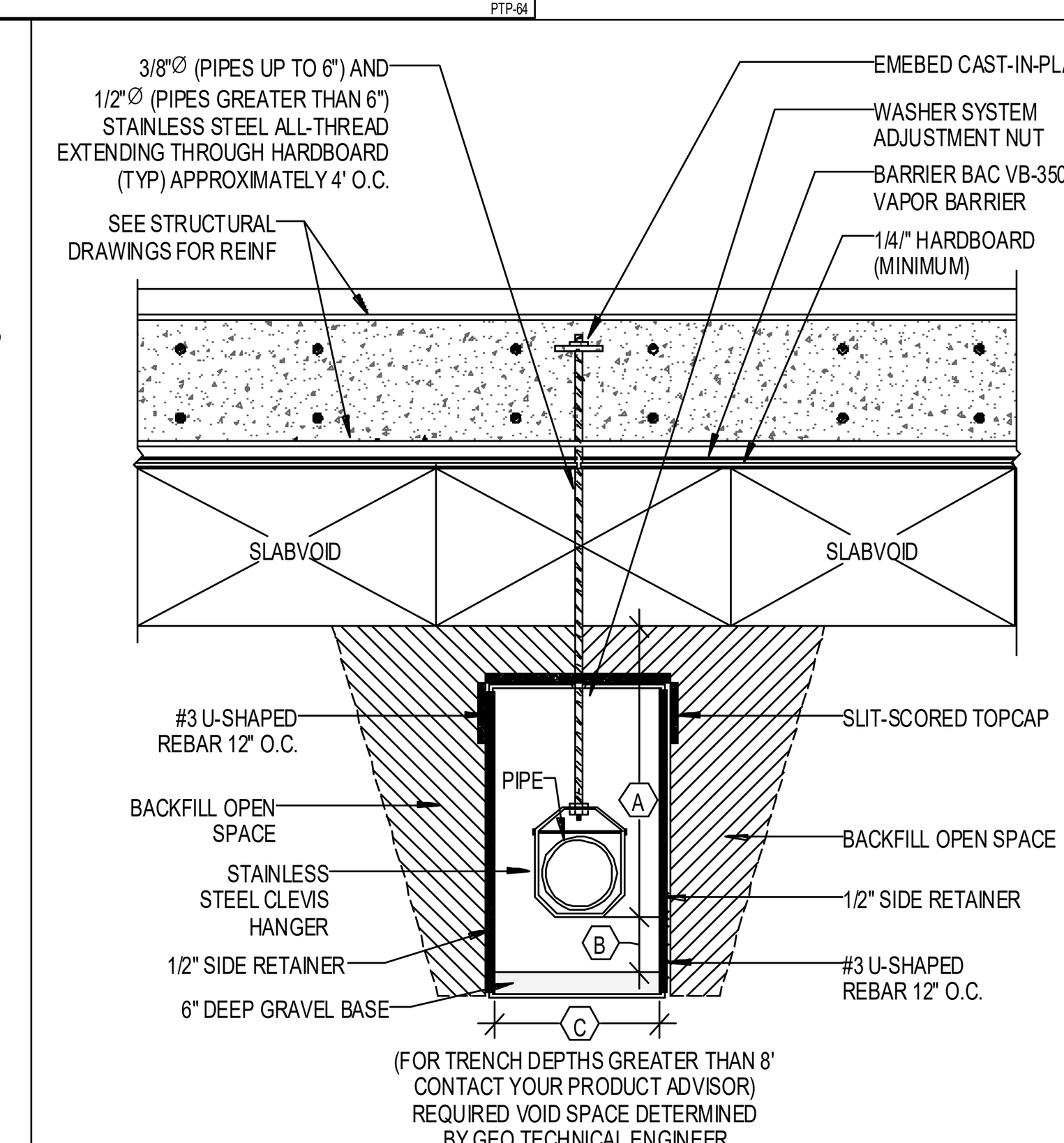


GENERAL NOTES
1. COORDINATE INSTALLATION WITH MANUFACTURER'S RECOMMENDATIONS & GUIDELINES
2. DO NOT DRIVE MACHINERY OVER SYSTEM.
3. STANDARD SYSTEM FOR USE IN CONVENTIONAL TRENCHES UP TO 8' IN DEPTH.
4. TRENCH DEPTHS MUST BE DEEP ENOUGH SO THE ENTIRE SYSTEM IS BELOW GRADE ENSURING THE SPECIFIED VOID SPACE REMAINS UNDER THE SLAB.

KEYED NOTES
(A) DEPTH FROM BOTTOM OF SLAB-VOID TO B.O.P. SHALL BE 18" MINIMUM FOR PIPE DIAMETER 6" AND SMALLER. FOR PIPE DIAMETERS LARGER THAN 6", DEPTH SHALL BE A MINIMUM OF 3X THE PIPE SIZE.
(B) VOID SPACE BETWEEN B.O.P AND TOP OF GRAVEL SHALL BE NO LESS THAN THE DISTANCE OF PIPE DIAMETER.
(C) TRENCH WIDTH SHALL BE 6" WIDER THAN THE SIZE OF THE SELECTED SYSTEM A MINIMUM OF FOR NECESSARY ALIGNMENT.

MANUFACTURE:
VOIDFORM PRODUCTS, INC
CONTACT: TODD DIEHL
OFFICE NUMBER: 817-429-0888 (EXT. 2245)
MOBILE NUMBER: 817-209-4216

20 VERTICAL PIPE UNDER CARTON FORM DETAIL
NOT TO SCALE



GENERAL NOTES
1. COORDINATE INSTALLATION WITH MANUFACTURERS' RECOMMENDATIONS & GUIDELINES.
2. DO NOT DRIVE MACHINERY OVER SYSTEM.
3. STANDARD SYSTEM FOR USE IN CONVENTIONAL TRENCHES UP TO 8' IN DEPTH.
4. TRENCH DEPTHS MUST BE DEEP ENOUGH SO THE ENTIRE SYSTEM IS BELOW GRADE ENSURING THE SPECIFIED VOID SPACE REMAINS UNDER THE SLAB.

KEYED NOTES
(A) DEPTH FROM BOTTOM OF SLAB-VOID TO B.O.P. SHALL BE 18" MINIMUM FOR PIPE DIAMETER 6" AND SMALLER. FOR PIPE DIAMETERS LARGER THAN 6", DEPTH SHALL BE A MINIMUM OF 3X THE PIPE SIZE.
(B) VOID SPACE BETWEEN B.O.P AND TOP OF GRAVEL SHALL BE NO LESS THAN THE DISTANCE OF PIPE DIAMETER.
(C) TRENCH WIDTH SHALL BE 6" WIDER THAN THE SIZE OF THE SELECTED SYSTEM A MINIMUM OF FOR NECESSARY ALIGNMENT.

MANUFACTURE:
VOIDFORM PRODUCTS, INC
CONTACT: TODD DIEHL
OFFICE NUMBER: 817-429-0888 (EXT. 2245)
MOBILE NUMBER: 817-209-4216

21 HORIZONTAL PIPE UNDER CARTON FORM DETAIL
NOT TO SCALE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRW ARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

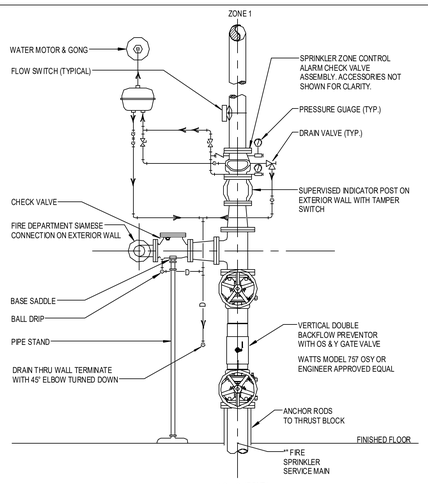
DBR
TBPE Firm Registration No. 2234

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

P6.1
PLUMBING DETAILS



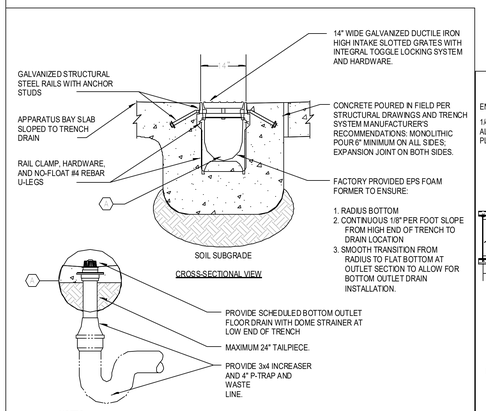
NOTES:

1. REFER TO PLAN DRAWINGS FOR PIPE SIZES.
2. UNDERGROUND PIPING AND RISERS SHALL BE LOCATED SO AS TO EXTEND NO MORE THAN 10'-0" INSIDE THE BUILDING FROM THE OUTSIDE EDGE OF THE BUILDING.
3. SOME JURISDICTIONS REQUIRE OUTDOOR OPERABILITY OF SYSTEM CONTROL VALVES. IN SUCH INSTANCES, THESE VALVES MUST BE PROVIDED AND THE RISER MUST BE CONFIGURED AND LOCATED ACCORDINGLY.
4. DRAWING IS DIAGRAMMATIC.

NOTES : (CONT.)

5. ALL POWER AND FLOW/TAMPER SWITCH WORK SHALL BE COORDINATED WITH ELECTRICAL AND FIRE ALARM CONTRACTORS ACCORDINGLY.
6. A WET PIPE SINGLE ZONE/SINGLE RISER ARRANGEMENT IS DEPICTED. QUANTITY OF ZONE VALVES MUST BE BASED ON BUILDING SIZE AND NFPA 13 PROTECTION AREA LIMITATION REQUIREMENTS.

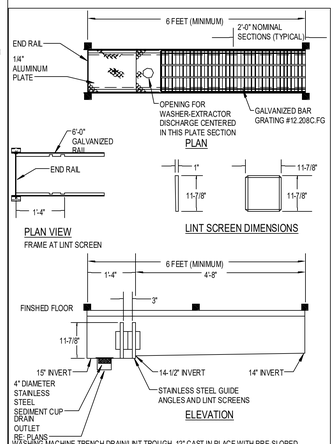
1 SPRINKLER SERVICE AND RISER ELEVATION
NOT TO SCALE



NOTES:

1. FLOOR DRAIN SHALL BE: BOTTOM OUTLET CAST IRON BODY, ADJUSTABLE 6" DIAMETER NICKEL BRONZE DOME STRAINER WITH STAINLESS STEEL MESH SCREEN, ANCHOR FLANGE, CLAMPING DEVICE AND SEDIMENT BUCKET. ZURN Z415G-SS-Y.
2. REFER TO FLOOR PLANS FOR TRENCH LENGTH(S).
3. REFER TO FLOOR PLANS FOR CONTINUATION OF WASTE PIPING AND FOR VENTING REQUIREMENTS. A COMBINATION WASTE AND VENT SYSTEM IS EMPLOYED.
4. TRENCH SYSTEM SHALL BE ABT, INC. TRENCH FORMER TFX-12 TRENCH FORMING SYSTEM CAST IN PLACE FORMED WITH PRE-MANUFACTURED EXPANDED POLYSTYRENE FORMS, GALVANIZED INLAY RAILS AND NO-FLOAT LEGS. ABT MODEL TR12-12.502D.FG-F21G.

2 APPARATUS BAY TRENCH DRAIN
NOT TO SCALE



WASHING MACHINE TRENCH DRAIN/LINT TROUGH, 12" CAST IN PLACE WITH PRE-SLOPED EPS FORMERS, GALVANIZED FRAME AND BAR GRATES, STAINLESS STEEL ANGLE AND FILTER SCREENS
ABT MODEL TS-12FG-2SSLS
NOTE: SYSTEM IS BASED ON AN OVERALL 6'-0" LONG TRENCH (MINIMUM); RE: PLANS, LENGTH MAY EXCEED THIS AND ADJUSTMENTS MUST BE MADE AS REQUIRED.

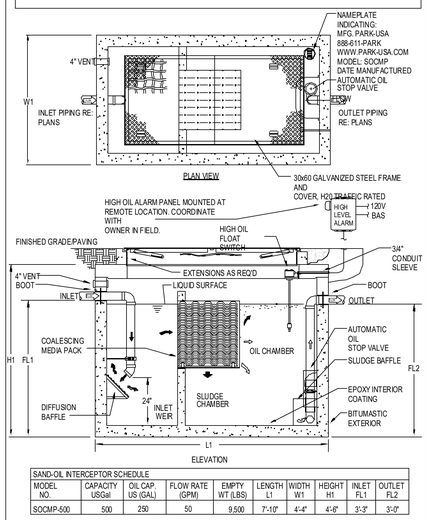
3 COMM. WASHER TRENCH DRAIN
NOT TO SCALE

SPECIFICATIONS:

CONCRETE
CLASS I/II CONCRETE WITH DESIGN STRENGTH OF 4,500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR, FIRST STAGE OF WALL AND BAFFLE WITH SECTIONAL RISER TO REQUIRED DEPTH.

REINFORCEMENT
GRADE 60 REINFORCED WITH STEEL REBAR CONFORMING TO ASTM A615 ON REQUIRED CENTERS OR EQUAL..

MATERIALS
ACCESS FRAME AND COVER SHALL BE FABRICATED WITH MINIMUM 1/4" THICK NON-SKID FLOOR PLATE, BOLTDOWN AND LIFTING HANDLES. ALL MATERIALS TO BE CORROSION RESISTANT.



SAND-OIL INTERCEPTOR SCHEDULE									
MODEL NO.	CAPACITY USGal	OIL CAP. US (GAL)	FLOW RATE (GPM)	EMPTY WT (LBS)	LENGTH L1	WIDTH W1	HEIGHT H1	INLET FL1	OUTLET FL2
SOCMP-500	500	250	50	9,500	7'-10"	4'-4"	4'-6"	3'-3"	3'-0"

4 SAND-OIL SEPARATOR DETAIL
NOT TO SCALE

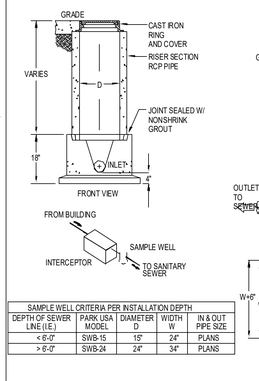
NOTES:

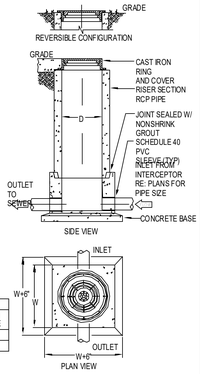
1. SAMPLING WELL MUST BE INSTALLED UNDER A SEPARATE PLUMBING PERMIT.
2. SAMPLING WELL MUST BE SET IN A CIRCULAR OR SQUARE CONCRETE PAD (1'-0" GREATER THAN OUTSIDE DIAMETER OF PIPE.)
3. INSTALLATION INSIDE BUILDING (ONLY IF INDICATED ON PLANS) MUST BE POURED IN PLACE (15" MINIMUM), NO CONCRETE PIPE PERMITTED, AND AIR-TIGHT COVER REQUIRED.
4. LAWN INSTALLATION MUST BE 4" ABOVE FINISHED GRADE.
5. DRIVE & SIDEWALK INSTALLATION MUST BE BROUGHT TO FINISHED GRADE.
6. TO BE INSTALLED ON PRIVATE PROPERTY, IN A LOCATION ACCESSIBLE TO CITY PERSONNEL.

SPECIFICATIONS:

CONCRETE
CLASS I/II CONCRETE WITH DESIGN STRENGTH OF 4,500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR AND FIRST STAGE OF WALL WITH SECTIONAL RISER TO REQUIRED DEPTH.

CAST IRON CASTINGS
MANHOLE COVER AND RING MANUFACTURED OF GREY CAST IRON CONFORMING TO ASTM A48 CLASS 30, HEAVY DUTY AASHTO H-20/HL93.





SAMPLE WELL CRITERIA PER INSTALLATION DEPTH				
DEPTH OF SEWER LINE (I.E.)	PARK USA MODEL	DIAMETER D	WIDTH W	IN & OUT PIPE SIZE
< 6'-0"	SWB-15	15"	24"	PLANS
> 6'-0"	SWB-24	24"	34"	PLANS

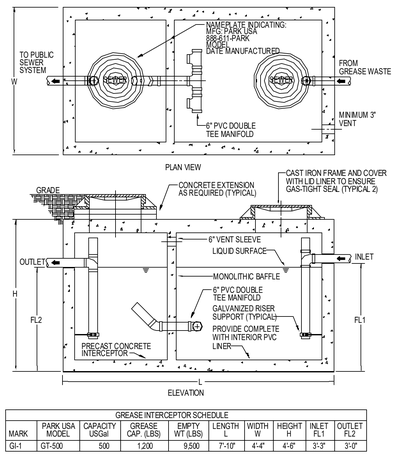
5 SAMPLE WELL
NOT TO SCALE

SPECIFICATIONS:

CONCRETE
CLASS I/II CONCRETE WITH DESIGN STRENGTH OF 4,500 PSI AT 28 DAYS. UNIT IS OF MONOLITHIC CONSTRUCTION AT FLOOR, FIRST STAGE OF WALL AND BAFFLE WITH SECTIONAL RISER TO REQUIRED DEPTH. MONOLITHIC BAFFLE REQUIRED, SLIDE-IN TYPE IS NOT ACCEPTABLE.

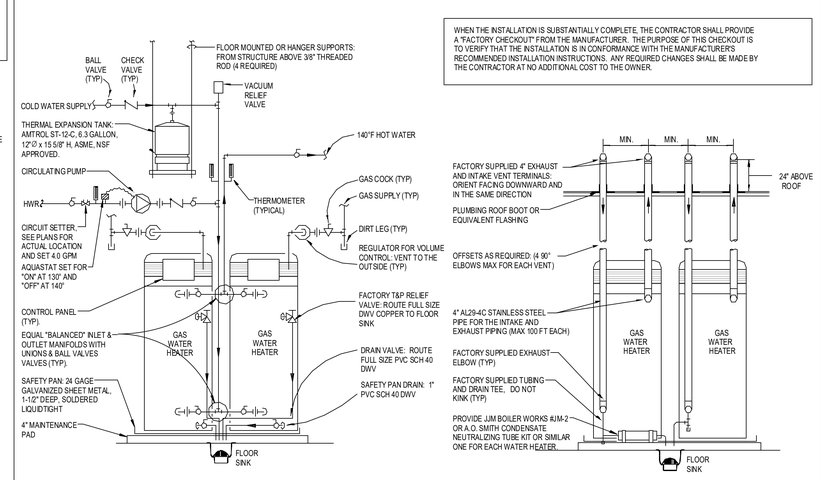
REINFORCEMENT
GRADE 60 REINFORCED WITH STEEL REBAR CONFORMING TO ASTM A615 ON REQUIRED CENTERS OR EQUAL.

CAST IRON CASTINGS
MANHOLE FRAMES AND COVERS MANUFACTURED OF GREY CAST IRON CONFORMING TO ASTM A48 CLASS 30. MANHOLE SHALL BE NOMINAL 24 INCH DIAMETER AND BE TRAFFIC DUTY.



GREASE INTERCEPTOR SCHEDULE										
MARK	PARK USA MODEL	CAPACITY USGal	GREASE CAP. (LBS)	EMPTY WT (LBS)	LENGTH L	WIDTH W	HEIGHT H	INLET FL1	OUTLET FL2
GI-1	GT-500	500	1,200	9,500	7'-10"	4'-4"	4'-6"	3'-3"	3'-0"

6 GREASE INTERCEPTOR
NOT TO SCALE

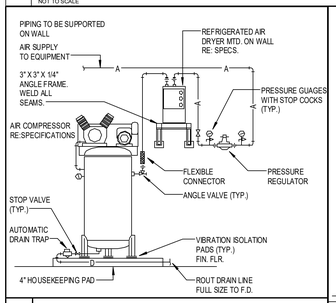


WATER HEATER DETAIL (FRONT)

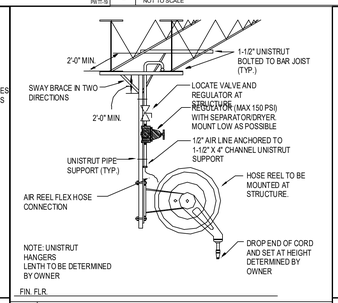
WHEN THE INSTALLATION IS SUBSTANTIALLY COMPLETE, THE CONTRACTOR SHALL PROVIDE A "FACTORY CHECKOUT" FROM THE MANUFACTURER. THE PURPOSE OF THIS CHECKOUT IS TO VERIFY THAT THE INSTALLATION IS IN CONFORMANCE WITH THE MANUFACTURER'S RECOMMENDED INSTALLATION INSTRUCTIONS. ANY REQUIRED CHANGES SHALL BE MADE BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

WATER HEATER DETAIL (REAR)

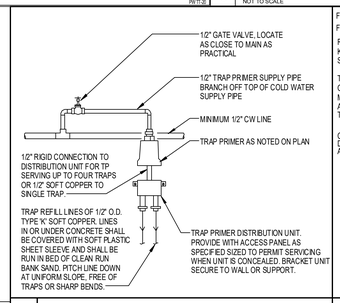
7 GAS DOUBLE CONDENSING WATER HEATER DETAIL
NOT TO SCALE



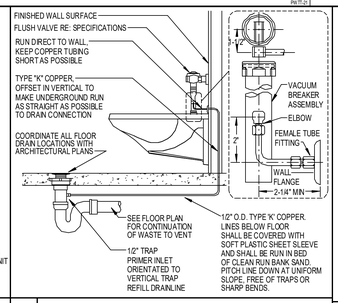
8 AIR COMPRESSOR DETAIL VERTICAL W/DRYER
NOT TO SCALE



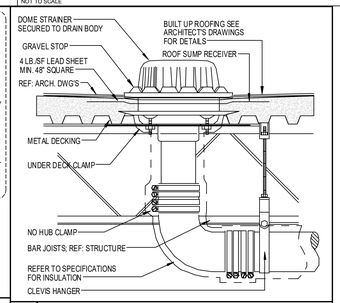
9 COMPRESSOR AIR HOSE REEL DETAIL
NOT TO SCALE



10 TRAP PRIMER DETAIL
NOT TO SCALE



11 TRAP PRIMER DETAIL
NOT TO SCALE



12 ROOF DRAIN DETAIL
NOT TO SCALE

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 203
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.637.4583 p
https://www.dbinc.com
TBPE Firm Registration No. 224
3900 Bee Cave Road, Austin, TX 78746
SW | JG | JB | AR | -

TN PN

NO.	REVISION	DATE

10/24/2024
DATE
DBR
DRAWN BY
DBR
CHECKED BY
223102.00
BRW PROJECT NUMBER

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

P6.2
PLUMBING DETAILS

ABBREVIATIONS

AC	ALTERNATING CURRENT
AF	AMPERE FUSE, AMPERE FRAME
AFC	ABOVE FINISHED CEILING
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AMPERE INTERRUPT CAPACITY
AL	ALUMINUM
AM	AMMETER
AMP	AMPLIFIER
ANN	ANNUNCIATOR
ASC	AMPERES SHORT CIRCUIT
AT	AMPERE TRIP RATING
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
BKR	BREAKER
BLDG.	BUILDING
C	CONDUIT, CELSIUS
CKT	CIRCUIT
CLG.	CEILING
CONT.	CONTINUOUS,CONTINUATION
CONTR	CONTROLLER, CONTRACTOR
CT	CURRENT TRANSFORMER/COOLING TOWER
CU	COPPER
DAS	DISTRIBUTED ANTENNA SYSTEM
DC	DIRECT CURRENT
DISC	DISCONNECT
DP	DISTRIBUTION PANEL
DPDT	DOUBLE-POLE, DOUBLE-THROW
DPST	DOUBLE-POLE, SINGLE-THROW
DWG	DRAWING
ELEV.	ELEVATOR
EPO	EMERGENCY POWER OFF
ERRC	EMERGENCY RESPONDER RADIO COVERAGE SYSTEM
FA	FIRE ALARM
FF	FURNITURE FEED
FLA	FULL LOAD AMPS
FTL	FEED-THRU LUGS
GA	GAUGE
GEN	GENERATOR
GND	GROUND
GTD	GENERATOR TRANSFER DEVICE
IG	ISOLATED GROUND
LF	LINEAR FEET
LTG	LIGHTING
LV	LOW VOLTAGE
LVL	LEVEL
MAX.	MAXIMUM
MC	METAL CLAD CABLE
MCA	MINIMUM CIRCUIT AMPS
MCB	MAIN CIRCUIT BREAKER
MCCB	MOLDED CASE CIRCUIT BREAKER
MD	MOTORIZED DAMPER
MDP	MAIN DISTRIBUTION PANEL
MFR	MANUFACTURER
MIC	MICROPHONE
MIN.	MINIMUM
MLO	MAIN LUGS ONLY
MOCP	MAXIMUM OVER-CURRENT PROTECTION
MSB	MAIN SWITCHBOARD
N3R	NEMA 3R
N4X	NEMA 4X
N.C.	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NF	NON-FUSED
NFS	NON-FUSED SWITCH
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
N.O.	NORMALLY OPEN
NO.	NUMBER
NTS	NOT TO SCALE
PH	PHASE
POS	POINT OF SALE
QTY	QUANTITY
RCP	REFLECTED CEILING PLAN
RCPT	RECEPTACLE
RE	REFERENCE, REFER
SF	SQUARE FOOT
SIM	SIMILAR
SKVA	STARTING KILOVOLT-AMPS
SPD	SURGE PROTECTION DEVICE
SPDT	SINGLE-POLE, DOUBLE-THROW
SPST	SINGLE-POLE, SINGLE-THROW
SPEC	SPECIFICATION
SQFT	SQUARE FOOT
ST	SHUNT TRIP
SWB	SWITCHBOARD
TL	TWIST-LOCK
TOC	TOP OF CURB
TOS	TOP OF STEEL
TR	TAMPER RESISTANT RECEPTACLE
TV	TELEVISION
TYP	TYPICAL
UG	UNDERGROUND
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SYSTEM
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF: WITH IN-USE HOUSING
WT	WATERTIGHT, WEIGHT
W/SF	WATTS PER SQUARE FOOT
XFMR	TRANSFORMER

MANY ABBREVIATIONS NOT LISTED MAY BE FOUND IN THE NATIONAL ELECTRIC CODE, OR IN THE INTERNATIONAL AND UNIFORM CODES

PHASING

(E)	EXISTING (TO REMAIN)
(D)	SHALL BE DEMOLISHED
(N)	PROVIDE NEW
(R)	RELOCATED ELEMENT

ELECTRICAL SYMBOLS

MOTORS AND CONTROLS

- MOTOR RATED SWITCH WITH THERMAL OVERLOADS
- SINGLE OR THREE PHASE MOTOR NUMBER INDICATES HORSE POWER
- ELECTRIC DUCT HEATER
- DISCONNECT (SAFETY) SWITCH "200/3/150" DENOTES AMPERES/POLE/FUSE, "NF" DENOTES NON-FUSED "N3R" DENOTES NEMA 3R
- ENCLOSED CIRCUIT BREAKER- "200/3/150" DENOTES AMPERES/POLE/TRIP.
- MOTOR STARTER FURNISHED BY DIVISION 23 AND INSTALLED BY DIVISION 26.
- COMBINATION DISCONNECT (SAFETY) SWITCH AND MOTOR STARTER, "30/3/15/80" DENOTES AMPERES/POLES/FUSE/ STARTER SIZE, "NF" DENOTES NON-FUSED. FURNISHED BY DIVISION 23 AND INSTALLED BY DIVISION 26.
- VFD — VARIABLE FREQUENCY DRIVE PROVIDED BY DIVISION 23 AND INSTALLED BY DIVISION 26.
- EPO — EMERGENCY POWER OFF BUTTON.

RECEPTACLES AND OUTLETS

ALL RECEPTACLES SHALL BE MOUNTED 18" ABOVE FINISHED FLOOR TO CENTER OF DEVICE UNLESS NOTED OTHERWISE. REFER TO SPECIFICATIONS AND DRAWINGS FOR ADDITIONAL REQUIREMENTS.

ABBREVIATIONS APPLICABLE TO RECEPTACLES:

"GFCI" GROUND FAULT INTERRUPTER
"WP" WEATHERPROOF
"IG" ISOLATED GROUND
"TR" TAMPER RESISTANT
"USB" RECEPTACLE WITH USB CHARGING PORTS
"AC" ABOVE COUNTER MOUNTING
"UC" UNDER COUNTER MOUNTING
"H" HORIZONTALLY ORIENTED RECEPTACLE
"SM" SOFFIT MOUNTED
"OR" ORANGE IN COLOR

- SIMPLEX WALL RECEPTACLE, NEMA 5-20R, 20A, 125V.
- DUPLEX WALL RECEPTACLE, NEMA 5-20R, 20A, 125V. SHADED INDICATES SPLIT-WIRED
- FOURPLEX (QUADRUPLEX) RECEPTACLE
- DUPLEX RECEPTACLE (PEDESTAL MOUNTED)
- CONTROLLED WALL RECEPTACLE. DUPLEX: SPLIT-WIRED QUAD: SEPARATELY WIRED UNDER A COMMON COVERPLATE.
- POWER DEVICE RED IN COLOR, ON EMERGENCY POWER CIRCUIT
- CEILING RECEPTACLE/QUAD, EMERGENCY POWER SYMBOL MAY APPLY
- SPECIAL RECEPTACLE, NEMA CONFIGURATION PER PLAN OR EQUIPMENT
- TV — TV ROUGH-IN: 3-GANG RECESSED TV BOX, CONTAINING 1 DUPLEX RECEPTACLE, 1 GANG FOR AV, 1 GANG FOR DATA
- FLOOR BOX OR POKE THRU. POKE-THRU'S WHERE IN SUSPENDED SLABS, RECESSED IN FOUNDATION WHERE SLAB ON GRADE
- FLUSH ELECTRICAL FLOOR OUTLET. REFER TO FLOOR BOX SCHEDULE, FIRE RATED POKE-THROUGH SCHEDULE AND KEYED NOTES.
- DC — DROP CORD WITH SIMPLEX RECEPTACLE UNLESS OTHERWISE NOTED
- CR — CORD REEL WITH DUPLEX RECEPTACLE UNLESS OTHERWISE NOTED
- J — JUNCTION BOX
  "MD" INDICATES POWER CONNECTION TO SERVE MOTOR DAMPER
  "HD" INDICATES POWER CONNECTION TO SERVE HAND DRYER
  "FV" INDICATES POWER CONNECTION TO SERVE FLUSH VALVES
- P — PULL BOX (OVER 4" SQUARE)
- BELL/BUZZER/CHIME
- PUSH BUTTON/DOOR BELL/START-STOP
- PP — POWER POLE
- POINT OF DIRECT CONNECTION TO EQUIPMENT
- C (2) — CLOCK RECEPTACLE SHALL BE MOUNTED 12" BELOW FINISHED CEILING. (2) DENOTES DOUBLE SIDED CLOCK.

LIGHTING

LETTER(S) DENOTE TYPE- SEE LIGHTING FIXTURE SCHEDULE FOR ADDITIONAL INFORMATION.

2' X 4' | 2' X 2' | 1' X 4' | 1' X 2' | 1' X 1'

- STRIP LIGHTING FIXTURES.
- ROUND DOWNLIGHT FIXTURE.
- SQUARE DOWNLIGHT FIXTURE.
- WALL MOUNTED LIGHTING FIXTURE.
- TRACK LIGHTING FIXTURE. MOUNTED AS SHOWN ON LIGHTING FIXTURE SCHEDULE.
- CEILING MOUNTED EXIT SIGN; ARROWS AS INDICATED. SHADED AREA DENOTES FACE.
- WALL MOUNTED EXIT SIGN; ARROWS AS INDICATED. SHADED AREA DENOTES FACE.
- EMERGENCY WALL MOUNTED LIGHTING FIXTURE. BATTERY OPERATED UNLESS NOTED OTHERWISE.
- SITE LIGHTING FIXTURE.

HATCHING PATTERNS BELOW SHALL APPLY TO ALL LIGHTING FIXTURE SYMBOLS.

- NL — EMERGENCY LIGHT FIXTURE WITH BATTERY PACK. PROVIDE WITH UNSWITCHED HOT FOR LOSS OF VOLTAGE AND CHARGING (SAME CIRCUIT AS NORMAL POWER LIGHTING). FIXTURES SHALL BE WIRED IN A MANNER AS TO ALLOW SWITCHING OF FIXTURES WITHOUT DISCHARGING THE EMERGENCY BATTERY. BATTERY PACK IS TO ONLY OPERATE IN THE EVENT OF A POWER OUTAGE.
  "NL" NIGHT LIGHT ON UNSWITCHED 24HR OPERATION
- EM CIRCUIT — LIGHT FIXTURE ON EMERGENCY BRANCH CIRCUIT. GENERATOR TRANSFER DEVICES REQUIRED (UL1008 OR UL924) PROVIDE UNSWITCHED HOT, NEUTRAL AND GROUND FOR ALL EMERGENCY LIGHTING ORIGINATING FROM THE EMERGENCY CIRCUIT SHOWN.
- CRITICAL OPERATIONS LIGHTING ORIGINATING FROM THE CRITICAL CIRCUIT INDICATED, HATCHED AS INDICATED. HATCHING TYPICAL FOR ALL CRITICAL BRANCH LIGHT FIXTURES

RACEWAYS AND WIRING

- CAP AND STAKE
- CONDUIT CONCEALED IN WALL OR CEILING
- UNDERGROUND, UNDERSLAB, CONCEALED ROUTING
- OHE — OVERHEAD ELECTRIC PRIMARY UTILITY POWER LINE
- CONDUIT UP/DOWN
- HASH MARKS INDICATE NUMBER OF CONDUCTORS. LEFT TO RIGHT: PHASE/NEUTRAL/GROUND/ISOLATED GROUND. NO HASH MARKS INDICATES EMPTY CONDUIT, 1" MINIMUM. UNLESS NOTED OTHERWISE.
- 1LA-2,4,6 — HOMERUN TO PANEL WITH CIRCUIT NUMBER(S) AS INDICATED.
- (ON)1LA-6 — PARTIAL/SHARED CIRCUIT HOMERUN TO PANEL.
- TELECOMMUNICATIONS CABLE TRAY SHALL BE CONCEALED ABOVE ACCESSIBLE CEILING UNLESS OTHERWISE NOTED

ELECTRICAL EQUIPMENT

- DISTRIBUTION PANEL
- MSB — SWITCHBOARD, MAIN DISTRIBUTION PANEL OR MOTOR CONTROL CENTER
- PANELBOARD (FLUSH/SURFACE MOUNT)
- FLOOR MOUNTED DRY-TYPE TRANSFORMER
- SUSPENDED OR WALL MOUNTED TRANSFORMER
- ATS — AUTOMATIC TRANSFER SWITCH
- FIRE RATED PLYWOOD TERMINAL BOARD, TYPE AS NOTED, 4' X 8' X 3/4" UNLESS NOTED OTHERWISE

COMMUNICATIONS

DEFAULT ELEVATION (UNLESS INDICATED OTHERWISE) TO CENTER OF ROUGH-IN: 18" ABOVE FINISHED FLOOR (AFF)

- DATA/COMM/AV ROUGH-IN. CONDUIT TO PLENUM AND BOX ONLY
- HS DS — SCHOOL INTERCOMMUNICATION SYSTEM HANDSET.

DEFAULT ELEVATION (UNLESS INDICATED OTHERWISE) TO CENTER OF ROUGH-IN: 42" AFF

- VC — VOLUME CONTROL - WALL MOUNTED
- CB — INTERCOM/PA SYSTEM CALL-IN OR CALL-BACK DEVICE

DEFAULT ELEVATION (UNLESS INDICATED OTHERWISE) TO CENTER OF ROUGH-IN: 120" AFF OR 12" BELOW CEILING, WHICHEVER IS LOWER

- S L — INTERCOM/PA SPEAKER "L" LOCAL SOUND REINFORCEMENT

CEILING MOUNTED DEVICES:

- S VC — INTERCOM/PA SPEAKER. "VC" INDICATES VOLUME CONTROL ON SPEAKER.
- AP — WIRELESS ACCESS POINT - CONTRACTOR TO PROVIDE J-BOX AND CONDUIT WITH PULLSTRING ONLY

ONE-LINE DIAGRAM

- TRANSFORMER, TYPE AND RATINGS AS NOTED
- 800A/3P — SWITCH, RATING AS SHOWN
- 400A — FUSE, RATING AS SHOWN
- ST — SHUNT TRIP
- GFP — GROUND FAULT PROTECTION
- K — KIRK-KEY INTERLOCK
- M — DIGITAL METER OR SUB-METER INTEGRATED INTO EQUIPMENT
- 1200/5 — CURRENT TRANSFORMER, RATED AS SHOWN
- GROUND CONNECTION
- AUTOMATIC TRANSFER SWITCH
- BUS DUCT PLUG
- M — ELECTRICAL UTILITY REVENUE METER
- SPD — SURGE PROTECTION DEVICE
- GANN — GENERATOR ANNUNCIATOR PANEL
- CIRCUIT BREAKER
- DRAW-OUT CIRCUIT BREAKER

DAYLIGHT ZONES

- DAYLIGHT ZONE/PRIMARY DAYLIGHT ZONE
- SECONDARY DAYLIGHT ZONE

DAYLIGHT ZONES SHALL BE INCLUSIVE OF THE FIXTURES WITHIN THE SHADED REGION, AND SHALL BE DIMMED USING ON-BOARD OR EXTERNAL CONTROL IN ACCORDANCE WITH IECC 2021. IECC 2018 OR 2015 MAY BE REFERENCED ONLY WHERE ADOPTED BY LOCAL AHJ.

GENERAL NOTES:

A. NOT ALL SYMBOLS SHOWN ON THIS SYMBOL LIST ARE USED IN THE CONTRACT DOCUMENTS.

MISCELLANEOUS

- SHADED SYMBOLS INDICATE EXISTING DEVICES TO REMAIN, UNLESS OTHERWISE NOTED.
- INDICATES WALL-MOUNTED WHEN ATTACHED TO ANY SYMBOL
- 1 — DRAWING NOTE REFERENCE
- SOS — AREA OF RESCUE ASSISTANCE

FIRE ALARM

- W — WATER FLOW SWITCH
- SP — SUPERVISORY SWITCH
- S — SMOKE DETECTOR - MULTI CRITERIA DETECTOR
- S # — SMOKE DETECTOR - "SB" INDICATES IN INTEGRAL SOUNDER BASE "D" INDICATES DUCT TYPE "R" INDICATES 120 VOLT RESIDENTIAL TYPE
- H — HEAT DETECTOR
- S BT — BEAM DETECTOR TRANSMITTER, HIGH IN CEILING WALL DIRECT LINE OF SIGHT.
- S BR — BEAM DETECTOR RECEIVER, HIGH IN CEILING WALL DIRECT LINE OF SIGHT.
- S — FIRE ALARM SPEAKER STROBE / CEILING MOUNTED
- S — FIRE ALARM SPEAKER / CEILING MOUNT.
- DH — MAGNETIC DOOR HOLDER
- R — AUXILIARY CONTROL RELAY
- FH — FIRE FIGHTER HANDSET
- F — FIRE ALARM PULL STATION +42" AFF
- F — FIREMAN'S TELEPHONE JACK +42" AFF
- AUDIO VISUAL FIRE ALARM HORN STROBE +80" AFF- 15/75cd U.N.O.
- VISUAL FIRE ALARM (STROBE) CEILING MOUNT - 15/75cd U.N.O.
- AUDIO FIRE ALARM HORN +80" AFF
- FACP — FIRE ALARM CONTROL PANEL
- ANN — REMOTE FIRE ALARM ANNUNCIATOR PANEL
- RPS — REMOTE POWER SUPPLY FOR AUDIO/VISUAL FIRE ALARM DEVICES.
- FSD — FIRE SMOKE DAMPER
- • — REMOTE LED INDICATOR LIGHT

SECURITY

- PB — ADA AUTO DOOR OPEN BUTTON
- DR — DOOR RELEASE BUTTON
- CR — WALL MOUNTED CARD READER

REFERENCE TECHNOLOGY/SECURITY SHEET FOR ADDITIONAL INFORMATION.

- SECURITY CAMERA LOCATION - CONTRACTOR TO PROVIDE J-BOX AND CONDUIT WITH PULLSTRING ONLY

SWITCHES AND LIGHTING CONTROL DEVICES

ALL SWITCH TYPES AND SENSORS TYPES FOUND ON 'LIGHTING CONTROL DEVICE SCHEDULE' LOCATED ON ELECTRICAL SCHEDULE SHEETS

SWITCH ANNOTATION AS FOLLOWS:

- X — TYPE, PER SCHEDULE; NO TYPE INDICATES SINGLE POLE TOGGLE SWITCH
- $a,b,c — SWITCH LEGS, PER PLAN, SHOWN HERE AS 3 (a,b,c)

OCCUPANCY SENSOR ANNOTATION, AS FOLLOWS:

- OCx — OCCUPANCY / VACANCE SENSOR 'x' INDICATES TYPE, PER SCHEDULE
  - CEILING SENSOR
  - WITH BRACKET INDICATES WALL / CORNER MOUNT

LIGHT SENSOR ANNOTATION, AS FOLLOWS:

- PC — DIGITAL PHOTOCELL
- DS — DAYLIGHT HARVESTING SENSOR

RELAY PANELS, CONTACTORS, TIME SWITCHES:

- XX — RELAYS/CONTACTORS/TIMERS/DEVICES WHERE 'XX' INDICATES:
  "LC" LIGHTING CONTRACTOR
  "LCP" LIGHTING CONTROL PANEL
  "TS" TIME SWITCH
  "TC" TIME CLOCK

DRAWING/DETAIL REFERENCE KEY

RE: 1 /E3-2 — REFER TO DRAWING/DETAIL NUMBER; SHEET NUMBER

1 / E3-2

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 205
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
TBPE Firm Registration No. 2234
https://www.dbrinc.com

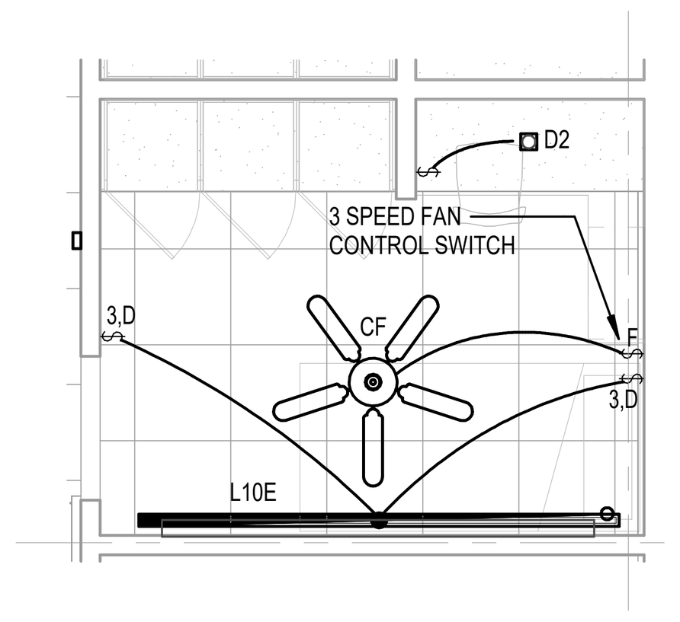
NO.	REVISION	DATE
SW	JCS	JB AR -

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

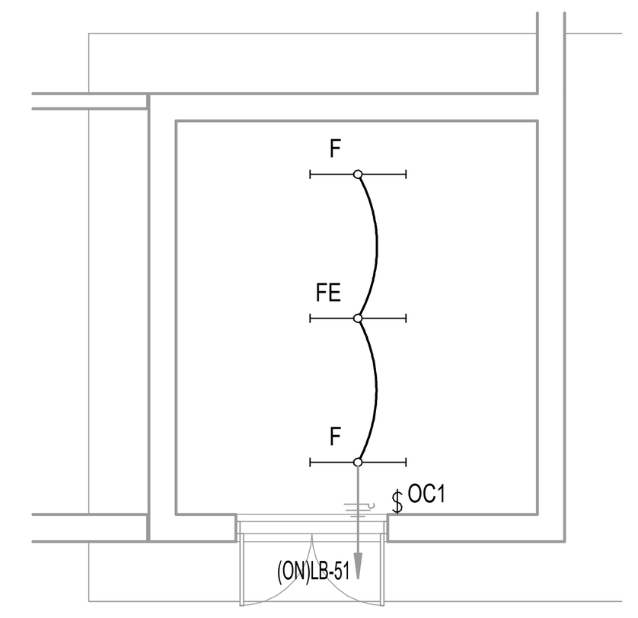
DATE
REVISION
NO.

E0.1
ELECTRICAL SYMBOL LEGEND



3 EL2.1 **ENLARGED SLEEPING ROOM LIGHTING PLAN**

1/4" = 1'-0"



4 EL2.1 **ELECTRICAL LIGHTING PLAN - STORAGE ROOM**

1/8" = 1'-0"

LIGHTING GENERAL NOTES:

A. CONTROL DEVICES SHALL BE PROVIDED IN ACCORDANCE WITH PERFORMANCE DESCRIPTION INDICATED IN THE LIGHTING CONTROL DEVICE SCHEDULE FOUND ON SCHEDULE SHEETS.

B. MULTIPLE SWITCHES SHOWN TOGETHER SHALL BE GANGED UNDER A COMMON COVER PLATE.

C. PROVIDE LABELING OF ALL CONTROL DEVICES, SWITCH PACKS, LIGHT FIXTURES, JUNCTION BOXES, ETC IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS.

D. LIGHTING FIXTURE LOCATIONS SHOWN TAKE PRECEDENT IN CEILING LOCATION TO ALL OTHER TRADES. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR ENSURING OTHER TRADES DO NOT IMPACT SPACING AND/OR OVERLAYMENT OF OTHER DEVICES WHERE LIGHT FIXTURES MUST BE INSTALLED.

E. REFERENCE SYMBOLS LEGEND FOR LIGHT SWITCH DEVICE NOMENCLATURE AND SWITCH-LEG ASSOCIATIONS.

F. ALL 2X2, 2X4 FIXTURES INSTALLED IN SUSPENDED GRID CEILING SHALL BE PROVIDED WITH (2) SECONDARY SUPPORT WIRES ANCHORED DIRECTLY TO STRUCTURE.

EMER. LIGHTING GENERAL NOTES:

A. PROVIDE ALL EMERGENCY LIGHT FIXTURES WITH UNSWITCHED HOT LEG AS DEFINED IN NEC 700.12

B. ROUTE AN UNSWITCHED HOT LEG TO ALL LIGHT FIXTURES DESIGNATED AS EMERGENCY FIXTURES. HOT LEG SHALL ORIGINATE FROM CIRCUIT SERVING NORMAL LIGHTING FIXTURES IN THAT SPACE. UNSWITCHED HOT LEG SHALL CONNECT TO THE NORMAL POWER SENSING LUG ON THE EMERGENCY BATTERY PACK.

C. PROVIDE UN-SWITCHED CIRCUIT TO ALL EXIT SIGNS.

LIGHTING CONTROLS COMMISSIONING

THE CONTRACTOR SHALL INCLUDE, AS PART OF THEIR SCOPE, THE REQUIREMENTS TO COMMISSION THE LIGHTING CONTROL SYSTEM, AS REQUIRED BELOW. THE LIGHTING CONTROL SYSTEM MAY BE STAND-ALONE, NETWORK, RELAY, CONTACTOR OPERATED, TIMER, PHOTOCELL, OR ANY COMBINATION OF THESE LISTED. FOR EACH OF THE FOLLOWING TASKS, RECORD THE DATE PERFORMED, PERSON(S) COMPLETING THE VERIFICATION, INITIAL SETTING/CONDITION, ACTIONS PERFORMED, AND FINAL SETTING CONDITION. SUBMIT DOCUMENTATION TO THE CITY HAVING JURISDICTION AT OR BEFORE SUBSTANTIAL COMPLETION. SUBMITTING AFTER SUBSTANTIAL COMPLETION WILL DELAY THE ISSUANCE OF A CERTIFICATE OF OCCUPANCY.

A. ENSURE ALL LIGHTING FIXTURES HAVE LAMPS THAT ARE FUNCTIONAL

B. TEST ALL EXIT SIGNS, EMERGENCY LIGHTING FIXTURES, AND EMERGENCY TRANSFER DEVICES OR CENTRAL BATTERY SYSTEM.

C. VERIFY THAT ALL OCCUPANCY SENSORS HAVE BEEN INSTALLED AND ARE OPERATIONAL.

D. TEST ALL WALL-SWITCH OCCUPANCY SENSORS

E. TEST ALL DIGITAL/LOW VOLTAGE SWITCHES AND THEIR PERIPHERALS, WHERE INSTALLED, SUCH AS:

   1. CEILING MOUNTED OCCUPANCY SENSORS
   2. POWER PACKS
   3. DAYLIGHT SENSING/HARVESTING SENSORS

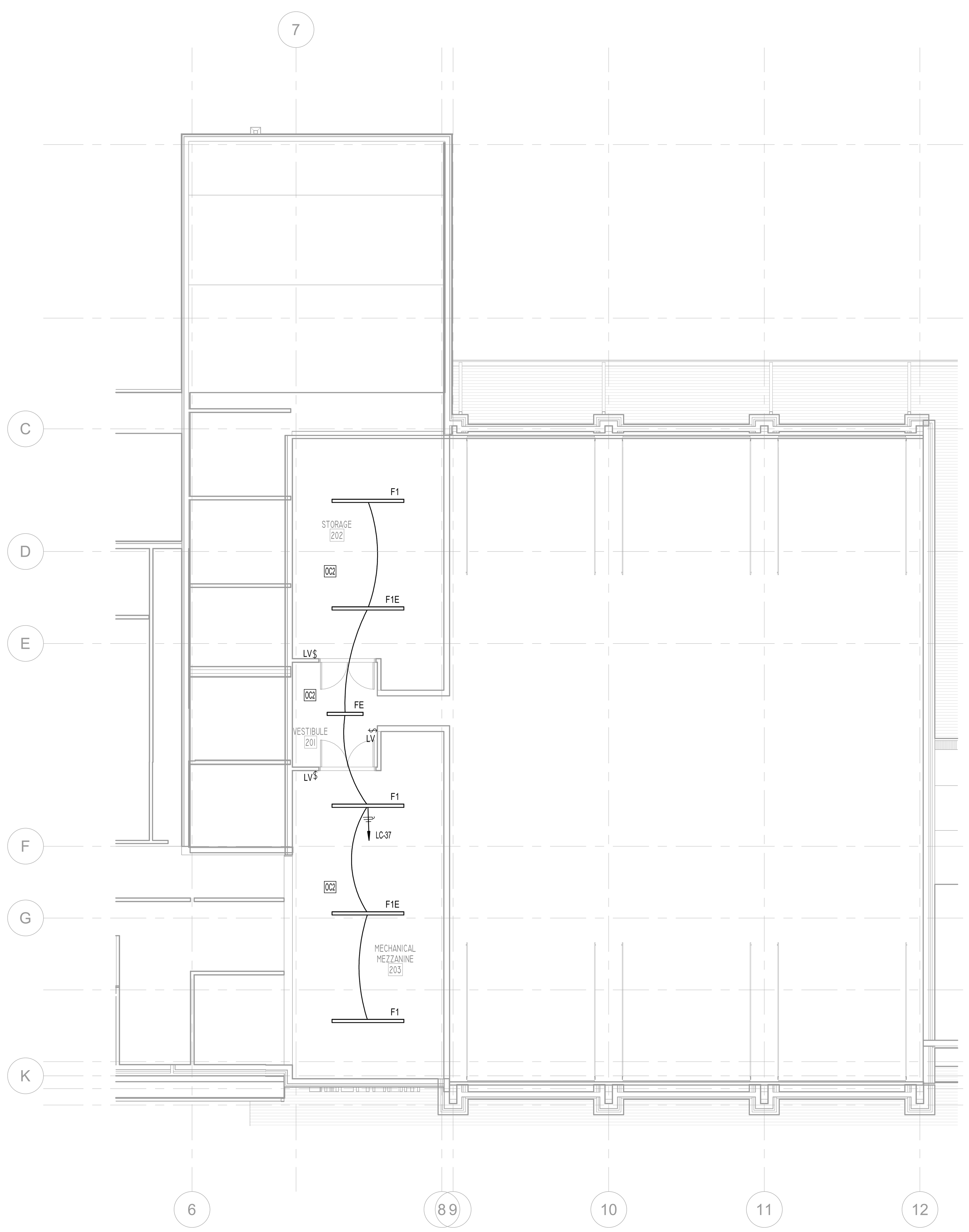
F. VERIFY THE FOLLOWING FUNCTIONALITY AND/OR INSTALLATION OF ALL CONTROL DEVICES

   1. SENSORS HAVE BEEN LOCATED AND AIMED TO RELEVANT LOCATIONS OF OCCUPANCY, PER MANUFACTURERS RECOMMENDATION
   2. VERIFY STATUS INDICATORS ON DEVICES ARE OPERATIONAL AND CORRECT
   3. DEVICES CONTROL LIGHTING FIXTURES AS SPECIFIED ON THE DRAWINGS
   4. ALL OCCUPANCY/VACANCY MODE TIME-OUTS ARE SET TO NO GREATER THAN 30 MINUTES.
   5. ALL CONTROL DEVICES ARE SET VACANCY MODE, OR NO MORE THAN 50% OF FIXTURES TURN ON AUTOMATICALLY UPON ENTERING A SPACE/ROOM.
   6. MOVEMENT IN ADJACENT SPACES OR CYCLING OF HVAC SYSTEMS DOES NOT FALSELY TRIGGER SENSORS. (VACANCY MODE PREFERRED TO PREVENT THIS) SHOULD ADDITIONAL INFORMATION REGARDING THE TESTING REQUIREMENTS BE NEEDED, REFERENCE IECC 2015 SECTION 408.3

ELECTRICAL KEYED NOTES

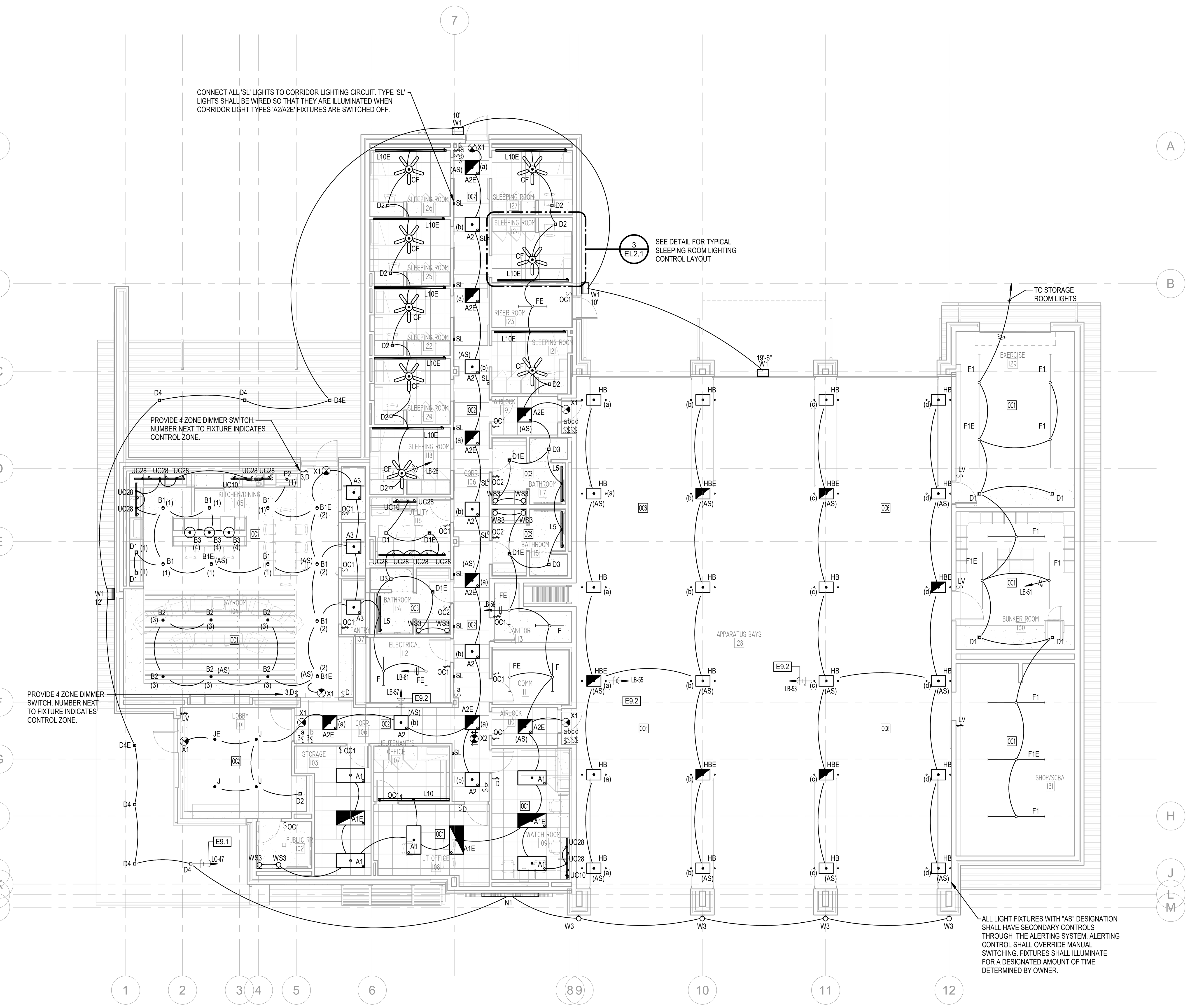
E9.1 ROUTE CIRCUIT THROUGH RELAY PANEL FOR TIME BASED AND PHOTO-SENSING CONTROLS. PROVIDE #10 WIRE ENTIRE LENGTH OF CIRCUIT.

E9.2 ROUTE CIRCUIT THROUGH RELAY PANEL FOR TIME BASED CONTROLS. PROVIDE TIE-IN WITH ALERTING SYSTEM.



TN PN 2 EL2.1 **ELECTRICAL LIGHTING PLAN LEVEL 2**

1/8" = 1'-0"



TN PN 1 EL2.1 **ELECTRICAL LIGHTING PLAN LEVEL 1**

1/8" = 1'-0"

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005

SW	JG	JB	AR	-

TN PN

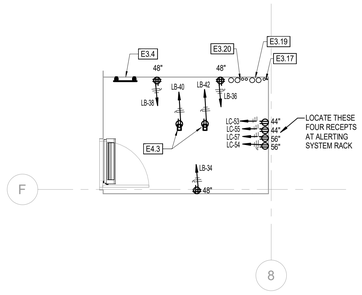
DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

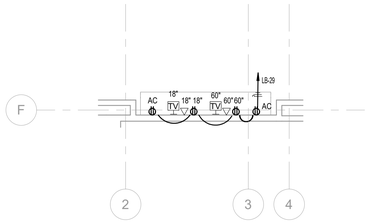
NO.	REVISION	DATE

EL2.1

ELECTRICAL LIGHTING PLANS



3 ENLARGED COMM ROOM POWER PLAN
EP2.1 — 1/4" = 1'-0"



4 ENLARGED DAYROOM POWER PLAN
EP2.1 — 1/4" = 1'-0"

GENERAL ELECTRICAL NOTES:

A. ELECTRICAL DEVICES SHOWN ARE NOT EXACT. ALL DEVICE LOCATIONS SHALL BE VERIFIED WITH ARCHITECTURAL MILLWORK, CASEWORK, AND GENERAL ELEVATION VIEWS.

B. ELECTRICAL CONTRACTOR SHALL PROVIDE CONDUIT, OUTLET BOXES, JUNCTION BOXES FOR ALL TECHNOLOGY, LOW VOLTAGE, ACCESS CONTROL SECURITY, SURVEILLANCE, AND OTHER DIVISION 27/28 SCOPE. REFER TO DIVISION 27/28 DRAWINGS AND SPECIFICATIONS FOR ALL WORK REQUIRED. OMISSION OF THIS SCOPE FROM DIV 26 SCOPE OF WORK IS PROHIBITED.

C. HVAC AND PLUMBING EQUIPMENT LOCATIONS ARE NOT EXACT, AND THE EXACT POINT OF CONNECTION TO EQUIPMENT MAY VARY. COORDINATE EXACT ROUGH-IN REQUIREMENTS IN FIELD AND WITH FINAL SUBMITTALS FOR ALL DIV. 21/22/23 EQUIPMENT.

D. PROVIDE LABELING OF ALL DEVICES, CONDUIT, PANELS, AND JUNCTION BOXES IN ACCORDANCE WITH ELECTRICAL SPECIFICATIONS.

E. MINIMIZE ROOF PENETRATIONS. WHERE ABLE, ROUTE ALL CONDUIT FOR ROOF MOUNTED EQUIPMENT THROUGH ROOF CURB. CONTRACTOR WILL BE RESPONSIBLE FOR COORDINATING NECESSARY WATER PROOFING AROUND ROOF PENETRATIONS WITH ROOFING INSTALLER.

F. ALL RECEPTACLES LOCATED IN RESTROOMS, JANITOR CLOSETS, MECHANICAL ROOMS, ELEVATOR PITS OR SHAFTS, ELEVATOR EQUIPMENT ROOMS, SERVING ELECTRIC DRINKING FOUNTAINS OR VENDING MACHINES, LOCATED WITHIN 6' OF A SINK, LOCATED ABOVE A WET COUNTERTOP OR IN A KITCHEN OR COFFEE BAR SHALL BE GFCI. FEED-THRU GFCI/GFI IS PROHIBITED, ALL GFCI/GFI DEVICES SHALL BE PROVIDED WITH INDIVIDUAL TEST/RESET FEATURES.

G. MULTI-WIRE HOME RUNS SHALL NOT BE ALLOWED. PROVIDE DEDICATED NEUTRALS FOR ALL CIRCUITS. SHARING CONDUIT IS PERMISSIBLE WHERE TOTAL CONDUCTOR AMPACITY DERATING HAS BEEN PERFORMED BY ELECTRICAL CONTRACTOR. THE NEUTRAL IS CONSIDERED CURRENT-CARRYING.

H. ALL RECEPTACLES SHALL BE TAMPER RESISTANT TYPE. CONTRACTOR MAY PROVIDE NON-TAMPER-RESISTANT RECEPTACLES WHERE NOT REQUIRED PER CURRENT NEC ARTICLE 406

I. LABEL ALL CIRCUITS AT ALL JUNCTION BOXES AND OUTLETS (AS DEFINED BY NEC) WITH TYPE-WRITTEN LABEL IDENTIFYING CIRCUIT ON THE BACK OF DEVICE COVER PLATES OR ON COVER OF JUNCTION BOX. IF A BOX HAS MULTIPLE CIRCUITS WITHIN, LABEL ALL CIRCUITS.

J. CONTRACTOR SHALL PROVIDE A COMPLETE, CODE COMPLIANT FIRE ALARM SYSTEM. SEE SPECIFICATIONS.

K. CONTRACTOR SHALL PROVIDE A BURIED COPPER GROUND LOOP AROUND PERIMETER OF BUILDING. SEE DETAILS AND SPECIFICATIONS.

L. CONTRACTOR SHALL PROVIDE A LIGHTNING PROTECTION SYSTEM AROUND PERIMETER OF ROOF. SEE DETAILS AND SPECIFICATIONS.

M. CONTRACTOR SHALL PROVIDE AN EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM. SEE SPECIFICATIONS.

ELECTRICAL KEYED NOTES

E3.1 PROPOSED LOCATION FOR GENERATOR STATUS PANEL.

E3.3 INDOOR UNIT SHALL RECEIVE POWER FROM OUTDOOR UNIT. SEE DETAIL. COORDINATE EXACT CONNECTION LOCATION AND REQUIREMENTS WITH MECHANICAL.

E3.4 PROVIDE COPPER GROUND BUS. SEE DETAIL.

E3.5 PROVIDE POWER TO MOTORIZED LOUVER. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH MECHANICAL PRIOR TO ROUGH-IN.

E3.10 DROP CORD FROM J-BOX IN STRUCTURE ABOVE. PROVIDE QUICK-RELEASE RECEPTACLE. SEE DETAIL 13/E6.1. VERIFY EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.

E3.11 POWER FOR OVERHEAD DOOR. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN. CONNECT TO UP/DOWN SWITCH PROVIDED WITH EQUIPMENT.

E3.12 LIGHTING CONTROL/RELAY PANEL. 100A WITH MINIMUM 12 RELAYS.

E3.13 PROVIDE CONDUIT AND WIRE TO WALL MOUNTED CONTROLLER AS REQUIRED. CONTROLLER FURNISHED WITH EQUIPMENT. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH MECHANICAL PRIOR TO ROUGH-IN.

E3.14 CONTROLS STATION FOR APPARATUS BAY OVERHEAD DOORS. PROVIDE CONTROL FOR ALL SIX DOORS WITH ALL WIRING AND CONDUIT AS REQUIRED.

E3.15 GAS SYSTEM CONTROL STATION. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH PLUMBING PRIOR TO ROUGH-IN.

E3.16 ONE (1) 1" CONDUIT AND ONE (1) 2" CONDUIT ROUTED FROM COMM ROOM OUT SIDEWALL OF MEZZ. STORAGE FOR ANTENNA AND SATELLITE T.V.

E3.17 ONE (1) 1" CONDUIT WITH PULLSTRING AND ONE (1) 2" CONDUIT WITH PULLSTRING ROUTED TO ROOF FOR ANTENNA AND SATELLITE T.V.

E3.18 TWO (2) 4" CONDUITS WITH PULLSTRING ROUTED IN STRUCTURE ABOVE FOR DATA/ACCESS CONTROL ON OTHER SIDE OF BAY. STUB INTO COMM. ROOM.

E3.19 TWO (2) 4" CONDUITS WITH PULLSTRING TO STORAGE SHED FOR FUTURE COMMUNICATIONS TOWER.

E3.20 TWO (2) 4" CONDUITS WITH PULLSTRING AND TWO (2) 2" CONDUITS WITH PULLSTRING TO J-BOX FOR TELECOM UTILITY CONNECTION.

E3.21 CONTROLS FOR GEF EXHAUST FANS SHALL BE INTERLOCKED WITH ALERTING SYSTEM. ON-DELAY - REMAIN OFF FOR 3 MINUTES THEN START. RUN FOR 10 MINUTES THEN OFF. IF ANOTHER CALL COMES IN DURING THIS SEQUENCE, RESTART AT ON-DELAY AND CONTINUE.

E3.22 PROVIDE 1" CONDUIT WITH PULLSTRING FROM 36"A.F.F. EXTENDING DOWN BELOW SLAB. EXTEND TO LOCATION 5'-0" OUTSIDE SLAB, NOT IN CONCRETE, AND STUB UP 12" ABOVE GRADE. PROVIDE WP CAP AND LABEL.

E3.23 CONTROLS FOR GEF-1/2/3 EXHAUST FANS. PROVIDE MANUAL OVERRIDE SWITCH. INTERLOCK WITH APP BAY GAS DETECTION SYSTEM. INTERLOCK WITH ALERTING SYSTEM SEQUENCING.

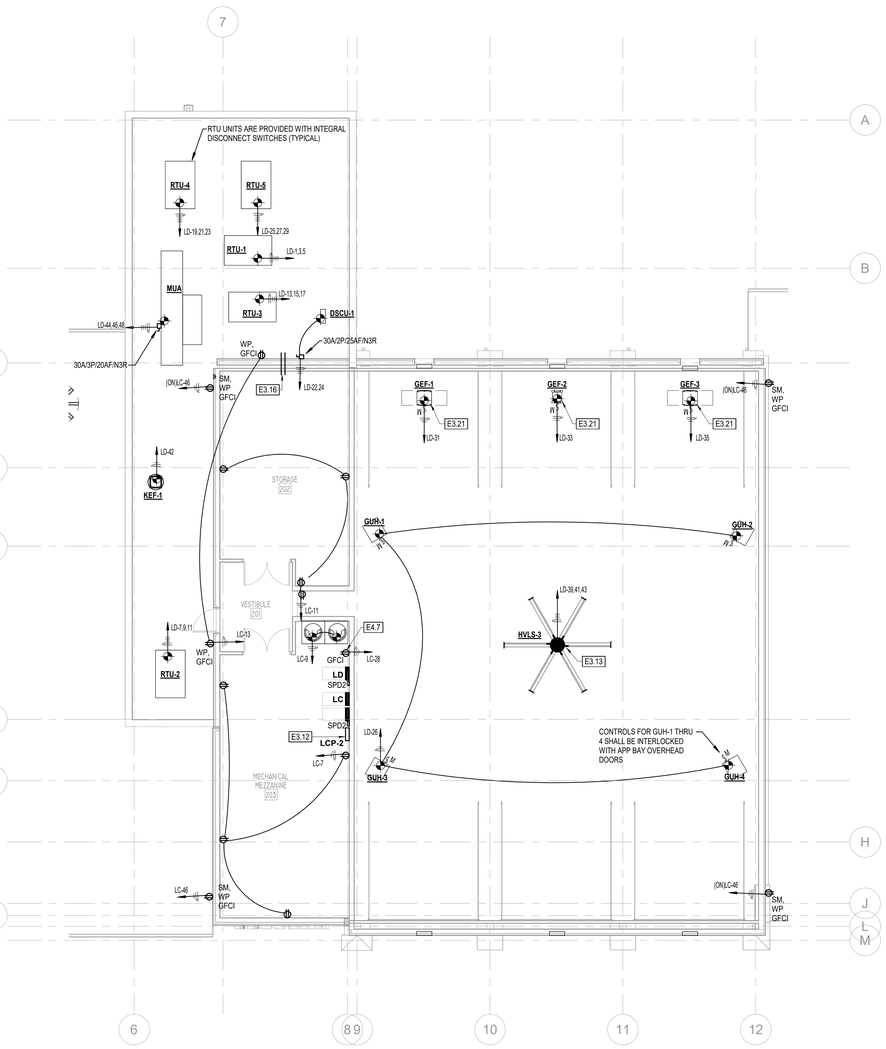
E3.24 INTERLOCK WITH OVERHEAD COILING DOOR.

E4.2 PROVIDE REMOTE GFCI TEST BUTTON ADJACENT TO EQUIPMENT AT NORMAL RECEPTACLE HEIGHT IN AN ACCESSIBLE LOCATION.

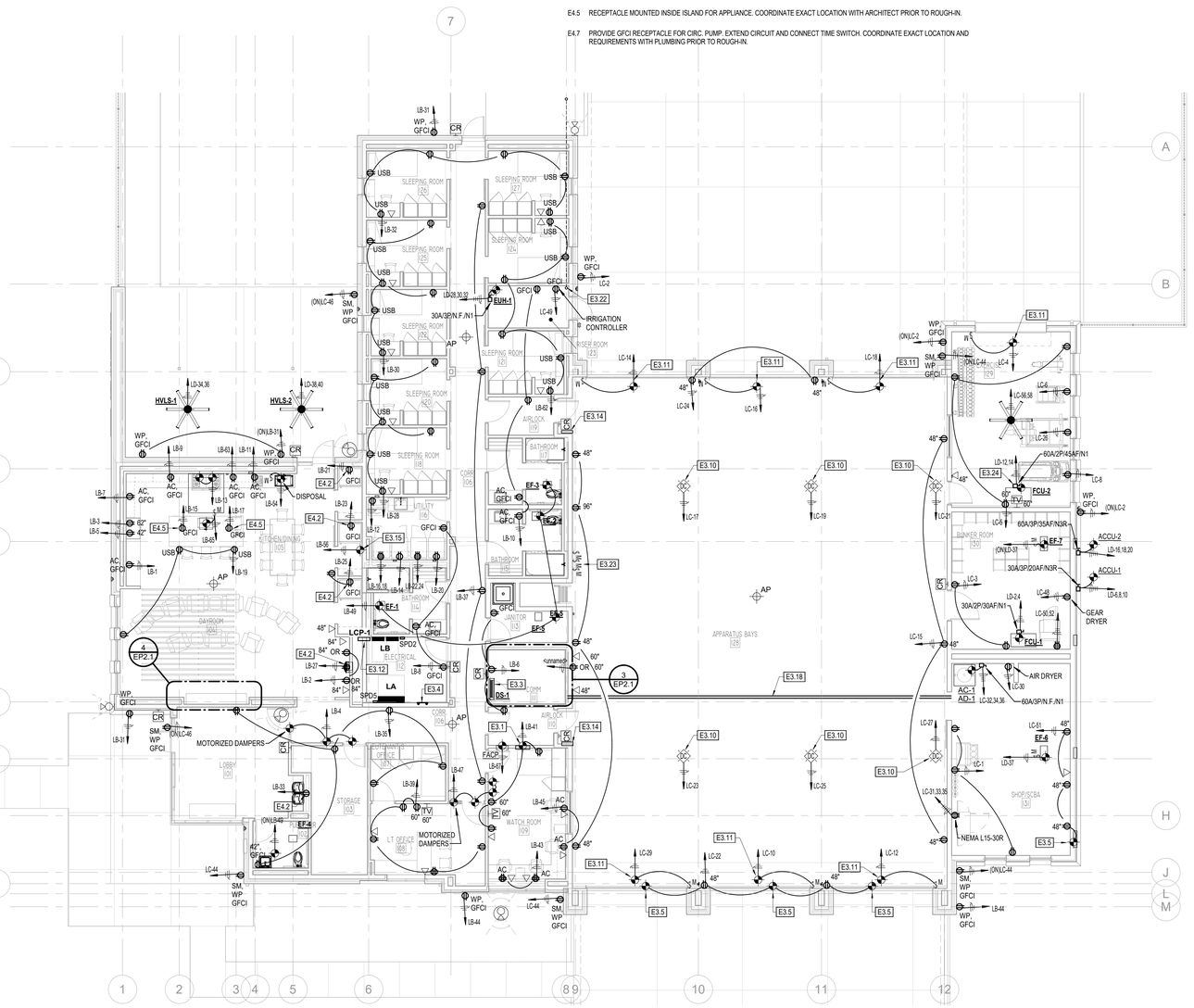
E4.3 PROVIDE 120V/30AMP TWISTLOCK RECEPTACLE ABOVE DATA RACK. SUSPEND J-BOX AT 108"A.F.F. WITH RIGID CONDUIT, DIAGONALLY BRACED.

E4.5 RECEPTACLE MOUNTED INSIDE ISLAND FOR APPLIANCE. COORDINATE EXACT LOCATION WITH ARCHITECT PRIOR TO ROUGH-IN.

E4.7 PROVIDE GFCI RECEPTACLE FOR CIRC. PUMP. EXTEND CIRCUIT AND CONNECT TIME SWITCH. COORDINATE EXACT LOCATION AND REQUIREMENTS WITH PLUMBING PRIOR TO ROUGH-IN.



2 ELECTRICAL POWER PLAN LEVEL 2
TN PN — EP2.1 — 1/8" = 1'-0"



1 ELECTRICAL POWER PLAN LEVEL 1
TN PN — EP2.1 — 1/8" = 1'-0"

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 150
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
1801 Rio Road Alvin, TX 77511

SW	JG	JB	AR	-

TN PN

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

EP2.1
ELECTRICAL POWER PLANS

STATE OF TEXAS
EDWARD PUENTES
103138
LICENSED
PROFESSIONAL
ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 350
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2294
DBR Project # 24500S

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	2231020.00

SW	JG	JB	AR	-

PM
TN

BRENHAM FIRE STATION #2
3007 JAMES WUTT BLVD.
BRENHAM, TX 77833

NO.	REVISION	DATE

ES2.1
ALERTING SYSTEM PLANS

US DIGITAL DESIGNS

Count	Name
1	G2 ATX STATION CONTROLLER
1	G2 UPS (G2 UPS)
2	G2 HDTV REMOTE
1	PUSH BUTTON (BLACK)
2	PUSH BUTTON - RED
2	G2 MESSAGE REMOTE 2
4	G2 MESSAGE SIGN STANDARD (MS G2-S)
2	G2 MS ADAPTOR PLATE DOUBLE (AP-D)
2	MS-ANT ANT-1
17	G2 LED SPEAKER, METAL BOX (HC-70)
2	G2 OMNISTROBE SPEAKER
7	SPEAKER FLUSH MOUNT
1	SPEAKER, METAL BOX
2	SPEAKER, WEATHERPROOF
2	G2 STROBE LIGHT

US DIGITAL DESIGNS

Count	Name
4	G2 PoE PORT REQUIRED

SYMBOL	DESCRIPTION
I/O	G2 I/O REMOTE
MR2	G2 MESSAGE REMOTE 2
RM2	G2 ROOM REMOTE 2
HDTV	G2 HDTV REMOTE
COLOR	G2 COLOR INDICATION REMOTE
	PUSH BUTTON - RED
	PUSH BUTTON - BLACK
VDO	G2 VIDEO DOOR STATION
MIC	G2 LOCAL AREA MICROPHONE
STR	G2 STROBE LIGHT
	OEM TRANSFORMER
	G2 OMNICALERT STROBE SPEAKER
	G2 LED SPEAKER, METAL BOX
	G2 LED SPEAKER, METAL BOX
	SPEAKER, WEATHERPROOF
	SPEAKER, FLUSH MOUNT
	SPEAKER, METAL BOX
12x6	G2 MESSAGE SIGN (MAX 12")
24x6	G2 MESSAGE SIGN (STANDARD 24")
	G2 MESSAGE SIGN (EXTENDED 36")
	OEM FLAT PANEL MONITOR, 80", WITH VOLUME CONTROL (CUSTOMER SUPPLIED)
	ADAPTER PLATE SINGLE
	ADAPTER PLATE DOUBLE
	ARTICULATING ARM MOUNT - LONG

SYMBOL	DESCRIPTION
ATX	G2 ATX STATION CONTROLLER
EXP	G2 EXPANSION MODULE
UPS	G2 UNINTERRUPTIBLE POWER SUPPLY
AMP	OEM AMPLIFIER

INSTALLER NOTES:
1. INSTALLER TO VERIFY WALL AND CEILING TYPE TO DETERMINE NEED FOR FLUSH OR SURFACE MOUNT INSTALLATION OF EQUIPMENT SPECIFIED.
2. INSTALLER TO COORDINATE CONNECTION BETWEEN ATX STATION CONTROLLER'S LINE-LEVEL AUDIO OUTPUT AND (EXISTING) OWNER-FURBISHED HOUSE AUDIO SYSTEM (AMP). (IF APPLICABLE)
3. INSTALLER TO PROVIDE CAT5 & 18/4 CABLES FROM ATX CONTROLLER TO CUSTOMER'S STATION RADIO NETWORK.
4. INSTALLER TO PROVIDE CAT5 CABLE FROM ATX CONTROLLER WAN OUTPUT TO CUSTOMER'S IN-STATION NETWORK.
5. INSTALLER TO COORDINATE CONNECTION BETWEEN EXISTING STATION LIGHTING CONTROL SYSTEM AND RELAY OUTPUT FROM ATX STATION CONTROLLER OR I/O REMOTE WITH OWNER. (IF APPLICABLE)
6. VOLUME CONTROL TO BE PROVIDED BY OWNER OR INSTALLER (IF SHOWN ON DRAWING)
7. INSTALLER TO VERIFY AND CONSIDER LOCATION(S) OF NETWORK AND RADIO CONNECTIONS.

PoE = G2 ATX Power-over-Ethernet (PoE) ports 1...8 and G2 Expansion Module ports 1...12
A:n = G2 ATX Amplifier 1...4 | EA:n = G2 External Amplifier 1...n | CH:n = G2 Message Remote 2 Channel 1 or 2

NOTES:
1. SEE ARCHITECTURAL SPECIFICATIONS FOR ALL ROUGH-IN AND INSTALLATION DETAILS.
2. US DIGITAL DESIGNS DOES NOT SUPPLY BACK BOXES, CONDUITS, OR MOUNTING FASTENERS.
3. US DIGITAL DESIGNS FIRE STATION ALERTING PLANS ARE DIAGRAMMATIC AND FOR QUOTING PURPOSES ONLY. DRAWING MAY NOT BE TO SCALE.
4. PHOENIX G2 SYSTEM IS ABLE TO SIGNAL OWNER-FURBISHED SYSTEMS, (EX)HAUST, LIGHT, GAS SHUT OFF, ETC.) BUT USDD DOES NOT SUPPLY THESE SYSTEMS AND CANNOT WARRANT OR SUPPORT ANY OF THEIR PERFORMANCE BEYOND THE TRANSMISSION OF RELAY SIGNAL TO THEM.

SIGNATURE REQUIRED
END-USER APPROVES STATION DESIGN FOR PURPOSES OF OBTAINING QUOTE.
NOTE: ALL STATION DESIGN ALIGNS WITH SITE CONDITIONS, (DOOR MOUNTING TYPE, ATX LOCATION ETC.)

project	BRENHAM FIRE DEPARTMENT, TX
building	FIRE STATION 2 GROUND LEVEL
address	BRENHAM, TX
filename	USDD_TX_BNHM_FS02_FSA.DWG
date	8/21/2024 - 8:40AM
design by	DMG / DWK

US DIGITAL DESIGNS

Count	Name
1	G2 ATX STATION CONTROLLER
1	G2 UPS (G2 UPS)
2	G2 HDTV REMOTE
1	PUSH BUTTON (BLACK)
2	PUSH BUTTON - RED
2	G2 MESSAGE REMOTE 2
4	G2 MESSAGE SIGN STANDARD (MS G2-S)
2	G2 MS ADAPTOR PLATE DOUBLE (AP-D)
2	MS-ANT ANT-1
17	G2 LED SPEAKER, METAL BOX (HC-70)
2	G2 OMNISTROBE SPEAKER
7	SPEAKER FLUSH MOUNT
1	SPEAKER, METAL BOX
2	SPEAKER, WEATHERPROOF
2	G2 STROBE LIGHT

SYMBOL	DESCRIPTION
I/O	G2 I/O REMOTE
MR2	G2 MESSAGE REMOTE 2
RM2	G2 ROOM REMOTE 2
HDTV	G2 HDTV REMOTE
COLOR	G2 COLOR INDICATION REMOTE
	PUSH BUTTON - RED
	PUSH BUTTON - BLACK
VDO	G2 VIDEO DOOR STATION
MIC	G2 LOCAL AREA MICROPHONE
STR	G2 STROBE LIGHT
	OEM TRANSFORMER
	G2 OMNICALERT STROBE SPEAKER
	G2 LED SPEAKER, METAL BOX
	G2 LED SPEAKER, METAL BOX
	SPEAKER, WEATHERPROOF
	SPEAKER, FLUSH MOUNT
	SPEAKER, METAL BOX
12x6	G2 MESSAGE SIGN (MAX 12")
24x6	G2 MESSAGE SIGN (STANDARD 24")
	G2 MESSAGE SIGN (EXTENDED 36")
	OEM FLAT PANEL MONITOR, 80", WITH VOLUME CONTROL (CUSTOMER SUPPLIED)
	ADAPTER PLATE SINGLE
	ADAPTER PLATE DOUBLE
	ARTICULATING ARM MOUNT - LONG

SYMBOL	DESCRIPTION
ATX	G2 ATX STATION CONTROLLER
EXP	G2 EXPANSION MODULE
UPS	G2 UNINTERRUPTIBLE POWER SUPPLY
AMP	OEM AMPLIFIER

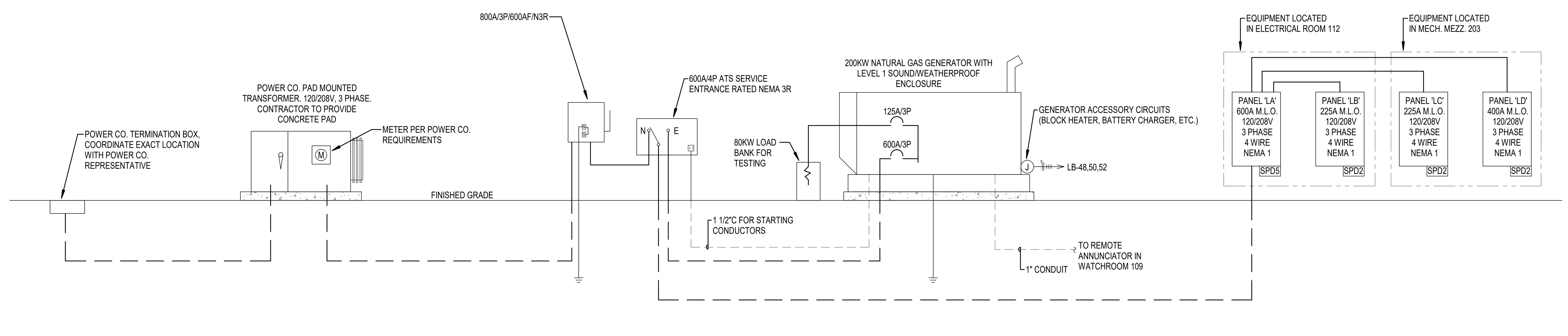
INSTALLER NOTES:
1. INSTALLER TO VERIFY WALL AND CEILING TYPE TO DETERMINE NEED FOR FLUSH OR SURFACE MOUNT INSTALLATION OF EQUIPMENT SPECIFIED.
2. INSTALLER TO COORDINATE CONNECTION BETWEEN ATX STATION CONTROLLER'S LINE-LEVEL AUDIO OUTPUT AND (EXISTING) OWNER-FURBISHED HOUSE AUDIO SYSTEM (AMP). (IF APPLICABLE)
3. INSTALLER TO PROVIDE CAT5 & 18/4 CABLES FROM ATX CONTROLLER TO CUSTOMER'S STATION RADIO NETWORK.
4. INSTALLER TO PROVIDE CAT5 CABLE FROM ATX CONTROLLER WAN OUTPUT TO CUSTOMER'S IN-STATION NETWORK.
5. INSTALLER TO COORDINATE CONNECTION BETWEEN EXISTING STATION LIGHTING CONTROL SYSTEM AND RELAY OUTPUT FROM ATX STATION CONTROLLER OR I/O REMOTE WITH OWNER. (IF APPLICABLE)
6. VOLUME CONTROL TO BE PROVIDED BY OWNER OR INSTALLER (IF SHOWN ON DRAWING)
7. INSTALLER TO VERIFY AND CONSIDER LOCATION(S) OF NETWORK AND RADIO CONNECTIONS.

PoE = G2 ATX Power-over-Ethernet (PoE) ports 1...8 and G2 Expansion Module ports 1...12
A:n = G2 ATX Amplifier 1...4 | EA:n = G2 External Amplifier 1...n | CH:n = G2 Message Remote 2 Channel 1 or 2

NOTES:
1. SEE ARCHITECTURAL SPECIFICATIONS FOR ALL ROUGH-IN AND INSTALLATION DETAILS.
2. US DIGITAL DESIGNS DOES NOT SUPPLY BACK BOXES, CONDUITS, OR MOUNTING FASTENERS.
3. US DIGITAL DESIGNS FIRE STATION ALERTING PLANS ARE DIAGRAMMATIC AND FOR QUOTING PURPOSES ONLY. DRAWING MAY NOT BE TO SCALE.
4. PHOENIX G2 SYSTEM IS ABLE TO SIGNAL OWNER-FURBISHED SYSTEMS, (EX)HAUST, LIGHT, GAS SHUT OFF, ETC.) BUT USDD DOES NOT SUPPLY THESE SYSTEMS AND CANNOT WARRANT OR SUPPORT ANY OF THEIR PERFORMANCE BEYOND THE TRANSMISSION OF RELAY SIGNAL TO THEM.

SIGNATURE REQUIRED
END-USER APPROVES STATION DESIGN FOR PURPOSES OF OBTAINING QUOTE.
NOTE: ALL STATION DESIGN ALIGNS WITH SITE CONDITIONS, (DOOR MOUNTING TYPE, ATX LOCATION ETC.)

project	BRENHAM FIRE DEPARTMENT, TX
building	FIRE STATION 2 MEZZANINE LEVEL
address	BRENHAM, TX
filename	USDD_TX_BNHM_FS02_FSA.DWG
date	8/21/2024 - 8:40AM
design by	DMG / DWK



1 ONE-LINE DIAGRAM
NOT TO SCALE

E23014

ONE-LINE DIAGRAM GENERAL NOTES:

A. MANUFACTURER OF ELECTRICAL GEAR SHALL PROVIDE A COORDINATION STUDY FOR THE ENTIRE ELECTRICAL SYSTEM IN ORDER TO SET BREAKERS. REFER TO SPECIFICATIONS. MANUFACTURER SHALL ALSO PROVIDE A FAULT CIRCUIT STUDY FOR THE ENTIRE ELECTRICAL SYSTEM IN ORDER TO SELECT INTERRUPTING RATINGS OF ALL CIRCUIT BREAKERS, DISTRIBUTION PANELBOARDS, PANELBOARDS, ETC. A FULLY RATED SYSTEM SHALL BE USED.

B. METERING EQUIPMENT ENCLOSURE PROVIDED BY POWER CO., INSTALLED BY ELECTRICAL CONTRACTOR PER POWER COMPANY SPECIFICATIONS. METERS INSTALLED BY POWER COMPANY.

C. ALL CONDUCTORS SHALL BE COPPER.

D. CONTRACTOR SHALL INSTALL FEEDERS BASED ON THE OVERCURRENT DEVICE RATING UNLESS OTHERWISE NOTED. CONTRACTOR SHALL REFER TO THE FEEDER SCHEDULE TO OBTAIN AND INSTALL THE FEEDERS REQUIRED.

E. SERVICE EQUIPMENT IN OTHER THAN DWELLING UNITS SHALL BE LEGIBLY MARKED IN THE FIELD WITH THE MAXIMUM AVAILABLE FAULT CURRENT AT THE TIME OF INSTALLATION AND CALCULATION. THE LABEL SHALL BE 2" X 3" IN SIZE AND SHALL BE BLUE LETTERING ON A CONTRASTING BACKGROUND. THIS LABEL SHALL ALSO INCLUDE THE DATE OF THE CALCULATION.

F. PRIOR TO INSTALLATION OF UNDERGROUND FEEDERS, THE ELECTRICAL CONTRACTOR SHALL SUBMIT AN UNDERGROUND ROUTING PLAN TO THE ENGINEER OF RECORD., INDICATING THE EXACT ROUTING PATH FOR ALL UNDERGROUND CONDUIT. INDICATE STUB-UP LOCATIONS, SIZE AND QUANTITY OF CONDUIT. ALL ELECTRICAL PANELS AND EQUIPMENT SHALL BE SHOWN ON THIS PLAN FOR REFERENCE OF CONDUIT TERMINATION.

G. DIVISION 26 INSTALLER SHALL COORDINATE NEW ELECTRICAL SERVICE WITH UTILITY COMPANY. PROVIDE CONDUIT, TRANSFORMER PAD, AND TAP BOX, WHERE REQUIRED. ALL NEW UTILITY WORK SHALL BE IN ACCORDANCE WITH LOCAL UTILITY SPECIFICATIONS.

FEEDER SCHEDULE

COPPER

RATING	SETS	CONDUCTOR SIZE	CONDUIT
30A	1	4#10, 1#10 G.	3/4"
40A	1	4#8, 1#10 G.	1"
50A	1	4#8, 1#10 G.	1"
60A	1	4#6, 1#10 G.	1"
70A	1	4#4, 1#8 G.	1 1/4"
80A	1	4#4, 1#8 G.	1 1/4"
90A	1	4#3, 1#8 G.	1 1/4"
100A	1	4#3, 1#8 G.	1 1/4"
125A	1	4#1, 1#6 G.	1 1/2"
150A	1	4#1/0, 1#6 G.	1 1/2"
175A	1	4#2/0, 1#6 G.	2"
200A	1	4#3/0, 1#6 G.	2"
225A	1	4#4/0, 1#4 G.	2 1/2"
250A	1	4#250, 1#4 G.	2 1/2"
300A	1	4#350, 1#4 G.	3"
350A	1	4#500, 1#3 G.	3 1/2"
400A	1	4#600, 1#3 G.	4"
450A	2	4#4/0, 1#2 G.	2 1/2"
500A	2	4#250, 1#2G.	2 1/2"
600A	2	4#350, 1#1G.	3"
700A	2	4#500, 1#1/0G.	4"
800A	2	4#600, 1#1/0G.	4"
1000A	3	4#500, 1#2/0G.	4"
1200A	4	4#350, 1#3/0G.	3"
1600A	4	4#600, 1#4/0G.	4"
	5	4#500, 1#4/0G.	4"
2000A	5	4#600, 1#250G.	4"
	6	4#500, 1#250G.	4"
2500A	6	4#600, 1#350G.	4"
	7	4#500, 1#350G.	4"
3000A	8	4#500, 1#400G.	4"
3500A	9	4#600, 1#500G.	4"
	10	4#500, 1#500G.	4"
4000A	10	4#600, 1#500G.	4"
	11	4#500, 1#500G.	4"
5000A	12	4#600, 1#750G.	4"
	14	4#500, 1#750G.	4"

1. ELECTRICAL CONTRACTOR SHALL PROVIDE THE NUMBER OF LUGS AND PROPER LUG SIZES TO ACCEPT CONDUCTOR SIZES SHOWN.
2. GROUND NOT REQUIRED AT SERVICE LATERAL.

SURGE PROTECTION DEVICE (SPD) SCHEDULE

MARK	MANUFACTURER	MODEL	VOLTAGE	PHASE	SURGE RATING PER MODE	BREAKER SIZE	ACCUGUIDE CABLE SIZE
SPD2	SOUTHERN TIER TECHNOLOGIES	T45120Y100AWAJ2S	208/120V	3	100/200kA	30A/3P	5 #10, 3/4" C.
SPD5	SOUTHERN TIER TECHNOLOGIES	T45120Y125ALAM1C	208/120V	3	125/250kA	60A/3P	5 #6, 1 1/2" C.

*ALL T45 SERIES SPD ENCLOSURES INSTALLED IN FOOD SERVICE AREAS (IE. KITCHENS, SNACK BARS, FOOD LABS, CULINARY ARTS ROOMS AND LIFE SKILLS ROOMS) SHALL BE RECESSED IN THE WALL. PROVIDE RECESSED WALL KIT #RKSS.

LIGHTING CONTROL RELAY PANEL 'LCP-1'

CIRCUIT	RELAY	LOAD
LB-51	20A/1P	BUNKER RM. LIGHTING
LB-53	20A/1P	APPARATUS BAY LIGHTING
LB-55	20A/1P	APPARATUS BAY LIGHTING
LB-57	20A/1P	CORRIDOR/LOBBY LIGHTING
LB-59	20A/1P	OFFICES/SLEEPING RMS. LIGHTING
LB-61	20A/1P	DAYROOM/SLEEPING RMS. LIGHTING
LB-26	20A/1P	DAYROOM/SLEEPING RMS. LIGHTING

LIGHTING CONTROL RELAY PANEL 'LCP-2'

CIRCUIT	RELAY	LOAD
LC-37	20A/1P	MEZZANINE LIGHTING
LC-39	20A/1P	SITE LIGHTING
LC-41	20A/1P	SITE LIGHTING
LC-43	20A/1P	SITE LIGHTING
LC-45	20A/1P	EXTERIOR LIGHTING
LC-47	20A/1P	EXTERIOR WALL PACKS
LC-44	20A/1P	SOFFIT MOUNTED RECEPTACLES
LC-46	20A/1P	SOFFIT MOUNTED RECEPTACLES

LOAD ANALYSIS - BRENHAM FIRE STATION #2

208 / 120 , 3 -PHASE, 4 -WIRE

Date: 8/12/2024

DESCRIPTION					NEC	KVA
LIGHTING:						
INTERIOR =	5,384 VA	X 125%			210.20(a)	6.7
EXTERIOR =	1,650 VA	X 125%			210.20(a)	2.1
POWER:						
RECEPTACLES =	11,000 S.F. X	1 VA/SF		11000 VA	220.44	
First	10,000 V.A.	X	100%	10000 VA	220.44	10.0
Remaining	1000 V.A.	X	50%	500 VA	220.44	0.5
		QUANTITY				
MISCELLANEOUS = DOORS	1,000	5				5.0
MISCELLANEOUS	41,373 VA					41.4
KITCHEN =	15,400 VA	10010.0			220.56	10.0
HVAC:						
COOLING/HTG./FANS =	80,899 VA	Largest of htg. and cooling plus fans				80.9
PLUMBING:						
WATER HEATER =	1,200 VA					1.2
DRINKING FOUNTAIN =	480 VA					0.5
CIRCULATING PUMP =	500 VA					0.5
AIR COMPRESSOR =	9,108 VA					9.1
					TOTAL =	167.9
SQUARE FOOTAGE = 11,000					TOTAL AMPS:	465.9
					SERVICE SIZE:	600.0
					SPARE AMPACITY:	134.1

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005

SW	JG	JB	AR	-

TN PN

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE
1	City Comments	10-24-2024

E4.1

ELECTRICAL ONE-LINE DIAGRAM

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURER	MODEL	MOUNTING	LAMPS	VOLTAGE	WATTAGE	DESCRIPTION
A1	DAYBRIGHT	2FGX-G-48L-835-4-XX-UNV-DIM	RECESSED	LED	120 V	36 VA	2'X4' RECESSED TROFFER, DIRECT/INDIRECT, 4800 LUMENS, 3500K, FOR GRID CEILINGS
A1E	DAYBRIGHT	2FGX-G-48L-835-4-XX-UNV-DIM-BSL10-LST	RECESSED	LED	120 V	36 VA	SAME AS TYPE A1 WITH EMERGENCY BATTERY PACK
A2	DAYBRIGHT	2FGXG-38B-835-2-XX-UNV-DIM	RECESSED	LED	120 V	32 VA	2'X2' RECESSED TROFFER, DIRECT/INDIRECT, 3800 LUMENS, 3500K, FOR GRID CEILINGS
A2E	DAYBRIGHT	2FGXG-38B-835-2-XX-UNV-DIM-BSL10-LST	RECESSED	LED	120 V	32 VA	SAME AS TYPE A2 WITH EMERGENCY BATTERY PACK
A3	DAYBRIGHT	2FGXG-38B-835-2-XX-UNV-DIM-FMA22	RECESSED	LED	120 V	32 VA	2'X2' RECESSED TROFFER, DIRECT/INDIRECT, 3800 LUMENS, 3500K, FOR GYP CEILINGS
B1	LIGHTOLIER	C4-P-DL-25-935-W-Z10-D20-U-XX-W	SUSPENDED	LED	120 V	18 VA	4" ROUND CYLINDER, WHITE, KITCHEN, 2500 LUMEN, 3500K
B1E	LIGHTOLIER	C4-P-DL-25-935-W-Z10-D20-U-XX-W	SUSPENDED	LED	120 V	18 VA	SAME AS TYPE 'B1' WITH EMERGENCY BATTERY PACK
B2	LIGHTOLIER	C4-P-DL-25-935-W-Z10-D20-U-XX-B	SUSPENDED	LED	120 V	18 VA	4" ROUND CYLINDER, BLACK, DAYROOM, 2500 LUMEN, 3500K
B3	ASTRO	13610-XX	PENDANT	LED	120 V	72 VA	18" ROUND PENDANT FIXTURE
CF	VISUAL COMFORT AND LIGHT	3JVR44RZW	SURFACE	-	120 V	46 VA	CEILING FAN, NO LIGHT KIT.
D1	LIGHTOLIER	P4S-DL-20-935-W-CC-Z10-U	RECESSED	LED	120 V	20 VA	4" SQUARE DOWNLIGHT, 2000 LUMEN, 3500K
D1E	LIGHTOLIER	P4S-DL-20-935-W-CC-Z10-U-EM6	RECESSED	LED	120 V	20 VA	SAME AS TYPE D1 WITH EMERGENCY BATTERY PACK
D2	LIGHTOLIER	C2SDL06935FLUPZU-HCL-C2SDLWT	RECESSED	LED	120 V	9 VA	2" SQUARE DOWNLIGHT
D3	VISUAL COMFORT AND LIGHT	E4S-F-LO-835-60-D-N-277-E4S-L-B-H-W	RECESSED	LED	120 V	17 VA	4" SQUARE SHOWER LIGHT, 1600 LUMEN, 3500K
D4	LIGHTOLIER	P4S-DL-15-940-W-CC-Z10-U	SURFACE	LED	120 V	26 VA	4" SQUARE DOWNLIGHT
D4E	LIGHTOLIER	P4S-DL-15-940-W-CC-Z10-U	SURFACE	LED	120 V	26 VA	SAME AS TYPE D4 WITH EMERGENCY BATTERY PACK
F	DAYBRIGHT	FLP-4-40-835-R-UNV-DIM-FLP-WG4	SURFACE OR CHAIN HUNG	LED	120 V	27 VA	4' INDUSTRIAL SURFACE MOUNT, 4000 LUMEN, 3500K, WITH WIRE GUARD
F1	DAYBRIGHT	FLP-8-80-835-R-UNV-DIM-HNH5-VHOOK-FLP-WG4(2)	SURFACE OR CHAIN HUNG	LED	120 V	54 VA	8' INDUSTRIAL CHAIN HUNG, 8000 LUMEN, 3500K, WITH WIRE GUARD AND CHAIN HANGER SET
F1E	DAYBRIGHT	FLP-8-80-835-R-UNV-DIM-HNH5-VHOOK-FLP-WG4(2)-BSL10-LST	SURFACE OR CHAIN HUNG	LED	120 V	54 VA	SAME AS TYPE 'F1' WITH EMERGENCY BATTERY PACK
FE	DAYBRIGHT	FLP-4-40-835-R-UNV-DIM-FLP-WG4-BSL10-LST	SURFACE OR CHAIN HUNG	LED	120 V	27 VA	SAME AS TYPE 'F' WITH EMERGENCY BATTERY PACK
FP	KIRLIN	LWR-09490-6500L-277-41K-POLE DIAMETER-FINISH	SURFACE	LED	120 V	74 VA	POLE MOUNTED FLAG POLE LIGHT
HB	DAYBRIGHT	FBZ-12L-840-UNV	SUSPENDED	LED	120 V	73 VA	SUSPENDED HIGH BAY FIXTURE
HBE	DAYBRIGHT	FBZ-12L-840-UNV-BSL20B2	SUSPENDED	LED	120 V	73 VA	SAME AS TYPE 'HB' WITH EMERGENCY BATTERY PACK
J	SPI LIGHTING	SIP12125-L38W-120-277V-3500K-DF_80-DF_DIM1-NODL-DF_MA01-CAC-FINISH	PENDANT	LED	120 V	38 VA	DECORATIVE ILLUMINATED CYLINDER PENDANTS FOR LOBBY, 4203 LUMENS, 3500K, REMOTE DRIVER, ARCHITECT TO SPECIFY FINISH
JE	SPI LIGHTING	SIP12125-L38W-120-277V-3500K-DF_80-DF_DIM1-NODL-DF_MA01-CAC-FINISH	PENDANT	LED	120 V	38 VA	SAME AS TYPE 'J' WITH EMERGENCY BATTERY PACK
L5	LEDALITE	49-0-8-L-935-15-Q-S-N-5.5-D-E-1-N-NN-C-S-4-S-4	RECESSED	LED	120 V	18 VA	5' RECESSED PERIMETER FIXTURE, 3500K, 375 LUMENS/FT, GYP CEILING INTERFACE
L10	LEDALITE	49-0-8-L-935-15-Q-S-N-10-D-E-1-N-NN-C-S-4-S-1	RECESSED	LED	120 V	35 VA	10' RECESSED PERIMETER FIXTURE, 3500K, 375 LUMENS/FT, GRID CEILING INTERFACE
L10E	LEDALITE	49-0-8-L-935-15-Q-S-N-10-D-E-1-B-NN-C-S-4-S-1	RECESSED	LED	120 V	35 VA	10' RECESSED PERIMETER FIXTURE, 3500K, 375 LUMENS/FT, GRID CEILING INTERFACE WITH EMERGENCY BATTERY PACK
LS	HK LIGHTING	ZXL20-IR1-S-A-FINISH-UNIV-21W-40-W-SOL-MHJB-12-BRZ		LED	120 V	21 VA	EXTERIOR LANDSCAPE LIGHTING
MB	ARC	S-KL2314US-16S	BOLLARD	LED	120 V	19 VA	18" TALL BOLLARD FIXTURE
N1	PINNACLE	MW-HE-840-LENGTH-WH18-U-FSD-1-0-FINISH	SURFACE, WALL	LED	120 V	46 VA	WALL MOUNTED EXTERIOR SIGN LIGHTER
P2	ASTRO	12240-XX	SUSPENDED	LED	120 V	42 VA	PENDANT FIXTURE FOR KITCHEN ISLAND, ARCHITECT TO SPECIFY FINISH, DISTRIBUTOR TO PROVIDE LED LAMP IN 3500K, 72W INCANDESCENT EQUIVELANT
S1	GARDCO	OPF-M-A11-740-T4W-AR1-UNV-FINISH	POLE	LED	120 V	131 VA	POLE MOUNTED AREA LIGHT. PROVIDE WITH 25' SQUARE, STRAIGHT, STEEL POLE AND CONCRETE FOUNDATION. SEE DETAIL.
SL	ASTRO	1212006-6008040	RECESSED, WALL	LED	120 V	2 VA	RECESSED, WALL MOUNTED STEP LIGHT MOUNTED AT 12"A.F.F. PROVIDE WITH LV DRIVER
UC10	DAYBRIGHT	LINCS100E-L28-935-UNV-FINISH-DIM-RSHL	SURFACE	LED	120 V	7 VA	10" UNDERCABINET LIGHT
UC28	DAYBRIGHT	LINCS100E-L28-935-UNV-FINISH-DIM-RSHL	SURFACE	LED	120 V	7 VA	28" UNDERCABINET LIGHT
W1	GARDCO	GBS-A03-740-T4M-UNV-FINISH	SURFACE	LED	120 V	25 VA	EXTERIOR WALL PACK
W3	ZANIBONI	W2L3DLS-26-40-A-6-C-BK-Z0-W	SURFACE	LED	120 V	26 VA	EXTERIOR WALL SCONCE
WS3	VISUAL COMFORT AND LIGHT	700BCBND-24-FINISH-LED930	SURFACE	LED	120 V	21 VA	24" WALL SCONCE MOUNTED VERTICALLY ON EITHER SIDE OF MIRROR
X1	EMERGI-LITE	LXN-1-N-R-M-UA-C	UNIVERSAL	LED	120 V	5 VA	SINGLE FACE EXIT LIGHT
X2	EMERGI-LITE	LXN-2-N-R-M-UA-C	UNIVERSAL	LED	120 V	5 VA	DUAL FACE EXIT LIGHT
Y1	COLOR KINETICS	523-000115-04-120-000185-07	GROUND KNUCKLE MOUNT	LED	120 V	46 VA	GROUND MOUNTED SIGN LIGHTER

NOTES:
1. LIGHTING FIXTURE CATALOG NUMBERS AND DESCRIPTIONS ARE SCHEDULED FOR ESTABLISHING QUALITY, APPEARANCE AND PERFORMANCE OF THE FIXTURES AS REQUIRED BY THE DESIGN. EXACT CATALOG NUMBERS DESCRIBING MOUNTING CONDITIONS, FINISHES AND REQUIREMENTS RELATED TO TRIMS AND LENS FOR ALL FIXTURES SHALL BE CONFIRMED (BY THE CONTRACTOR) WITH THE ROOM FINISH SCHEDULE AND REFLECTED CEILING PLANS, INCLUDING GRID TYPES, ON THE ARCHITECTURAL DRAWINGS PRIOR TO BIDDING. FIXTURES SHALL BE SUBMITTED ACCORDING TO THE CONDITIONS INDICATED ON THE ARCHITECTURAL PLANS. REFER TO THE WRITTEN SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.
2. THE NEW LIGHT FIXTURES SCHEDULED ARE THE BASIS OF DESIGN. IT IS NOT INTENDED TO LIMIT COMPETITION FROM EQUAL MANUFACTURERS. ALL BIDDERS SHALL SUBMIT THEIR PROPOSED LIGHT FIXTURES IN SUBMITTAL FORM A MINIMUM OF 10 BUSINESS DAYS PRIOR TO BID DATE FOR REVIEW. APPROVED LIGHT FIXTURES WILL BE ISSUED IN AN ADDENDUM.

2018 IECC STANDARD SEQUENCE OF OPERATIONS

ROOM TYPE	OCCUPANCY SENSOR: AUTO ON	OCCUPANCY SENSOR: MANUAL ON (VACANCY)	OCCUPANCY SENSOR: AUTO OFF (20MIN MAX)	OCCUPANCY SENSOR: PARTIAL OFF AT NORMAL HOURS	OCCUPANCY SENSOR: AUTO OFF AFTER HOURS (30MIN MAX)	TIME SWITCH: TIME ON	TIME SWITCH: TIME OFF	TIME SWITCH: ASTRONOMIC OR PHOTOCELL ON/OFF	DAYLIGHT CTL: AUTO STEP CONTROL WITH OFF	DAYLIGHT CTL: AUTO CONTINUOUS DIM WITH OFF	LT REDUCT: MANUAL BI-LEVEL REDUCTION CONTROL	LT REDUCT: MANUAL CONTINUOUS DIM CONTROL	MANUAL CONTROL: MANUAL ON/OFF SWITCH	MANUAL CONTROL: MANUAL DIMMER SWITCH	MANUAL CONTROL: DISPLAY, ACCENT, TASK CONTROL	SEQUENCE OF OPERATION
Spaces (≤ 300 sq ft)	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
"Enclosed Offices "	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
"Open Plan Office Areas ≤600SqFt zones"	50%		20 MIN							D	•	D	•	D	•	Auto On 50%; Occupancy sensor Auto Off; Manaul control and ≥50% light reduction with two on/off controls. Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Class/Lecture/Training Room	50%		20 MIN							D	•	D	•	D	•	Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Conference/Meeting Room	50%		20 MIN							D	•	D	•	D	•	Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Copy/Print Room	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Restroom	100%		20 MIN										•			Auto On 100%. Occupancy sensor Auto Off; Manual control.
Lunch/Break Rooms/Lounges	50%		20 MIN							D	•	D	•	D	•	Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Corridor	100%		20 MIN							D		D	•	D	•	Auto On 100%. Occupancy sensor Auto Off; Manual control device; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Stairwell	100%		20 MIN							D		D	•	D		Auto On 100%; Occupancy sensor Auto Off; Manual control; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Storage Room	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Cafeteria / Gym		•					11PM			D	•	D	•	D		Manual On; Time Off with closing hours. After hours 2 hour override from manual control device; Where ≥150W in daylight area, continuous dimming daylighting control with dimmer switch.
Multipurpose Rooms	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Locker Room	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off controls; Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
Lab	50%		20 MIN							D	•	D	•	D		Auto On 50%; Occupancy sensor Auto Off; Manual control and ≥50% light reduction with two on/off switches. Where ≥150W in daylight area, use continuous dimming daylighting control and dimmer switch.
"Warehouse Aisle (Racks)"	50%			50% 20 MIN	20 MIN	OPEN	CLOSE			D	•	D	•			Time On 50%; Occupancy sensor Partial Off ≥50%; Manual control device; After hour occupancy sensor Auto On/Off; Where ≥150W in daylight area, continuous dimming daylighting control.
"Warehouse Open Area"				50% 20 MIN	20 MIN	OPEN	CLOSE			D	•	D	•	•		Time On 50%; Occupancy sensor Partial Off ≥50%; Local control device; After hour occupancy sensor Auto On/Off; Where ≥150W in daylight area, continuous dimming daylighting control.
Restaurant / Dining							CLOSE			D		D				Manual On; Time Off with closing hours. After hours 2 hour override from manual control device; Where ≥150W in daylight area, continuous dimming daylighting control with dimmer switch.
Building Façade / Landscape (Decorative)						CLOSE	OPEN	•								Dusk Auto On with astro time switch or photocell; Evening Time Auto Off no later than one hour after business close. Morning Time Auto On no earlier than one hour before business open; Dawn Auto Off.
"Exterior / Parking Lots / Site Lighting (Setback)"						6AM	12AM	•								Dusk Auto On with astro time switch or photocell; Reduce at least 30% from midnight or up to one hour after business close. Auto On to full at 6:00AM or up to one hour before business open. Dawn Auto Off.
Parking Garage						OPEN	CLOSE									Time On 100% when open. Time Off when closed.

LIGHTING CONTROLS DEVICE SCHEDULE

TYPE	DESCRIPTION	COMMENTS
S S^{3} S^{4} S^{K}	LINE VOLTAGE SWITCH.	'3' INDICATES THREE WAY SWITCHING. '4' INDICATES FOUR WAY SWITCHING. 'K' INDICATES SWITCH SHALL BE KEYED SWITCH.
S^{MC}	LINE VOLTAGE MOMENTARY CONTACT SWITCH.	
S^{DR}	LINE VOLTAGE DIMMER SWITCH	DIMMER FOR USE IN DWELLING UNIT. COORDINATE DIMMING TYPE WITH FINAL FIXTURE AND LAMP SELECTION TO ENSURE COMPATIBILITY.
$S^{3,D}$	LINE VOLTAGE DIMMER WITH 3-WAY SWITCH.	3-WAY DIMMER FOR USE IN DWELLING UNIT. COORDINATE DIMMING TYPE WITH FINAL FIXTURE AND LAMP SELECTION TO ENSURE COMPATIBILITY.
S^{F}	MULTI-SPEED FAN CONTROLLER WITH LINE VOLTAGE SWITCH.	
S^{T}	LINE VOLTAGE TIMER SWITCH WITH DIGITAL TIMER.	RATED FOR 120/277VAC. PROVIDE WITH AUDIBLE & VISUAL ALERTS. USER PROGRAMMABLE FOR 5MIN-12HR TIME-OUT SETTINGS.
S^{OC1}	LINE VOLTAGE WALL MOUNT DUAL TECHNOLOGY OCCUPANCY SENSOR	SENSOR SHALL BE SET TO VACANCY MODE
S^{OC2}	LINE VOLTAGE WALL MOUNT DUAL TECHNOLOGY OCCUPANCY SENSOR WITH DUAL RELAYS.	SENSOR SHALL BE SET TO VACANCY MODE. ONE RELAY SHALL SERVE LIGHTING IN AREA INDICATED, AND ONE RELAY SHALL SERVE EXHAUST FAN
S^{OCD}	LOW VOLTAGE OC SENSOR SWITCH WITH 0-10V DIMMER	SENSOR SHALL BE SET TO VACANCY MODE
S^{LV} S^{LVK}	LOW VOLTAGE MANUAL CONTROL.	CONNECT TO POWER PACK OR ROOM CONTROLLER IF OCCUPANCY SENSORS ARE INDICATED ON PLAN. PROVIDE MULTI-BUTTON SWITCH AS REQUIRED PER SWITCH LEGS SHOWN ON PLANS. 'K' INDICATES SWITCH SHALL BE KEYED SWITCH.
S^{OR} S^{ORK}	LOW VOLTAGE MANUAL CONTROL.	CONNECT TO RELAY PANEL OR TIME CLOCK FOR TIME OF DAY OVERRIDE AS NOTED ON PLANS. PROVIDE MULTI-BUTTON SWITCH AS NOTED ON PLANS. 'K' INDICATES SWITCH SHALL BE KEYED SWITCH.
S^{D}	LOW VOLTAGE SWITCH WITH 0-10V DIMMER	PROVIDE MULTI-BUTTON SWITCH AS REQUIRED PER SWITCH LEGS SHOWN ON PLANS. PROVIDE POWER PACKS OR ROOM CONTROLLERS AS REQUIRED.
OC1	CEILING MOUNTED DUAL TECH OCCUPANCY SENSOR.	SET TO VACANCY MODE. PROVIDE POWER PACKS AS NEEDED.
OC2	CEILING MOUNTED DUAL TECH OCCUPANCY SENSOR.	SET TO OCCUPANCY MODE. PROVIDE POWER PACKS AS REQUIRED.
OC3	CEILING MOUNTED ULTRASONIC OR MICROPHONIC OCCUPANCY SENSOR.	SET TO OCCUPANCY MODE. PROVIDE POWER PACKS AS REQUIRED.
OC4	CORNER MOUNTED DUAL TECH OCCUPANCY SENSOR.	SET TO VACANCY MODE. PROVIDE POWER PACKS AS REQUIRED.
OC5	WET LOCATION PIR OCCUPANCY SENSOR.	CONNECT GARAGE OCCUPANCY SENSORS TO RELAY PANEL SERVING AREA. PROVIDE POWER PACKS FOR CONTROL WHERE NOT LOCATED IN THE GARAGE.
OC6	CEILING MOUNTED DUAL TECH OCCUPANCY SENSOR FOR HIGH BAY APPLICATION.	SET TO VACANCY MODE. PROVIDE POWER PACKS AS REQUIRED.
PC	DIGITAL PHOTOSENSOR	CONNECT TO ROOM CONTROLLER OR RELAY PANEL AS NOTED ON PLANS.
DS	DAYLIGHT HARVESTING SENSOR	CONNECT TO ROOM CONTROLLER OR INDIVIDUAL LIGHT FIXTURE FOR DAYLIGHT HARVESTING DIMMING CONTROL.

NOTES:
1. WATTSTOPPER IS THE BASIS OF DESIGN.
2. THE LIGHTING CONTROLS SCHEDULED ARE THE BASIS OF DESIGN. IT IS NOT INTENDED TO LIMIT COMPETITION FROM EQUAL MANUFACTURERS. ALL BIDDERS SHALL SUBMIT THEIR PROPOSED LIGHTING CONTROLS IN SUBMITTAL FORM A MINIMUM OF 10 BUSINESS DAYS PRIOR TO BID DATE FOR REVIEW. APPROVED LIGHTING CONTROL SYSTEMS WILL BE ISSUED IN AN ADDENDUM.
3. BASIS OF DESIGN SHALL BE A HARD-WIRED TYPE SYSTEM, UNLESS NOTED OTHERWISE.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET
SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4393 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #:245005

SW	JG	JB	AR	-

DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

E5.1

ELECTRICAL SCHEDULES

Panelboard LA

22000 A AIC Rating
X New
Existing

120/208 Wye Volt, 3 Phase, 4 Wire | 1 Section | Type 1 -Nema Rating | Mains Type: MCB | 600 A MCB -- 800 A BUS (Copper) -- | LUGS: -- -- | Mounting Stye: SURFACE

NOTE	LOAD (VA)	TYPE	DESCRIPTION	WIRE	CB	CKT		CB	WIRE	DESCRIPTION	TYPE	LOAD (VA)	NOTE
						1	2						
	52587 VA	Other; L; R; SP; ...	PANEL 'LB'	4/0	225 A	3	4	225 A	4/0	PANEL 'LC'	L; R; WH; SP; ...	45155 VA	
						5	6						
		Spare; SP; F; C; H				7	8	--	12	Space	--	0 VA	
	80797 VA		PANEL 'LD'	600	400 A	9	10	--	12	Space	--	0 VA	
						11	12	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	13	14	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	15	16	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	17	18	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	19	20						
	0 VA	--	Space	12	--	21	22	60 A	6	SPD5	SP	0 VA	
	0 VA	--	Space	12	--	23	24						

NEC REF:	Load Type	Conn.	Fct.	Diversity	NEC REF:	Load Type	Conn.	Fct.	Diversity
220.44	(R)Receptacle	33720 VA	64.83%	21860 VA	210.20A	(L)Lighting	6846 VA	125.00%	8558 VA
220.56	(K)Kitchen	13400 VA	65.00%	8710 VA		(EL)Ext. Ltg.			
220.60	(C)Cooling	65476 VA	100.00%	65476 VA	620.14	(E)Elevators			
220.60	(H)Heating	18226 VA	100.00%	0 VA		(WH)Wat. Htr.	1200 VA	100.00%	1200 VA
220.60	(F)Fans	15455 VA	100.00%	15455 VA	220.5	(MT)Lrg. Motor			
	(M)Misc.	42018 VA	100.00%	42018 VA		(SP)Sub Pnl.	0 VA	Not Computed	0 VA
					630.11B	(W) Welders			

Total Connected Load: 196765 VA VA = 546 A
Total Load (Diversified): 163701 VA VA = 454 A

Location of Panel: ELECTRICAL 112

Panelboard LB

10000 A AIC Rating
X New
Existing

120/208 Wye Volt, 3 Phase, 4 Wire | 2 Section | Type 1 -Nema Rating | Mains Type: MLO | 0 A -- -- 225 A BUS (Copper) -- | LUGS: SINGLE -- | Mounting Stye: SURFACE

NOTE	LOAD (VA)	TYPE	DESCRIPTION	WIRE	CB	CKT		CB	WIRE	DESCRIPTION	TYPE	LOAD (VA)	NOTE
	180 VA	R	KITCHEN COUNTER	12	20 A	1	2	20 A	12	DAY ROOM MONITORS	R	360 VA	
	1000 VA	K	MICROWAVE	12	20 A	3	4	20 A	12	MOTORIZED DAMPERS	M	300 VA	
	1000 VA	K	MICROWAVE	12	20 A	5	6	20 A	12	CONV. RECEPTS	R	540 VA	
	180 VA	R	KITCHEN COUNTER	12	20 A	7	8	20 A	12	CONV. RECEPTS	R	540 VA	
	180 VA	R	KITCHEN COUNTER	12	20 A	9	10	20 A	12	CONV. RECEPTS	R	720 VA	
	180 VA	R	KITCHEN COUNTER	12	20 A	11	12	20 A	12	ICE MACHINE	K	1000 VA	
	400 VA	M	GAS RANGE/RANGE HOOD	12	20 A	13	14	20 A	12	WASHER	K	1000 VA	3
	1000 VA	K	U.C. APPLIANCE	12	20 A	15	16	30 A	10	DRYER	M	3000 VA	
	1000 VA	K	U.C. APPLIANCE	12	20 A	17	18						
4	540 VA	R	ISLAND RECEPTS	12	20 A	19	20	20 A	12	WASHER	K	1000 VA	3
	1000 VA	K	REFRIGERATOR	12	20 A	21	22	20 A	12	DRYER	M	3000 VA	
	1000 VA	K	REFRIGERATOR	12	20 A	23	24						
	1180 VA	R; K	REFRIGERATOR	12	20 A	25	26	20 A	12	SLEEPING ROOMS LIGHTING	Oth...	485 VA	1
	500 VA	M	BOTTLE FILLER	12	20 A	27	28	20 A	12	SLEEPING ROOMS	R	1080 VA	4
4	720 VA	R	R DAYROOM 104	12	20 A	29	30	20 A	12	SLEEPING ROOMS	R	1080 VA	4
	720 VA	R	EXTERIOR RECEPTS	12	20 A	31	32	20 A	12	SLEEPING ROOMS	R	1080 VA	4
	500 VA	M	M LOBBY 101	12	20 A	33	34	20 A	12	COMM ROOM QUAD	R	360 VA	
	1080 VA	R	LOBBY/CORR./STOR....	12	20 A	35	36	20 A	12	COMM ROOM QUAD	R	360 VA	
	720 VA	R	CORRIDOR RECEPTS	12	20 A	37	38	20 A	12	COMM ROOM QUAD	R	360 VA	
	1080 VA	R	LT. OFFICE	12	20 A	39	40	30 A	10	DATA RACK	R	2400 VA	
	740 VA	R; M	WATCH ROOM 109	12	20 A	41	42	30 A	10	DATA RACK	R	2400 VA	
	720 VA	R	WATCHROOM RECEPTS	12	20 A	43	44	20 A	12	EXTERIOR RECEPTS	R	360 VA	
	360 VA	R	WATCHROOM RECEPTS	12	20 A	45	46	20 A	12	SERVICE AREA RECEPT	R	360 VA	
	400 VA	M	MOTORIZED DAMPERS	12	20 A	47	48	20 A	12	GENERATOR ACCESSORY...	M	1200 VA	
	102 VA	F	EF-1 THRU 5	12	15 A	49	50	20 A	12	GENERATOR ACCESSORY...	M	1200 VA	
1	701 VA	L	EXERCISE/BUNKER LIGHTING	12	20 A	51	52	20 A	12	GENERATOR ACCESSORY...	M	1200 VA	
1	876 VA	L	APPARATUS BAY LIGHTING	12	20 A	53	54	20 A	12	K KITCHEN/DINING 105	K; M	1200 VA	
1	876 VA	L	APPARATUS BAY LIGHTING	12	20 A	55	56	20 A	12	GAS CONTROLLER	M	200 VA	
1	575 VA	L	CORRIDOR/LOBBY LIGHTING	12	20 A	57	58	20 A	12	SITE STORAGE RM RECEPTS	R	360 VA	
1	1100 VA	Oth...	OFFICES/SLEEPING RMS LTG.	12	20 A	59	60	20 A	12	GATE OPERATOR	M	1200 VA	
1	972 VA	L	DAY ROOM/SLEEPING RMS...	12	20 A	61	62	20 A	12	SLEEPING ROOMS	R	1080 VA	4
	180 VA	R	KITCHEN COUNTER	12	20 A	63	64	--	12	Space	--	0 VA	
	1200 VA	K	DISPOSAL	12	20 A	65	66	--	12	Space	--	0 VA	
2	200 VA	M	FACP	12	20 A	67	68	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	69	70	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	71	72	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	73	74	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	75	76	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	77	78	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	79	80						
	0 VA	--	Space	12	--	81	82	30 A	10	SPD2	SP	0 VA	
	0 VA	--	Space	12	--	83	84						

NEC REF:	Load Type	Conn.	Fct.	Diversity	NEC REF:	Load Type	Conn.	Fct.	Diversity
220.44	(R)Receptacle	21000 VA	73.81%	15500 VA	210.20A	(L)Lighting	5161 VA	125.00%	6451 VA
220.56	(K)Kitchen	12400 VA	65.00%	8060 VA		(EL)Ext. Ltg.			
220.60	(C)Cooling			0 VA	620.14	(E)Elevators			
220.60	(H)Heating			0 VA		(WH)Wat. Htr.			
220.60	(F)Fans	102 VA	100.00%	102 VA	220.5	(MT)Lrg. Motor			
	(M)Misc.	13500 VA	100.00%	13500 VA		(SP)Sub Pnl.	0 VA	Not Computed	0 VA
					630.11B	(W) Welders			

Total Connected Load: 52587 VA VA = 146 A
Total Load (Diversified): 44037 VA VA = 122 A

Location of Panel: ELECTRICAL 112

Panelboard LC

10000 A AIC Rating
X New
Existing

120/208 Wye Volt, 3 Phase, 4 Wire | 2 Section | Type 1 -Nema Rating | Mains Type: MLO | 0 A -- -- 225 A BUS (Copper) -- | LUGS: SINGLE -- | Mounting Stye: SURFACE

NOTE	LOAD (VA)	TYPE	DESCRIPTION	WIRE	CB	CKT		CB	WIRE	DESCRIPTION	TYPE	LOAD (VA)	NOTE
	540 VA	R	SHOP SCBA RECEPTS	12	20 A	1	2	20 A	12	EXTERIOR RECEPTS	R	540 VA	
	360 VA	R	BUNKER ROOM RECEPTS	12	20 A	3	4	20 A	12	EXERCISE ROOM DOOR	M	1000 VA	
	540 VA	R	EXERCISE ROOM RECEPTS	12	20 A	5	6	20 A	12	EXERCISE EQUIP	R	180 VA	
	720 VA	R	MEZZANINE RECEPTS	12	20 A	7	8	20 A	12	EXERCISE EQUIP	R	180 VA	
	1200 VA	WH	GAS WATER HEATER	12	20 A	9	10	20 A	12	APPARATUS BAY DOOR	M	1000 VA	
	720 VA	R	MEZZ. STORAGE REC.	12	20 A	11	12	20 A	12	APPARATUS BAY DOOR	M	1000 VA	
	360 VA	R	ROOF RECEPTS	12	20 A	13	14	20 A	12	APPARATUS BAY DOOR	M	1000 VA	
	540 VA	R	APPARATUS BAY RECEPTS	12	20 A	15	16	20 A	12	APPARATUS BAY DOOR	M	1000 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	17	18	20 A	12	APPARATUS BAY DOOR	M	1000 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	19	20	20 A	12	APPARATUS BAY RECEPTS	R	720 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	21	22	20 A	12	APPARATUS BAY RECEPTS	R; M	660 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	23	24	20 A	12	APPARATUS BAY RECEPTS	R	360 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	25	26	20 A	12	EXERCISE ROOM RECEPTS	R	180 VA	
	500 VA	R	APP. BAY DROP CORD	10	30 A	27	28	20 A	12	CIRC PUMP	R	180 VA	
	1000 VA	M	APPARATUS BAY DOOR	12	20 A	29	30	20 A	12	AIR DRYER	M	370 VA	
						31	32						
	8640 VA	M	SCBA COMPRESSOR	10	30 A	33	34	50 A	8	AIR COMPRESSOR	M	9108 VA	
						35	36						
1	297 VA	L	LEVEL 2 LIGHTING	12	20 A	37	38						
1	131 VA	L	SITE LIGHTING	12	20 A	39	40	30 A	10	SPD2	SP	0 VA	
1	393 VA	L	SITE LIGHTING	12	20 A	41	42						
1	131 VA	L	SITE LIGHTING	12	20 A	43	44	20 A	12	SOFFIT RECEPTS	R	720 VA	1
1	301 VA	L	EXTERIOR LIGHTING	12	20 A	45	46	20 A	12	SOFFIT RECEPTS	R	1080 VA	1
1	432 VA	L	EXTERIOR WALL LIGHTS	12	20 A	47	48	20 A	12	EQUIPMENT DRYER	K	1000 VA	
	180 VA	R	IRRIGATION CONTROLLER	12	20 A	49	50	30 A	10	EXTRACTOR	M	3000 VA	
	640 VA	R; M	R SHOP/SCBA 131	12	20 A	51	52						
	180 VA	R	ALERTING SYSTEM	12	20 A	53	54	20 A	12	ALERTING SYSTEM	R	180 VA	
	180 VA	R	ALERTING SYSTEM	12	20 A	55	56	20 A	12	EXERCISE ROOM FAN	F	32 VA	
	180 VA	R	ALERTING SYSTEM	12	20 A	57	58						
	0 VA	--	Space	12	--	59	60	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	61	62	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	63	64	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	65	66	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	67	68	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	69	70	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	71	72	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	73	74	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	75	76	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	77	78	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	79	80	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	81	82	--	12	Space	--	0 VA	
	0 VA	--	Space	12	--	83	84	--	12	Space	--	0 VA	

NEC REF:	Load Type	Conn.	Fct.	Diversity	NEC REF:	Load Type	Conn.	Fct.	Diversity
220.44	(R)Receptacle	12720 VA	89.31%	11360 VA	210.20A	(L)Lighting	1685 VA	125.00%	2106 VA
220.56	(K)Kitchen	1000 VA	100.00%	1000 VA		(EL)Ext. Ltg.			
220.60	(C)Cooling			0 VA	620.14	(E)Elevators			
220.60	(H)Heating			0 VA		(WH)Wat. Htr.	1200 VA	100.00%	1200 VA
220.60	(F)Fans	32 VA	100.00%	32 VA	220.5	(MT)Lrg. Motor			
	(M)Misc.	28518 VA	100.00%	28518 VA		(SP)Sub Pnl.	0 VA	Not Computed	0 VA
					630.11B	(W) Welders			

Total Connected Load: 45155 VA VA = 125 A
Total Load (Diversified): 44216 VA VA = 123 A

Location of Panel: MECHANICAL MEZZANINE 203

Panelboard LD

10000 A AIC Rating
X New
Existing

120/208 Wye Volt, 3 Phase, 4 Wire | 1 Section | Type 1 -Nema Rating | Mains Type: MLO | 0 A -- -- 400 A BUS (Copper) -- | LUGS: SINGLE -- | Mounting Stye: SURFACE

NOTE	LOAD (VA)	TYPE	DESCRIPTION	WIRE	CB	CKT		CB	WIRE	DESCRIPTION	TYPE	LOAD (VA)	NOTE
						1	2						
	9360 VA	C	RTU-1	10	30 A	3	4	30 A	10	FCU-1	H	5720 VA	
						5	6						
	14040 VA	C	RTU-2	8	40 A	7	8	20 A	12	ACCU-1	C	5076 VA	
						9	10						
						11	12	45 A	8	FCU-2	H	9006 VA	
	9360 VA	C	RTU-3	10	30 A	13	14						
						15	16	35 A	8	ACCU-2	C	7128 VA	
						17	18						
	7200 VA	C	RTU-4	10	30 A	19	20						
						21	22	25 A	10	DSCU-1/DS-1	C	3952 VA	
						23	24						
						25	26	20 A	12	GAS UNIT HEATERS	H	200 VA	
	9360 VA	C	RTU-5	10	30 A	27	28						
						29	30	20 A	12	EUH-1	H	3300 VA	
	1656 VA	F	GEF-1	10	25 A	31	32						
	27 VA	F	GEF-2	12	15 A	33	34	15 A	12	HVLS-1	F	32 VA	
	1656 VA	F	GEF-3	10	25 A	35	36						
	146 VA	F	EF-6	12	15 A	37	38	15 A	12	HVLS-2	F	32 VA	
						39	40						
	5400 VA	F	HVLS-3	12	20 A	41	42	20 A	12	KEF-1	F	864 VA	
						43	44						
	0 VA	--	Space	12	--	45	46	20 A	12	MUA-1	F	5508 VA	
	0 VA	--	Space	12	--	47	48						
	0 VA	--	Space	12	--	49	50	20 A	12	Spare	--	0 VA	
	0 VA	--	Space	12	--	51	52	20 A	12	Spare	--	0 VA	
	0 VA	--	Space	12	--	53	54	20 A	12	Spare	--	0 VA	
	0 VA	--	Space	12	--	55	56						
	0 VA	--	Space	12	--	57	58	30 A	10	SPD2	SP	0 VA	
	0 VA	--	Space	12	--	59	60						

NEC REF:	Load Type	Conn.	Fct.	Diversity	NEC REF:	Load Type	Conn.	Fct.	Diversity
220.44	(R)Receptacle				210.20A	(L)Lighting			
220.56	(K)Kitchen					(EL)Ext. Ltg.			
220.60	(C)Cooling	65476 VA	100.00%	65476 VA	620.14	(E)Elevators			
220.60	(H)Heating	18226 VA	100.00%	0 VA		(WH)Wat. Htr.			
220.60	(F)Fans	15321 VA	100.00%	15321 VA	220.5	(MT)Lrg. Motor			
	(M)Misc.					(SP)Sub Pnl.	0 VA	Not Computed	0 VA
					630.11B	(W) Welders			

Total Connected Load: 99023 VA VA = 275 A
Total Load (Diversified): 80797 VA VA = 224 A

Location of Panel: MECHANICAL MEZZANINE 203

PANEL SCHEDULE NOTES:

1. ROUTE CIRCUIT THROUGH LIGHTING CONTROL RELAY PANEL LCP-1
2. PROVIDE RED HANDLE BREAKER.
3. PROVIDE GFCI TYPE BREAKER.
4. PROVIDE ARC-FAULT TYPE BREAKER.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
TBPLS Firm Registration No. 10194697
SW | JCS | JB | AR | -

TN PN

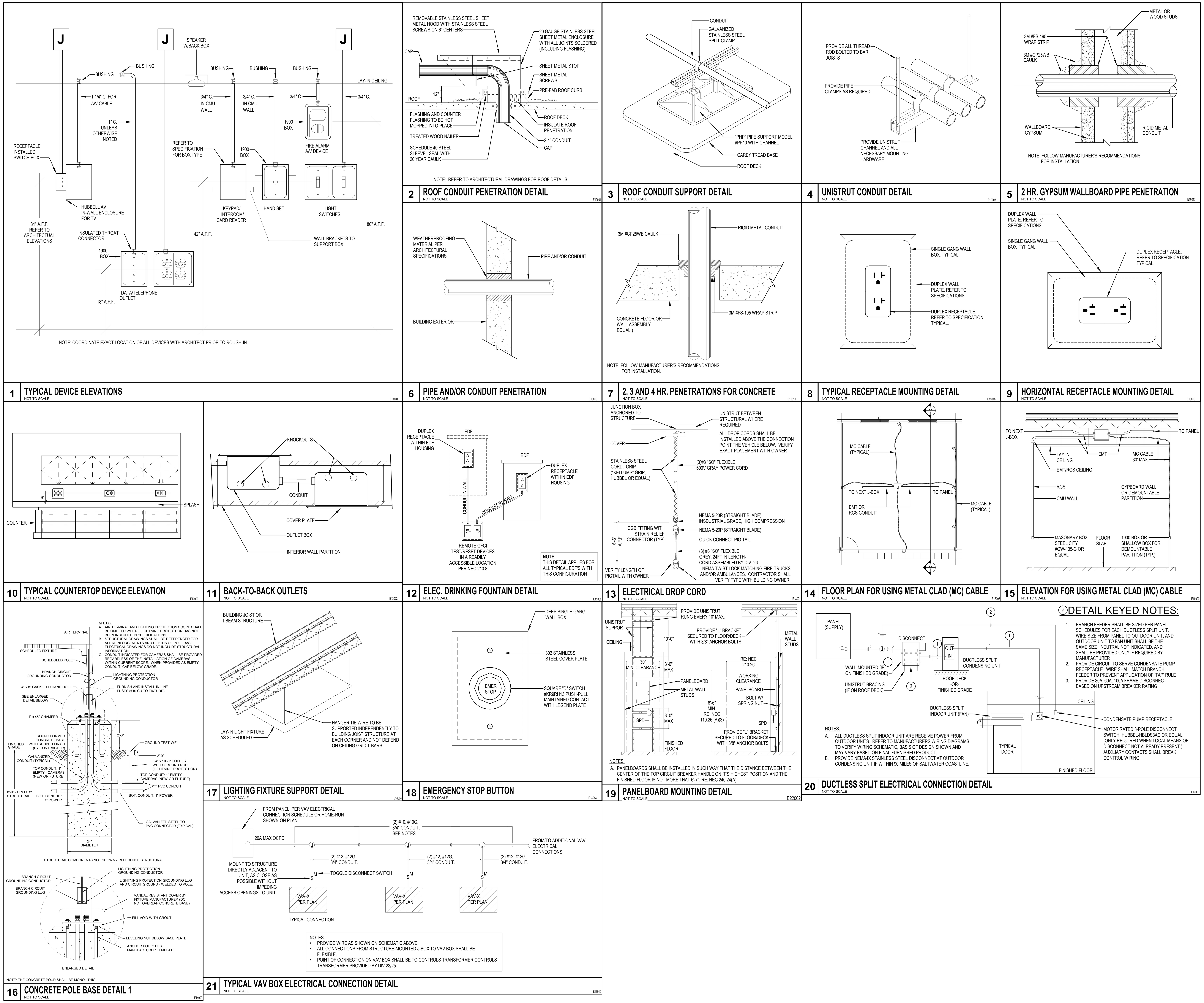
DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

E5.2

ELECTRICAL PANEL SCHEDULES


1 TYPICAL DEVICE ELEVATIONS
NOT TO SCALE
NOTE: COORDINATE EXACT LOCATION OF ALL DEVICES WITH ARCHITECT PRIOR TO ROUGH-IN.
2 ROOF CONDUIT PENETRATION DETAIL
NOT TO SCALE
NOTE: REFER TO ARCHITECTURAL DRAWINGS FOR ROOF DETAILS.
3 ROOF CONDUIT SUPPORT DETAIL
NOT TO SCALE
4 UNISTRUT CONDUIT DETAIL
NOT TO SCALE
5 2 HR. GYPSUM WALLBOARD PIPE PENETRATION
NOT TO SCALE
NOTE: FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION
6 PIPE AND/OR CONDUIT PENETRATION
NOT TO SCALE
7 2, 3 AND 4 HR. PENETRATIONS FOR CONCRETE
NOT TO SCALE
NOTE: FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION.
8 TYPICAL RECEPTACLE MOUNTING DETAIL
NOT TO SCALE
9 HORIZONTAL RECEPTACLE MOUNTING DETAIL
NOT TO SCALE
10 TYPICAL COUNTERTOP DEVICE ELEVATION
NOT TO SCALE
11 BACK-TO-BACK OUTLETS
NOT TO SCALE
12 ELEC. DRINKING FOUNTAIN DETAIL
NOT TO SCALE
NOTE: THIS DETAIL APPLIES FOR ALL TYPICAL EDF'S WITH THIS CONFIGURATION
13 ELECTRICAL DROP CORD
NOT TO SCALE
14 FLOOR PLAN FOR USING METAL CLAD (MC) CABLE
NOT TO SCALE
15 ELEVATION FOR USING METAL CLAD (MC) CABLE
NOT TO SCALE
16 CONCRETE POLE BASE DETAIL 1
NOT TO SCALE
NOTE: THE CONCRETE POUR SHALL BE MONOLITHIC.
17 LIGHTING FIXTURE SUPPORT DETAIL
NOT TO SCALE
18 EMERGENCY STOP BUTTON
NOT TO SCALE
19 PANELBOARD MOUNTING DETAIL
NOT TO SCALE
NOTES:
A. PANELBOARDS SHALL BE INSTALLED IN SUCH WAY THAT THE DISTANCE BETWEEN THE CENTER OF THE TOP CIRCUIT BREAKER HANDLE ON IT'S HIGHEST POSITION AND THE FINISHED FLOOR IS NOT MORE THAT 6'-7". RE: NEC 240.24(A).
20 DUCTLESS SPLIT ELECTRICAL CONNECTION DETAIL
NOT TO SCALE
DETAIL KEYED NOTES:
1. BRANCH FEEDER SHALL BE SIZED PER PANEL SCHEDULES FOR EACH DUCTLESS SPLIT UNIT. WIRE SIZE FROM PANEL TO OUTDOOR UNIT, AND OUTDOOR UNIT TO FAN UNIT SHALL BE THE SAME SIZE. NEUTRAL NOT INDICATED, AND SHALL BE PROVIDED ONLY IF REQUIRED BY MANUFACTURER.
2. PROVIDE CIRCUIT TO SERVE CONDENSATE PUMP RECEPTACLE. WIRE SHALL MATCH BRANCH FEEDER TO PREVENT APPLICATION OF "TAP RULE"
3. PROVIDE 30A, 60A, 100A FRAME DISCONNECT BASED ON UPSTREAM BREAKER RATING
NOTES:
A. ALL DUCTLESS SPLIT INDOOR UNIT ARE RECEIVE POWER FROM OUTDOOR UNITS. REFER TO MANUFACTURERS WIRING DIAGRAMS TO VERIFY WIRING SCHEMATIC, BASIS OF DESIGN SHOWN AND MAY VARY BASED ON FINAL FURNISHED PRODUCT.
B. PROVIDE NEMA4X STAINLESS STEEL DISCONNECT AT OUTDOOR CONDENSING UNIT IF WITHIN 90 MILES OF SALTWATER COASTLINE.
21 TYPICAL VAV BOX ELECTRICAL CONNECTION DETAIL
NOT TO SCALE
NOTES:
• PROVIDE WIRE AS SHOWN ON SCHEMATIC ABOVE.
• ALL CONNECTIONS FROM STRUCTURE-MOUNTED J-BOX TO VAV BOX SHALL BE FLEXIBLE.
• POINT OF CONNECTION ON VAV BOX SHALL BE TO CONTROLS TRANSFORMER CONTROLS TRANSFORMER PROVIDED BY DIV 23/25.

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED
PROFESSIONAL ENGINEER
10/24/2024

BRW ARCHITECTS
3535 TRAVIS STREET SUITE 250
DALLAS, TEXAS 75204
214-528-8704
BRWARCH.COM

DBR
512.637.4300 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project # 2443000
SW | JG | JB | AR

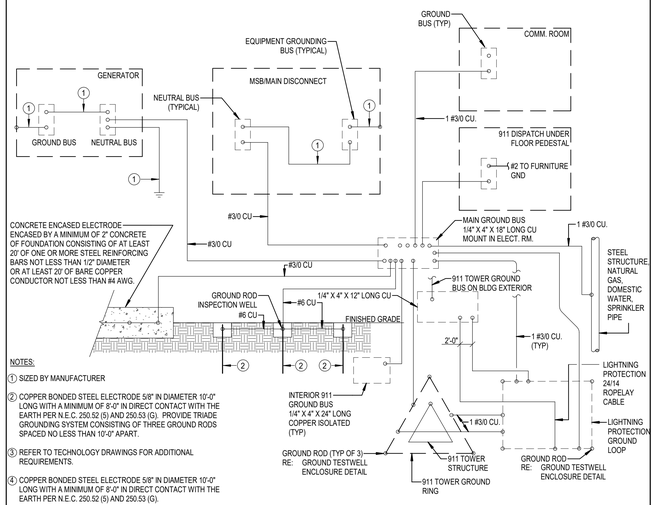
DATE	10/24/2024
DRAWN BY	DBR
CHECKED BY	DBR
BRW PROJECT NUMBER	223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

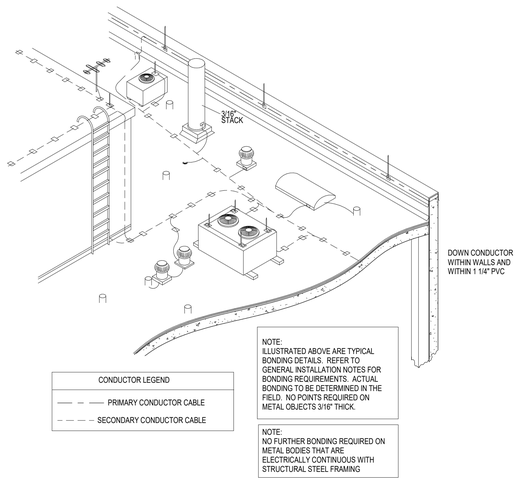
NO.	REVISION	DATE

E6.1

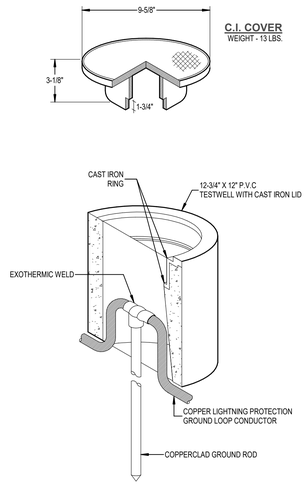
ELECTRICAL DETAILS



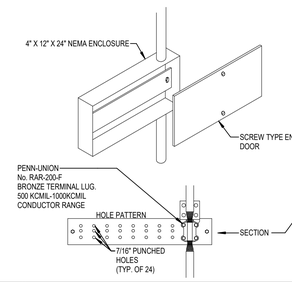
1 GROUNDING SYSTEM AND BONDING DETAIL
NOT TO SCALE 17001



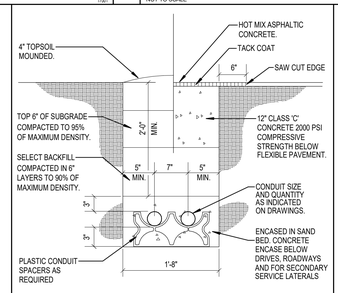
2 TYPICAL LIGHTNING PROTECTION DETAIL
NOT TO SCALE E1500



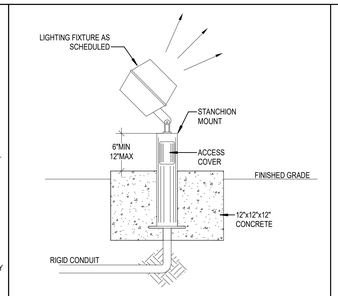
3 GROUND TESTWELL ENCLOSURE
NOT TO SCALE E1605



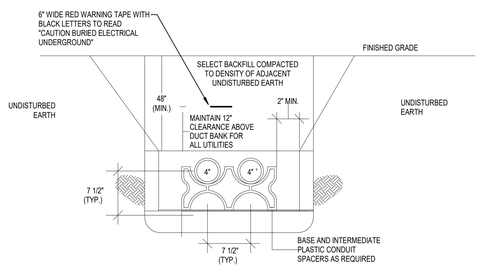
4 TYPICAL GROUNDING BUS DETAIL
NOT TO SCALE 16002



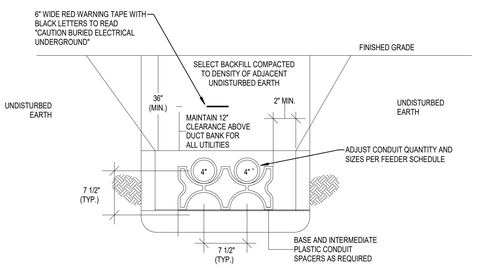
5 CONDUIT BURIAL DETAIL
NOT TO SCALE E1000A



6 GROUND MOUNTED FLOODLIGHT DETAIL
NOT TO SCALE E1402



7 PRIMARY SERVICE TRENCH DETAIL
NOT TO SCALE E2000



8 SECONDARY SERVICE TRENCH DETAIL
NOT TO SCALE E2010

STATE OF TEXAS
EDWARD PUENTES
102338
LICENSED PROFESSIONAL ENGINEER
10/24/2024

BRWARCHITECTS
3535 TRAVIS STREET SUITE 100
DALLAS, TEXAS 75204
214.528.8704
BRWARCH.COM

DBR
512.657.4583 p
https://www.dbrinc.com
TBPE Firm Registration No. 2234
DBR Project #2402

SW | JCS | JB | AR | -

TN PN

DATE 10/24/2024
DRAWN BY DBR
CHECKED BY DBR
BRW PROJECT NUMBER 223102.00

BRENHAM FIRE STATION #2
3007 JAMES NUTT BLVD.
BRENHAM, TX 7783

NO.	REVISION	DATE

E6.2

ELECTRICAL DETAILS

Brenham Fire Station #2
3007 James Nutt Blvd.
Brenham, TX 77833

PROJECT MANUAL

OCTOBER 24, 2024
BRW PROJECT NO. 223102.00

THE CITY OF BRENHAM — **OWNER**
200 W. VULCAN ST.
BRENHAM, TEXAS 77833
(979) 337-7200

BROWN REYNOLDS WATFORD ARCHITECTS, INC. — **ARCHITECT**
175 CENTURY SQUARE DRIVE, SUITE 350
COLLEGE STATION, TEXAS 77840
(979) 694-1791

GESSNER ENGINEERING — **CIVIL / STRUCTURAL ENGINEER**
401 W. 26TH ST.
BRYAN, TEXAS 77803
(979) 680-8840

DBR ENGINEERING CONSULTANTS, INC. — **MECHANICAL / ELECTRICAL / PLUMBING ENGINEER**
2500 S. HIGHWAY 183, SUITE 500
AUSTIN, TEXAS 78744
(512) 637-4393

SECTION 00 00 07 - SEALS PAGE

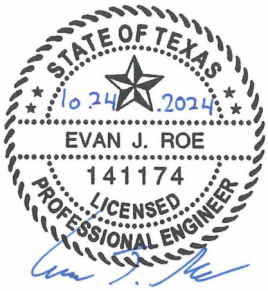
ARCHITECT AND CONSULTANTS' SEALS PAGE

ARCHITECT:
Brown Reynolds Watford Architects, Inc.
Ray Holliday, AIA, Principal
175 Century Square Drive, Suite 350
College Station, Texas 77840
(979) 649-1791

10/24/2024

CIVIL ENGINEER:
Gessner Engineering
Pedro Rico, Jr., P.E.
401 W. 26th St.
Bryan, Texas 77803
(979) 680-8840

STRUCTURAL ENGINEER:
Gessner Engineering
Evan J. Roe, P.E.
401 W. 26th St.
Bryan, Texas 77803
(979) 680-8840



MEP ENGINEER:
DBR Engineering Consultants, Inc.
Mechanical: Edward Puentes, P.E.
Plumbing: Edward Puentes, P.E.
Electrical: Edward Puentes, P.E.
2500 S. Highway 183, Suite 500
Austin, Texas 78744
(512) 637-4393

10/24/2024

SECTION 00 00 10 - TABLE OF CONTENTS

END OF SECTION 00 00 10

SECTION 00 00 15 - LIST OF DRAWINGS

G1.1 TITLE SHEET AND DRAWING INDEX
G1.2 MASTER KEYNOTE LIST
G1.3 CODE COMPLIANCE INFORMATION
G1.4 LIFE SAFETY PLAN

C0.1 BOUNDARY AND TOPOGRAPHIC SURVEY

AS1.1 ARCHITECTURAL SITE PLAN
AS1.2 ARCHITECTURAL SITE DETAILS
AS1.3 ARCHITECTURAL SITE DETAILS

C0.0 CIVIL NOTES
C1.0 CIVIL SITE PLAN
C1.1 CIVIL FIRE SITE PLAN
C2.0 CIVIL DEMOLITION PLAN
C3.0 CIVIL DIMENSION PLAN
C4.0 CIVIL PAVING PLAN
C5.0 CIVIL GRADING PLAN
C6.0 CIVIL PRE DRAINAGE MAP
C6.1 CIVIL POST DRAINAGE MAP
C6.2 CIVIL DRAINAGE CALCULATIONS
C7.0 CIVIL OVERALL UTILITY
C8.0 CIVIL STORM PLAN
C8.1 CIVIL STORM PROFILES
C8.2 CIVIL STORM PROFILES
C9.0 CIVIL SANITARY SEWER PLAN
C9.1 CIVIL SANITARY SEWER PROFILES
C10.0 CIVIL WATER PLAN
C10.1 CIVIL WATER PROFILES
C11.0 CIVIL EROSION PLAN
C11.1 CIVIL EROSION CONTROL NOTES
C11.2 CIVIL EROSION CONTROL DETAILS
C12.0 CIVIL DETAILS
C12.1 CIVIL DETAILS
C12.2 CIVIL DETAILS
C12.3 CIVIL DETAILS

L1.2 LANDSCAPE PLAN
L1.2 ENLARGED LANDSCAPE PLAN
L1.3 LANDSCAPE DETAILS
L1.4 IRRIGATION PLAN
L1.5 IRRIGATION DETAILS

S0.0 NOTES
S0.1 NOTES
S0.2 UPLIFT PLAN
S1.0 DIMENSION CONTROL PLAN

S1.1 FOUNDATION PLAN
S1.2 MEZZANINE & LOW ROOF FRAMING PLAN
S1.3 HIGH ROOF FRAMING PLAN
S2.0 BRACE ELEVATIONS
S3.0 STRUCTURAL WALL SECTIONS
S4.0 BUILDING ELEVATIONS
S5.0 FOUNDATION DETAILS
S5.1 FOUNDATION DETAILS
S5.2 FOUNDATION DETAILS – SLAB ON GRADE
S5.3 BASE PLATE DETAILS
S5.4 TYPICAL STEEL CONNECTION DETAILS
S5.5 TYPICAL FLOOR FRAMING DETAILS
S5.6 TYPICAL ROOF FRAMING DETAILS
S5.7 CMU WALL DETAILS
S5.8 COLD FORMED METAL
S6.0 SCHEDULE

A1.0 PARTITION TYPES
A1.1 FLOOR PLANS
A1.2 DIMENSION FLOOR PLANS
A1.3 ROOF PLAN AND DETAILS
A1.4 ROOF DETAILS
A2.1 EXTERIOR ELEVATIONS
A2.2 BUILDING SECTIONS
A2.3 BUILDING SECTIONS
A3.1 WALL SECTIONS
A3.2 WALL SECTIONS
A3.3 SECTION DETAILS
A4.1 DOOR SCHEDULE AND DOOR TYPES
A4.2 STOREFRONT AND CURTAINWALL TYPES
A5.1 ENLARGED PLANS AND INTERIOR ELEVATIONS
A5.2 INTERIOR ELEVATIONS
A5.3 MILLWORK SECTIONS
A6.1 REFLECTED CEILING PLANS
A7.1 FINISH PLANS
A8.1 SIGNAGE PLANS
A9.1 FURNISHING PLANS (FOR INFORMATION ONLY)

MEP1.1 MEP SITE PLAN
MEP2.2 MEP ROOF PLAN

M0.1 MECHANICAL SYMBOL LEGEND
M2.1 MECHANICAL PLANS
M3.1 KITCHEN HOOD PLAN
M4.1 MECHANICAL CONTROLS
M5.1 MECHANICAL SCHEDULES
M6.1 MECHANICAL DETAILS

P0.1 PLUMBING SYMBOL LEGEND
P2.1 PLUMBING PLANS

P3.1 PLUMBING ENLARGED PLAN
P4.1 PLUMBING RISERS
P5.1 PLUMBING SCHEDULES
P6.1 PLUMBING DETAILS
P6.2 PLUMBING DETAILS

E0.1 ELECTRICAL SYMBOL LEGEND
E4.1 ELECTRICAL ONE-LINE DIAGRAM
E5.1 ELECTRICAL SCHEDULES
E5.2 ELECTRICAL PANEL SCHEDULES
E6.1 ELECTRICAL DETAILS
E6.2 ELECTRICAL DETAILS
EL2.1 ELECTRICAL LIGHTING PLANS
EP2.1 ELECTRICAL POWER PLANS
ES2.1 ALERTING SYSTEM PLANS

END OF SECTION 00 00 15

SECTION 00 30 00 - INFORMATION AVAILABLE TO BIDDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Documents Available:
   1. Site Survey
   2. Geotechnical Investigation Reports

1.03 EXISTING CONDITION INFORMATION

A. This document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

1.04 SITE SURVEY

A. Survey information that includes information on existing conditions, prepared by Hodde & Hodde Land Surveying, Inc., is available for viewing as part of Drawings.

1.05 GEOTECHNICAL INVESTIGATION

A. A Geotechnical Investigation for the project site has been performed by Gessner Engineering, 401 W. 26th St., Bryan, Texas 77803. A copy of Gessner Engineering Report No. 23-0693, dated March 25, 2024, is bound herein.

B. Log of borings indicates materials penetrated at specific locations. Owner and/or Architect assume no responsibility for any conclusions of interpretations made by Contractor related to information included in the Report. Should contractor require additional information concerning subsurface conditions, he may without cost to Owner, make additional investigations. Should additional investigations produce information different from that in Soil Report, promptly notify Owner in writing.

C. Contractor shall read and otherwise become completely familiar with contents of Soil Report, including but not limited to its recommendations for preparation of subsoil, bases, sub-bases and fill and construction of building foundations and parking surfaces in compliance with recommendations in Report. Should discrepancy be found between the requirements of Soil Report and the drawings and/or specifications, notify Owner in writing prior to beginning work.

1.06 EXISTING CONDITIONS

A. Bidders shall visit the site of work, existing buildings, review any available existing drawings, and all conditions affecting the work of this project. Any claims after contract award for difficulties encountered which could have been foreseen by such site review will not be recognized by the Owner.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 00 30 00

Mr. Ray Holliday, AIA, ASLA, LI
Brown Reynolds Watford Architects, Inc.
175 Century Square Drive, Suite 350
College Station, Texas 77840
March 25, 2024

GESSNER
ENGINEERING

GEOTECHNICAL ENGINEERING STUDY

City of Brenham Fire Station No. 2
James Nutt Boulevard
Brenham, Texas
Gessner Engineering Job No. 23-0693

March 25, 2024

Mr. Ray Holliday, AIA, ASLA, LI
Brown Reynolds Watford Architects, Inc.
175 Century Square Drive, Suite 350
College Station, Texas 77840

Re: Geotechnical Engineering Study
City of Brenham Fire Station No. 2
James Nutt Boulevard
Brenham, Texas
Gessner Engineering Job No. 23-0693

Dear Mr. Holliday:

This report conveys our geotechnical engineering study conducted for the proposed City of Brenham Fire Station No. 2 to be located in Brenham, Texas. The following report contains our design recommendations and considerations based on our understanding of the information provided to us. The purpose of this study was to drill borings within the proposed project site, to perform laboratory testing to classify and characterize subsurface conditions, and to prepare an engineering report presenting foundation design and construction recommendations for the proposed fire station, as well as pavement design and construction recommendations. We trust that this report is responsive to your project needs. Please contact us if you have any questions or if we can be of further assistance.

We are happy to be of service to you on this phase of the project and look forward to the opportunity to provide additional services for geotechnical engineering, structural engineering, civil engineering, land surveying, and construction materials testing as the project progresses.

Sincerely,
GESSNER ENGINEERING, LLC F-7451

Katie K. Ward, M.S., E.I.T.

Andrew B. Irvin, P.E.

Copies Submitted:
Mr. Ray Holliday, AIA, ASLA, LI

CONTENTS

Introduction

This report describes the procedures utilized during this study and presents the results of our geotechnical engineering investigation for the proposed City of Brenham Fire Station No. 2. Gessner Engineering was authorized to provide the subsurface investigation and report for this project by Mr. Ray Holliday on January 18, 2024.

Project Description

The project consists of the proposed construction of a fire station at the site located on James Nutt Boulevard in Brenham, Texas, in Washington County. It is understood that the proposed fire station will have a footprint of approximately 10,000 square feet (sf). This project also includes ancillary driveway and parking area pavements.

Engineering recommendations are provided on the basis of existing conditions at the time of drilling and a file containing a site plan entitled, "20240126_Brenham Fire Station No. 2_Site Plan.pdf", provided in an email on January 26, 2024, by Ms. Chloe Mengers with Brown Reynolds Watford Architects, Inc.

Scope of Services

The Texas Section of the American Society of Civil Engineers defines an engineered foundation as one that includes a geotechnical engineering investigation. To act as this first phase of an engineered foundation, our scope of work for this project consisted of:

1. Drilling 5 test borings at the selected locations within the project site to evaluate the subsurface arrangement of strata and groundwater conditions.

2. Performing geotechnical laboratory tests on recovered samples to evaluate the physical and engineering properties of the strata observed.

3. Engineering analysis to develop recommendations with respect to:

    - Site, subgrade, and fill preparation
    - Foundation design and construction
    - Pavement design and construction

SITE INVESTIGATION PROCEDURES

Subsurface conditions at the site were evaluated by drilling 5 borings at the locations shown on the *Project Layout* in the Appendix. These locations are approximate and distances were measured using a hand-held GPS locator. Between February 19 and 20, 2024, the borings for the structure were drilled to a depth of approximately 50 feet below the existing ground surface and the borings for the pavement were drilled to a depth of approximately 10 feet below the existing ground surface using a track-mounted drill rig.

The *Logs of Borings*, presenting the subsurface soil descriptions, type of sampling used, laboratory results, and additional field data, are presented in the Appendix. The *Symbols and Terms*, which defines the terms and descriptive symbols used on the logs, is also provided in the Appendix.

Samples were taken continuously for the first 10 feet in 2 foot increments. Below 10 feet, samples were taken at 5 foot intervals to the termination of the boring.

Samples of soil were obtained by means of a Split-Spoon with Standard Penetration Test (SPT). This test consists of measuring the number of blows required for a free-falling hammer to drive a standard Split-Spoon sampler 12 inches into the subsurface material after being seated 6 inches. The test is terminated after 50 blows regardless of whether 12 inches of penetration has been achieved. If all 50 blows fall within the first 6 inches (seating blows), then refusal (Ref.) for 6 inches or less will be denoted on the *Logs of Borings*. This blow count, or SPT "N" value, is used to evaluate the engineering properties of the stratum. Correlations between the unconfined compressive strength and the "N" value for the in situ soils have been developed to estimate the bearing capacity of the soils.

All samples were removed from samplers in the field, visually classified, and sealed in sample containers to preserve their in situ moisture contents.

Throughout the report, the soils are referred to in terms used to describe their consistency. The term consistency refers to the degree of adhesion between the soil particles and to the resistance offered against forces that tend to deform or rupture the soil aggregate. Consistency of clays and other cohesive soils is usually described as very soft, soft, firm, stiff, very stiff, and hard. Additional consistency terms used on cohesive soils are plastic, lean, and fat. As a soil approaches the characteristics of a clay soil, the greater the variety of states of consistency in which it may be found. The physical properties of a plastic soil change depending upon the moisture content of the soil. The degree of plasticity is sometimes expressed by the terms fat and lean. Lean clay is only slightly plastic; whereas fat clay has a high plasticity.

LABORATORY TESTING

Samples obtained during the field program were visually classified in the laboratory by a geotechnical engineer or their representative. A testing program was conducted on selected samples in accordance with the ASTM Standard Test Procedures, as directed by the geotechnical engineer, to aid in classification and evaluation of engineering properties required for analysis.

The laboratory testing program for this project included sieve analyses, moisture contents, Atterberg limits, and sulfate contents.

Sieve analyses were performed by passing the sample through a series of sieves to classify the soil based on their particle size. This allows a determination of the type of soils, distribution of the particle sizes and the interaction between the particles. Sieves used for this test include a series of screens of various sizes to determine the amount of various particle sizes in a sample.

Moisture content tests were performed in accordance with ASTM D 2216 by placing a sample into an oven with a constant temperature and comparing the mass before oven drying to the mass after oven drying. Changes in the moisture content have an effect on the behavior of plastic soils. Variations in the moisture content from the state observed during investigation to the moisture content from the state observed during construction can result in expansive soil-related movements. If the moisture content of the soil increases after construction, for example, the soil can induce uplift forces on the structure it is supporting.

The structure of clay consists of a random arrangement of flat plates. Edges of the particles are positively charged, and the face is negatively charged. Negative charges on the face of the clays bond with positive water ions in the soil, causing a volumetric change resulting in expansion of the soils. This water may be released with the application of pressure from load, evaporation, or suction from gravity or vegetation. The specific chemical makeup of the various clays causes them to have a stronger or weaker ability to bond with water.

In order to relate moisture content and soil consistency, Atterberg limit tests were performed on the samples in accordance with ASTM D 4318. The Atterberg limit test is comprised of 2 separate tests: plastic limit and liquid limit. The plastic limit test determines the moisture content of the soil in its dry state while the liquid limit test determines the moisture content as the soil nears a liquid state.

The plastic limit is described as the moisture content of the soil where it transitions between brittle and plastic behavior. This point is determined by rolling the samples in threads 1/8 inch (3 mm) in diameter to the point at which they begin to crack and/or crumble.

The liquid limit describes the moisture content of the soil where it transitions between plastic and liquid behavior. In conducting this test, the sample is placed in the Casagrande cup, or liquid limit device. A standard grooving tool is used to create a gap in the center of the sample 0.53 inches (13.5 mm) in width. The cup is then dropped repeatedly onto the hard rubber base at a rate of 120 blows per minute. The liquid limit is the moisture content at which the groove closes at 25 blows.


Liquid Limit Device

The plasticity index (PI) is the difference between the liquid limit and the plastic limit and provides a description of the moisture states a soil can experience. The PI is an indicator of the potential for expansion or contraction of the soil.

When the liquid limit is unattainable as defined in Tex-104-E, the PI may be determined in accordance with Tex-107-E (BLS). The bar linear shrinkage (BLS) test determines shrinkage of soils by placing soil in a sample mold at a moisture content slightly above the liquid limit, oven drying it overnight, and measuring the dry length. The difference between the dry and the wet lengths is representative of the potential linear shrinkage of that soil strata. Linear shrinkage results (in percent) may be multiplied by a factor of 1.6 to determine the PI.

Results of the laboratory tests are presented on the *Logs of Borings* in the Appendix and are discussed in the following sections. Samples will be retained in our laboratory for 30 days after submittal of this report.

SITE CONDITIONS

Site Geology

Major soil formations provide information with regards to the depth and magnitude of the conditions, as well as anticipated features of the soils in this area. This information provides typical data for the area. While it is valid as a general reference, it does not provide data accurate enough to replace site specific engineering analysis.

The site is mapped as being underlain by Fleming Formation as indicated on the Geologic Atlas of Texas, Austin Sheet as published by the University of Texas at Austin. The Fleming Formation is composed of clay and sandstone. The clay is silty, commonly calcareous and forms brownish-black soil. The sandstone is medium to coarse grained, calcareous, thick bedded, cross-bedded, light-yellowish to light gray in color, weathers light gray to medium gray in color, with reworked Cretaceous fossils.

In addition, the Willis Formation (gravel, sand, silt, and clay), Alluvium deposits (clay, silt, sand, gravel, and organic matter), and the Oakville Sandstone Formation (sandstone and clay) are also mapped nearby. Although not specifically mapped at the site, these may be encountered at construction.

Surface Conditions

Based on online imagery, the topography is gently sloping across the proposed project site. At the time of drilling, ground cover for the proposed site consisted of moderate grass.

Subsurface Conditions

Subsurface stratigraphy at this site can be described as clay and sand. The *Logs of Borings* should be consulted for more specific stratigraphic information. Each stratum has been designated by grouping soils that possess similar physical and engineering characteristics. Lines designating the interfaces between strata on the logs represent approximate boundaries, and transitions between strata may be gradual.

The near-surface soils generally exhibit moderate to very high potential for volumetric change due to moisture variations, as indicated by the measured PI for each sample, which are presented on the *Logs of Borings* in the Appendix.

Groundwater Conditions

The borings were dry augered to their completed depth in an attempt to observe groundwater conditions. Groundwater seepage was observed in Borings BH-1 through BH-3 at the time of the drilling and upon drilling completion at depths ranging between approximately 39 to 41 feet below the existing ground surface. Due to the limited depth of exploration, Borings PH-1 and PH-2 remained dry during drilling operations. It should be noted that groundwater at the site may occur in the form of “perched” water traveling along pervious seams or layers within the soils. The frequency of such groundwater is expected to increase during and soon after periods of wet weather. The direction of flow of subsurface moisture is unknown and many times will differ from the surface topography. Caution should be taken when constructing in wet seasons and all water accumulated during construction shall be removed prior to concrete placement.

An extensive groundwater study is beyond the scope of this report. Should construction activities require further evaluation of groundwater volumes, seasonal fluctuations, and direction, contact Gessner Engineering.

General Foundation Considerations

Review of the borings and test data indicates that the factors discussed below may affect foundation design and construction at this site. This information may be used to help mitigate possible movement over the life of the structure.

The majority of the soils encountered in our borings are plastic and exhibit expansive soil-related movement properties. Structures constructed on-grade may experience differential movements due to volumetric changes of the underlying and surrounding soils.

Movement of expansive soils is caused by fluctuations in the moisture content of soil particles. Because homogeneous expansive clay soils have relatively low permeability compared to granular soils, fluctuations in the moisture content of the soils might normally be expected to occur over a long period. However, permeability is increased with geotechnical phenomena such as ground faults, surface fractures due to desiccation of clays, and decomposition of tree roots that cause fissures and cracks that become widely disseminated over time.

Due to the repeated wetting, swelling, drying, and shrinking of the clay as it weathers, the fissures often fill with silt and sand, and create pathways for water that can exacerbate the infiltration process. Water can also easily move through naturally occurring sand strata, sand seams, and micro-cracks in clay soil caused by previous shrinkage. High negative pressures, also known as suction, in clay soils with low water content also increase the tendency for water to be absorbed into the clay.

Environmental factors other than climatic conditions can also affect expansive soils. Soil shrinkage may be caused by water extraction by trees and other vegetation, a process known as transpiration. Swelling can be a result of water infiltration into the soil from lawn irrigation systems, broken water pipes, flooded and leaking utility trenches, poor drainage, or leaking swimming pools; or it can be a result of slow moisture replenishment and equalization after the removal of a tree. The combined effect and variability of all of these possibilities make it difficult to accurately predict expansive soil ground movements.

Foundation movements are considered problematic only if they result in negative phenomena that detrimentally affect the performance or appearance of a building. The negative phenomena are considered to be structural if the load carrying capacity of the superstructure or foundation elements are affected, or are considered to be cosmetic if only the appearance of the exterior cladding or interior wall, floor, or ceiling finishes are affected.

Foundation movements can also affect the serviceability of a building, such as the opening or closing of doors. This type of movement typically occurs because of differential movements between various parts of a building. Differential movements often lead to high internal stresses in building components and subsequent cracking and separating of exterior cladding systems such as brick, cement-board panels, or in the interior finishes such as gypsum drywall panels, wood paneling, and flooring.

Expansive Soil-Related Movements

Gessner Engineering has calculated the potential vertical rise (PVR) of the soils at this site using the Texas Department of Transportation Method Tex-124-E. Movement may be either heave or settlement depending on the changes in the moisture content. The PVR at this site is calculated to ranging between approximately **2.75 to 3.75 inches**, assuming an active zone of 10 feet. Due to assumptions and generalities required for the calculation of the potential vertical movement, it should only be taken as an approximation. It should be noted that moisture variations in the subgrade soils due to poor drainage, perched water in pervious layers, leakage of utilities, etc. could induce volumetric changes resulting in movements that are in excess of those estimated by the PVR procedure.

Foundation Options

The following recommendations are based on the data obtained from our field and laboratory studies, our past experience with geotechnical conditions similar to those at this site, and our engineering design analyses. The **structural slab-on-voids foundation system** is the primary recommendation for this site because of its minimal risk for differential movement. Due to the expansive nature of the soils on this site, a secondary option is not provided. It is the opinion of Gessner Engineering that the amount of site preparation required to enable a slab-on-grade foundation system to perform adequately would be equivalent or in excess of the cost of a slab-on-voids foundation system.

Structural Slab-on-Voids

A structural slab isolates the foundation from the soils through the use of void forms, a crawl space, or another method. These foundations are typically employed when the amount of site preparation required to reduce the PVR value to acceptable levels for a slab-on-grade foundation system would be equivalent or in excess of the cost of a slab-on-void system or when a structure is sensitive to movement. The principle behind structural elevated foundation systems is to found the structure on deep, stable soils or rock that is unlikely to be affected by seasonal changes to the shallow soils. The deep founding elements are typically piles or piers. The floor system is constructed above the shallow soils. This isolation from the surficial soils prevents damages caused by periodic shrinkage and heave of expansive clays.

The minimum amount of soil separation between the shallow foundation elements and the subgrade shall be **8 inches**. Shallow soils at site have sufficient cohesion to remain stable during excavation of earth formed grade beams. Grade beam width and depth should be properly evaluated by the structural engineer and designed to span from pier to pier. It is also recommended that a vapor barrier be placed between the supporting soils and the concrete floor slab in accordance with ASTM E 1745-11, ASTM E 1643-11, and ACI 302.2R-06. Piers shall be designed in accordance with the *Deep Foundations* section of this report.

For the long-term effectiveness of void systems, earth retainers shall be employed to protect the void. Where an interior crawl space is provided or the interior soils and fill have sufficient cohesion to remain open, perimeter earth retainers may be used. Earth retainers shall be placed with a secure overlap against a formed concrete surface and keyed into firm soil to provide adequate support at

the top and bottom of the retainer against lateral earth pressure. In full slab-on-void systems, it is recommended that earth retainers be installed on both sides of beams and excavations. This installation protects against interior collapses where soils have been disturbed by construction activities. The retainers may be placed in a manner similar to that for exterior earth retainers as described previously, or may be set prior to the pour. Should the earth retainers be set prior to the pour, they shall be either keyed into the soil below to provide support at top and bottom or be designed and supported to cantilever over the void. Cantilevered earth retainers typically require a more rigid earth retainer and extend up the grade beam a minimum distance of twice the void depth.

In foundations with crawl spaces, adequate ventilation and drainage in accordance with code requirements should be provided to minimize moisture accumulation within the crawl space.

Care should be taken in all foundation systems to provide adequate drainage around the structure and prevent ponding of runoff adjacent to the foundation. In addition, systems that extend from the building into the shallow soils such as plumbing should be designed to accommodate the movement of the shallow soils. Where utilities extend beyond the interior voids into natural soil or fill at the exterior face of the structure, flexible connections should be used. Gessner Engineering recommends the clearance between the utilities and the foundation subgrade soils be equal to or greater than the required clearance below the structure.

Subgrade for the structural slab foundation system shall be prepared in accordance with the *Foundation Earthwork* section of this report.

Deep Foundations

Based on the current available project information and the soils data obtained, drilled piers or other deep foundation elements **are anticipated** for this foundation system. The foundation shall be supported on **drilled straight-shaft piers**. Founding soils at this site may not provide sufficient cohesion to be able to remain stable during the augering of the shaft. **Due to the presence of sandstone, high-powered, high-torque drilling equipment should be anticipated for drilled piers construction at this site.**

Drilled straight-shaft piers shall bear to a minimum depth of **23 feet** below the existing ground surface and shall be designed for an allowable side shear resistance capacity of **1,600 psf** for the portion of the shaft extending below a depth of 10 feet. The allowable side shear resistance was evaluated using a calculated factor of safety of at least 2.

Drilled straight-shaft piers bearing at a minimum depth of **23 feet** below the existing ground surface may also be proportioned using a maximum allowable end bearing pressure of **9,000 psf for net dead plus sustained live load** and **13,500 psf for net total load**. These bearing pressures were evaluated using calculated factors of safety of 3 and 2 for net dead plus sustained live load and net total load, respectively. If end bearing capacity is included in the pier capacity for structural design, the side shear resistance should be neglected along the portion of the shaft located one shaft diameter from the bottom of the pier. **In addition, we recommend that a minimum of 70 percent of the applied load be carried in side shear.**

Piers shall not be spaced closer than 3 times the pier diameter, center-on-center, without decreasing the pier capacity. It is recommended that piers be reinforced with minimum area of reinforcement of 0.5 percent of the pier cross sectional area to resist tensile forces on the pier from expansion of the

clays in contact with it. Note that ultimate pier depths from a level finished floor will vary due to the soil strata and slope of the site. Pier depths are based on the natural grade existing at the time of this investigation and shall not extend past 48 feet below the ground surface existing at the time of our study.

For bid purposes, the owner should anticipate that deeper piers will be required in some areas. Consequently, contractors bidding on the job should include unit costs for various depths of additional pier embedment. Unit costs should include those for both greater and lesser depth in soil.

Water encountered during pier drilling shall be removed prior to the concrete pour. If water is unable to be removed, concrete should be placed using the tremie method. Piers must be poured the same day they are drilled; pier shafts shall *not* be left open overnight. Piers that are unable to be poured on the same day as they are drilled shall be backfilled overnight.

Pier Shaft Potential Uplift Forces

The pier shafts will be subject to potential uplift forces if the surrounding expansive soils within the active zone are subjected to alternate drying and wetting conditions. The maximum potential uplift force acting on the shaft may be estimated by:

Formula 1: Pier Shaft Potential Uplift Force

$$F_u = 13.3 \times \pi \times D$$

Where:
F_u = uplift force in kips; and
D = diameter of the shaft in feet.

Allowable Uplift Resistance

Resistance to uplift forces exerted on the piers will be provided by the sustained compressive axial force (dead load) plus the allowable uplift resistance provided by the soil. The resistance provided by the soil depends on the shear strength of the soils adjacent to the pier shaft and below the depth of the active zone. The allowable uplift resistance provided by the soils at this site **for straight-shaft piers** may be estimated using 2/3 of the axial compressive side shear resistance for the portion of the shaft extending below a depth of 10 feet. The allowable uplift resistance for these soils is **1,000 psf**. These values were evaluated using a factor of safety of 2.

Temporary Casing

Groundwater seepage was observed in the test borings at the time of our subsurface exploration. Therefore, groundwater seepage and/or side sloughing is likely to be encountered at the time of construction, depending on climatic conditions prevalent at the time of construction. **Therefore, it is recommended that the bid documents require the foundation contractor to specify unit costs for different lengths of casing that may be required.**

Earthwork

Construction areas should be stripped of all vegetation, loose topsoil, surficial concrete, etc. Roots of trees within the proposed building footprint should be excavated and removed from the construction area. During earthwork, best practices shall be applied to limit erosion and pollution by sedimentation. At all times, the contractor shall work to maintain natural drainage and prevent the accumulation of runoff.

To achieve the required moisture content, the following recommendations are included as an aid to contractors. Where subgrade or layer of soil material requires moisture before compaction, uniformly apply water to surface of subgrade. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to achieve compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value. Alternate methods to achieve the end result of specified moisture content and compaction may also be used.

Four different methods may be utilized to successfully compact the soil. They include the processes of static weight, kneading action, impact, or vibration. Soil must be compacted using a compactor in accordance with the ASTM standards. A compactor is required to compact the soil to such a large degree. Track equipment such as bull dozers apply pressure across a large surface area and are therefore limited in their capabilities compared to a compactor. If the general fill or select fill is not compacted properly, the fill material and structures constructed on it are subject to settlement.

Foundation Earthwork

The following earthwork recommendations are provided for the design parameters as described previously in the report.

For a **structural slab-on-voids foundation system** at this site, it is recommended that a minimum of **6 inches** of existing material be overexcavated and general fill be compacted in place as needed to form a level building pad.

The building pad shall extend a minimum of 5 feet from the edge of the building footprint in all directions. Fill shall slope away at an angle that allows for proper drainage (see *Drainage* section).

Construction areas should be stripped of all vegetation, loose topsoil, surficial concrete, etc. Roots of trees within the proposed building footprint should be excavated and removed from the construction area. Once final subgrade elevation has been achieved, exposed soil subgrade areas shall be proof rolled with a 15 ton roller (minimum) or equivalent equipment as approved by the engineer to detect weak zones. Weak areas detected during the proof rolling process, as well as zones containing debris and/or organics and voids resulting from removal of tree roots, etc., should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in situ soils. Finally, the minimum amount of fill shall be placed to evenly build up the pad. Fill amounts may be increased to raise the building pad to the desired finished floor elevation or to decrease the movement potential of the site.

General Fill

General fill to be used beneath a structural slab-on-voids shall have a PI no greater than 30 and shall be free of debris and organics. All general fill should be placed on prepared surfaces in lifts not to

exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches. General fill should be compacted to at least 92 percent of the Standard Proctor (ASTM D 698) density at a moisture content ranging within 2 percent of optimum moisture content.

Select Fill

Select fill to be utilized beneath the foundation should consist of a low plasticity soil with a PI between 8 and 18, a maximum gravel content (percentage retained on No. 4 sieve) of 40 percent, and rocks no larger than 2 inches in their largest dimension; or a crushed limestone base material meeting the requirements of the Texas Department of Transportation (TxDOT) 2014 Standard Specifications Item 247, Type A, Grade 3. Alternatively, a low-plasticity granular fill material that does not meet these specifications may be utilized only if approved by Gessner Engineering. All select fill should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches. Select fill should be compacted to at least 95 percent of the Standard Proctor (ASTM D 698) density at a moisture content ranging within 2 percent of optimum moisture content for depths of 3 feet or less. If fill in excess of 3 feet is required, all select fill deeper than 3 feet shall be compacted to 98 percent of Standard Proctor (ASTM D 698).

Site Fill

For site areas not below pavements or ground-supported structures, the **on-site soils or imported fill** may be used to achieve the desired grade. If imported fill is to be used, **it shall have a PI consistent with or less than the PI of the existing near-surface soils** and shall be free of debris and organics.

All fill should be placed on prepared surfaces in lifts not to exceed 8 inches loose measure, with compacted thickness not to exceed 6 inches. Fill should be compacted to at least 92 percent of the Standard Proctor (ASTM D 698) density at a moisture content ranging within 2 percent of optimum moisture content.

Drainage

The performance of the foundation system for the proposed building will not only be dependent upon the quality of construction, but also upon the stability of the moisture content of the near surface soils. Therefore, Gessner Engineering recommends that site drainage be developed so that ponding of surface runoff near the structure does not occur. Accumulation of water near the structure foundation may cause moisture variations in the soils adjacent to the foundation, thus increasing the potential for structural distress.

Slope adjacent to foundations is addressed in Section 1804.4 of the 2018 International Building Code, which requires a 5 percent slope in the first 10 feet. Where sites do not allow this, the code allows drainage structures to accommodate the runoff. It should be noted that this requirement conflicts with accessibility standards, which would govern at entrances and other travel paths.

Pavement Recommendations

Recommendations for both rigid and flexible pavements are presented in this report. The Owner and/or design team may select either pavement type depending on the performance criteria established for the project. In general, flexible pavement systems have a lower initial construction cost as compared to rigid pavements. However, maintenance requirements over the life of the pavement are typically much greater for flexible pavements. This typically requires regularly scheduled observation and repair, as well as overlays and/or other pavement rehabilitation at approximately one-half to two-thirds of the design life. Rigid pavements are generally more durable and require less maintenance after construction.

For either pavement type, drainage conditions will have an impact on long-term performance, particularly where permeable base materials are utilized in the pavement section. Pavement design should be in accordance with the *Pavement Drainage Considerations* section of this report.

Subgrade Conditions

Gessner Engineering assumes that the subgrade in pavement areas will consist of the recompacted on-site materials, placed and compacted as recommended in the *Pavement Earthwork* section of this report. Based on our experience with similar subgrade soils, a California Bearing Ratio (CBR) value of 3.0 has been assigned for use in pavement thickness design analyses.

Design Information

Rigid pavement recommendations were prepared assuming traffic categories A and B for light-duty, and C for heavy-duty pavements. An average daily truck traffic (ADTT) of 10, 25, and 100 were assigned for light and heavy-duty pavements, respectively.

Flexible pavement recommendations were prepared assuming a 20-year design life and Equivalent Single Axle Loads (ESAL's) ranging between 30,000 and 175,000.

Rigid Pavement

It is recommended that rigid pavements be considered in areas of channelized traffic, particularly in areas where truck or bus traffic is planned, and particularly where such traffic will make frequent turns, such as garbage dumpsters as described in the *Garbage Dumpsters* section of this report.

For the concrete parking lots, sidewalks and drives, frequent control joints should be used to direct shrinkage cracking with a maximum joint spacing as shown in the table below. It should be noted that the pavement thicknesses listed are minimum recommendations only and are not based on a pavement system design. Expansion joints shall be placed at anticipated stress points and dowels shall be placed across these joints. The concrete section may be reinforced and designed in accordance with ACI standard practices or may be designed as a jointed system in accordance with ACI 330R-08.

Subgrade stabilization shall comply with the *Lime Treatment* section of this report, with thickness as described in the following table.

Loading	Traffic Category	Concrete Thickness (inches)	Lime Stabilized Subgrade Thickness (inches)	Control Joint Maximum Spacing (feet)	Average Daily Truck Traffic (ADTT)
Sidewalks	-	4.0	6.0	Sidewalk Width	-
Light-Duty Pavements	A	5.0	6.0	12.5	10
	B	6.0	6.0	15.0	25
Heavy-Duty Pavements	C	7.0	6.0	15.0	100

Table 3: Rigid Pavement System Recommendations

It is recommended that the concrete pavements be reinforced with bar mats. Concrete reinforcing should be centered in the slab. Reinforcing should not extend across expansion joints.

All control joints should be formed or sawed to a depth of at least 1/4 the thickness of the concrete slab. Sawing of control joints should begin as soon as the cutting can be performed without raveling of the concrete. Control joints may be hand formed or formed by using a premolded filler. It is recommended that all longitudinal and transverse construction joints be dowelled to promote load transfer. Expansion joints are needed to separate the concrete slab from fixed objects such as drop inlets, light standards and buildings. No expansion or construction joints should be located in a swale or drainage collection locations.

Based on Formula 3-3 in the ACI 330R-08 Guide for the Design and Construction of Concrete Parking Lots, the minimum area of steel required for a reinforced section shall be computed by the drag formula:

Formula 1: Drag Formula

$$A = \frac{\left(LC_f wh\right)}{24 f_s}$$

Where:

A = area of steel reinforcement (in^2/ft)
L = distance between joints (ft)
C_f = Coefficient of subgrade resistance (use 1.5)
w = density of concrete (lb/ft^3)
h = slab thickness (in)
f_s = allowable tensile stress in steel reinforcement (psi)

If possible, the pavement should develop a minimum slope of 0.015 feet/feet to provide surface drainage. Reinforced concrete pavement should cure a minimum of 3 and 7 days before allowing automobile and truck traffic, respectively.

Portland Cement Concrete

Portland cement concrete should have a maximum slump of 5 inches and should have a minimum 28-day compressive strength of 4,000 psi. Air entrainment is recommended and should meet the recommendations as outlined in ACI-330R-08, Table 4.1. A liquid membrane-forming curing compound should be applied as soon as practical after broom finishing the concrete surface. The curing compound will help reduce the loss of water from the concrete. The reduction in the rapid loss in water will help reduce shrinkage cracking of the concrete.

The M_r of concrete is a measure of the flexural strength of the concrete as determined by breaking concrete beam test specimens. An M_r of approximately 450 to 550 psi at 28 days was used in the analysis and is typical of local concrete production.

Garbage Dumpsters

Where flexible pavements are constructed at any site, it is recommended that reinforced concrete pads be provided in front of and beneath trash receptacles. Dumpster trucks, if any, should be parked on the rigid pavement when trash receptacles are lifted.

It is suggested that such pads also be provided in drives where the dumpster trucks make turns with small radii to access the receptacles.

Sidewalks

Concrete sidewalks are planned throughout the facility for pedestrian traffic. It is recommended that subgrade stabilization be extended beneath sidewalks to reduce movement that would interfere with required ADA specifications. Reference the concrete section above and subgrade section below for details.

Flexible Pavement

Flexible pavement sections recommended for this site are as listed in the table below:

Loading	Pavement Section	Asphaltic Concrete Thickness (inches)	Flexible Base Course Thickness (inches)	Lime Stabilized Subgrade Thickness (inches)	Estimated ESALs
Light-Duty Pavements	Design Section 1	2.0	6.0	6.0	30,000
	Design Section 2	2.0	8.0	6.0	65,000
Heavy-Duty Pavements	Design Section 3	3.0	6.0	6.0	95,000
	Design Section 4	3.0	8.0	6.0	175,000

Table 4: Flexible Pavement System Recommendations

Asphaltic Concrete Surface Course

Asphaltic concrete surface course should conform to TxDOT Standard Specifications, Item 340, Type D. Asphaltic concrete should be compacted to a minimum of 92 percent of the maximum theoretical specific gravity (Rice) of the mixture determined according to Test Method Tex-227-F.

Pavement specimens, which shall be either cores or sections of asphaltic pavement, will be tested according to Test Method Tex-207-F. The nuclear-density gauge or other methods that correlate satisfactorily with results obtained from project roadway specimens may be used when approved by the Engineer. Unless otherwise shown on the plans, the Contractor shall be responsible for obtaining the required roadway specimens at their expense and in a manner and at locations selected by the Engineer.

Flexible Base Course

Flexible base course should be crushed limestone conforming to TxDOT Standard Specifications, Item 247, Type A, Grades 1 or 2. Base course should be placed in lifts with a maximum thickness of 8 inches and compacted to a minimum of 95 percent of the maximum density at a moisture content within the range of 2 percentage points below to 2 percentage points above the optimum moisture content as determined by Tex-113-E.

Lime Treatment

Lime treatment is recommended to improve the subgrade material beneath pavements. The type of subgrade treatment to stabilize soils on the site depends on the type of soil located under pavements. The site is characterized primarily by expansive clay on the surface in the pavement area. Therefore, it is recommended that lime be used to stabilize the expansive clayey material at this site. To provide a suitable, weather-resistant working surface for construction activity and add a structural component to the pavement section, the upper **6 inches** of the plastic subgrade clays shall be treated with hydrated lime. It should be noted that stabilization recommendations are based on current grades. Should the site grading modify the surficial soils, variations from anticipated stabilization may be required.

Lime treatment of the subgrade soils should be in accordance with the TxDOT Standard Specifications, Item 260. A sufficient quantity of hydrated lime should be mixed with the subgrade soils to reduce the soil-lime mixture PI to 18 or less. For estimating purposes, it is recommended that 5 percent lime by weight be assumed for treatment. **For construction purposes, it is recommended that the optimum lime content of the subgrade soils be determined by laboratory testing.** Lime-treated subgrade soils should be compacted to a minimum of 95 percent of the maximum density at a moisture content within the range of optimum moisture content to 3 percentage points above the optimum moisture content as determined by Tex-114-E.

Laboratory testing was performed to determine the concentration of soluble sulfates in the subgrade soils, the results of which are presented in the *Soluble Sulfate Test Results* in the Appendix. Based on these test results, a sulfate reaction is not anticipated at this site. If surficial soils vary from what is noted in this geotechnical investigation at the time of construction, it is recommended that additional soluble sulfate tests be performed on the different material.

Additional Considerations

It is important that proper perimeter drainage be provided so that infiltration of surface water from unpaved areas surrounding the pavement is minimized, or if this is not possible, curbs should extend through the base and into the subgrade. A crack sealant compatible to both asphalt and concrete should be provided at concrete-asphalt interfaces. It should be noted that post-construction subgrade movements and cracking of asphaltic pavements is not uncommon for subgrade conditions such as those observed at this site.

Pavement Earthwork

If required, fill used beneath pavement shall have a PI between 8 and 30. Any fill beneath pavement shall be compacted to a minimum of 95 percent of the maximum density as determined by the modified moisture/density relation (ASTM D 1557) at -2 to +2 percent of the optimum moisture content. (As an alternative, compaction to at least 98 percent of the ASTM D 698 maximum dry density may be considered). The prepared subgrade should also be proof rolled to confirm proper preparation and uniformity. If weak areas are detected during the proof rolling process, or if there are zones containing debris and/or organics, or if there are voids resulting from removal of tree roots, then **we recommend that the soils be removed down to a competent soil layer, as demonstrated by a passing proof roll test, and replaced with compacted select fill.** If utilized, the select fill shall meet the specifications mentioned in the *Select Fill* section of this report. This undercut should extend a minimum of 24 inches horizontally beyond all paving limits. The top portion of fill shall be chemically stabilized as recommended in the *Subgrade Treatment* section of this report.

Pavement Drainage Considerations

As with any soil-supported structure, the satisfactory performance of a pavement system is contingent on the provision of adequate surface and subsurface drainage. Insufficient drainage that allows saturation of the pavement subgrade and/or the supporting granular pavement materials will reduce the performance and service life of the pavement systems.

Surface and subsurface drainage considerations crucial to the performance of pavements at this site include (but are not limited to) the following:

1) Any known natural or man-made subsurface seepage at the site that may occur at sufficiently shallow depths as to influence moisture contents within the subgrade should be intercepted by drainage ditches or below grade French drains.

2) Final site grading should eliminate isolated depressions adjacent to curbs which may allow surface water to pond and infiltrate into the underlying soils. **If used, curbs adjacent to flexible pavement systems should completely penetrate subgrade materials and should be installed to sufficient depth to reduce infiltration of water beneath the curbs.**

3) Pavement surfaces should be maintained to help minimize surface ponding and to provide rapid sealing of any developing cracks. These measures will help reduce infiltration of surface water downward through the pavement section.

Other Issues

Large trees adjacent to foundations should be avoided, as they can affect soil moisture contents significantly by creating concentrations of dry soils around the trees. If trees adjacent to a foundation cannot be avoided, property owners should maintain the drip line of the trees, which is typically consistent with the root system and can help keep the root system from causing foundation issues.

Maintenance of the entire landscape is a good practice for maintaining consistent moisture contents and minimizing foundation movement. Proper landscape maintenance uses vegetation as a natural moisture content indicator, as both over and under watering will result in distress of the plants.

Any elements that can affect the moisture content of the soils supporting a foundation, such as pools or plumbing, pose a risk to foundations. Care should be taken to prevent and quickly repair any leaks to minimize foundation damage.

Care should be taken when constructing adjacent to slopes to prevent bearing capacity failure due to nearby slope failure. For slopes steeper than 1 to 1, Section 1808.7.2 of the 2018 International Building Code recommends a minimum set back from slopes of 15 feet or one-half the height of the slope.

Construction Materials Testing

The performance of foundation systems and pavements is dependent upon the quality of construction. Compaction testing of fill material and concrete strength tests are required by the 2018 International Building Code. Therefore, it is recommended that Gessner Engineering monitor foundation installation to identify the proper founding strata and depths and to help evaluate building pad and foundation construction. We would be pleased to develop a plan for foundation monitoring to be incorporated in the overall quality control program. For more information, please contact Gessner Engineering's dedicated dispatch number for materials testing at 979-325-TEST (8378).

General Comments

Foundation excavations should be observed by the Geotechnical Engineer or their representative prior to placement of reinforcing steel and concrete. This is necessary to observe that the founding soils at the bottom of the excavations are similar to those encountered in our borings and that excessive loose materials and water are not present in the excavations. If soft pockets of soil are encountered in the foundation excavations, they should be overexcavated and replaced with a compacted non-expansive fill material or lean concrete up to the design foundation bearing elevations. Gessner Engineering would be pleased to provide foundation design review, foundation inspection prior to the concrete pour, and construction materials testing.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site or due to the modifying effects of weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, Gessner Engineering should be immediately notified so that further evaluation and supplemental recommendations can be provided.

Limitations

The scope of services for this project does not include, either specifically or by implication, any environmental or biological (e.g., mold, fungi, and bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

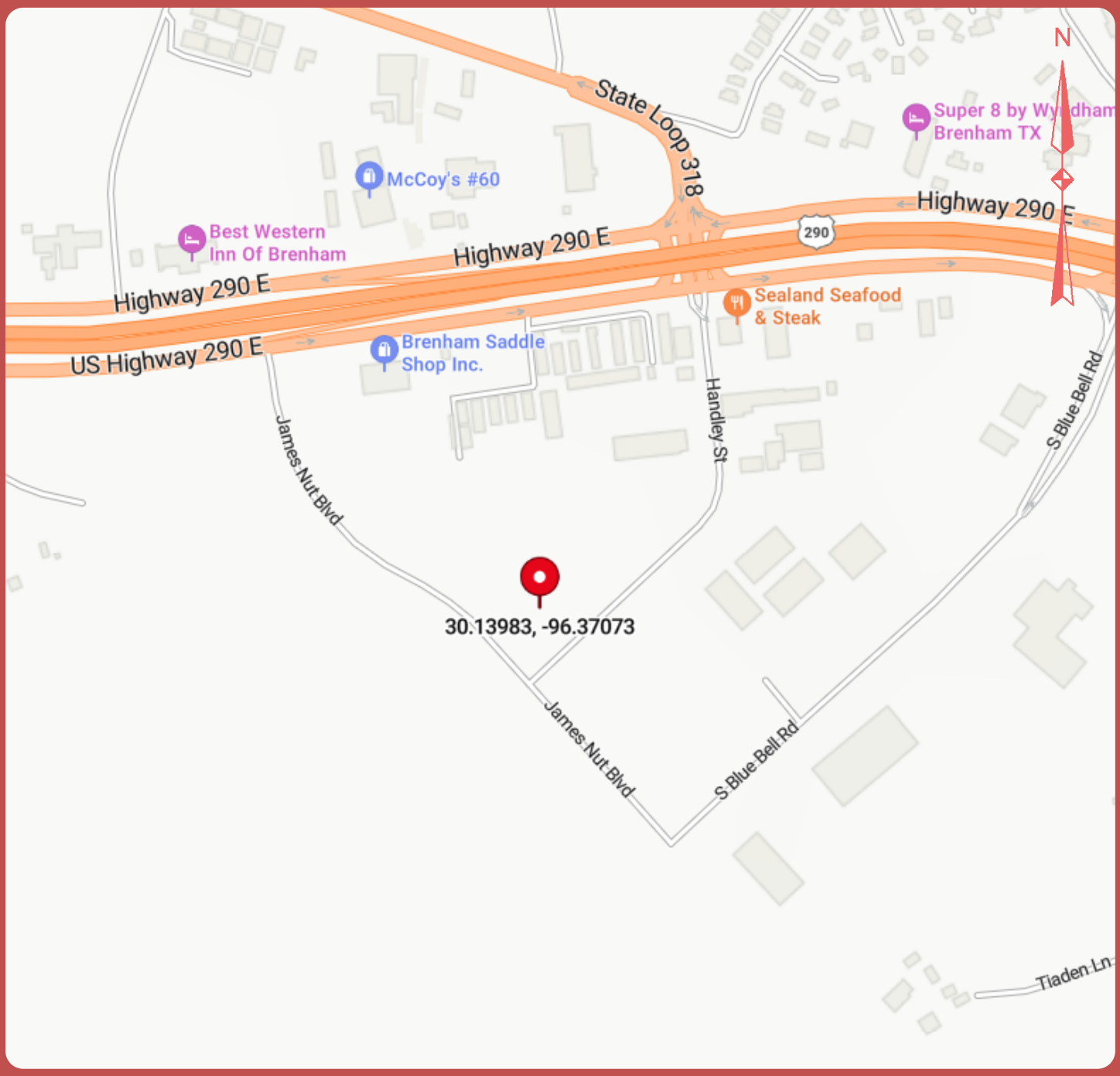
For any excavation construction activities at this site, all Occupational Safety and Health Administration (OSHA) guidelines and directives should be followed by the Contractor during construction to ensure a safe working environment. In regards to worker safety, OSHA Safety and Health Standards require the protection of workers from excavation instability in trench situations.

This report has been prepared for the use of Mr. Ray Holliday, AIA, ASLA, LI with Brown Reynolds Watford Architects, Inc. and their design representatives for the specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. This report was written and recommendations were made based on the soil data collected on February 19 and 20, 2024. If construction is delayed or the proposed area experiences severe weather conditions, please contact the geotechnical engineer prior to construction. No warranties, either expressed or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Gessner Engineering reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX

- ✓ Project Location
- ✓ Project Layout
- ✓ Logs of Borings
- ✓ Sulfate Content Test Results
- ✓ Symbols and Terms
- ✓ Glossary of Geological Terms

Mobile B-37 Drill Rig: Bubba Red



GESSNER ENGINEERING

CITY OF BRENHAM FIRE STATION NO. 2

JAMES NUTT BOULEVARD
BRENHAM, TEXAS

PROJECT LOCATION

Corporate: 401 W 26th Street, Suite 3 | Bryan, Texas 77803
www.gessnerengineering.com |1-877-GESSNER
Bryan | Brenham | Fort Worth | Georgetown | San Antonio

PLAN | DESIGN | VERIFY

TBPLS F-1093910 TBPE F-7451

Scale:	NTS
Job No.	23-0693
Drawn By:	KRG
Checked By:	KKW
Drawn Date:	03.01.24
Drawing No.	1

Borings	Approximate Location
BH-1	30.13983, -96.37073
BH-2	30.13989, -96.37097
BH-3	30.13972, -96.37096
PH-1	30.13990, -96.37134
PH-2	30.13967, -96.37064

GESSNER ENGINEERING

CITY OF BRENHAM FIRE STATION NO. 2

JAMES NUTT BOULEVARD
BRENHAM, TEXAS

PROJECT LAYOUT

Corporate: 401 W 26th Street, Suite 3 | Bryan, Texas 77803
www.gessnerengineering.com |1-877-GESSNER
Bryan | Brenham | Fort Worth | Georgetown | San Antonio

PLAN | DESIGN | VERIFY

TBPLS F-1093910 TBPE F-7451

Scale:	NTS
Job No.	23-0693
Drawn By:	KRG
Checked By:	KKW
Drawn Date:	03.01.24
Drawing No.	2

GESSNER ENGINEERING

LOG OF BORING NO: BH-1

CLIENT:	Brown Reynolds Watford Architects, Inc.	**BOREHOLE LOCATION:**	30.13983, -96.37073
PROJECT:	City of Brenham Fire Station No. 2	**GROUND SURFACE ELEVATION:**	312 feet
	James Nutt Boulevard	**BOREHOLE TERMINATION DEPTH:**	50 feet
	Brenham, Texas	**INITIAL GROUNDWATER DEPTH:**	41 feet
PROJECT NO:	23-0693	**FINAL GROUNDWATER DEPTH:**	41 feet
DATE:	2/20/2024	**GROUND COVER:**	Moderate Grass
DRILLER:	CME Testing and Engineering, Inc.	***ALL DEPTHS, ELEVATIONS, AND LOCATIONS ARE APPROXIMATE**	

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
0				1/3/3			27.1					CLAY, Firm, Brown, with sand, calcareous deposits, and trace gravel
				4/3/4	54	37	26.0		93		CH	CLAY, Firm to Very Stiff, Brown, Gray, and Tan with trace gravel from 2 to 6 feet
5				1/3/3			26.6					
				3/5/7	73	50	25.4		99		CH	
10				4/7/9			27.9					
15				17/48/23	38	20	12.8		68		CL	CLAY, Sandy, Hard, Gray and Tan, with sandstone lenses
20				46/26/ 50-3"			18.4					
25				15/24/31			7.9					SAND, Silty, Dense to Very Dense, Tan, with clay seams
30				25/21/23			7.5					
35				15/25/26		2	5.8		19		SM	

(Continued Next Page)

LOG OF BORING NO: BH-1

CLIENT: Brown Reynolds Watford Architects, Inc.
PROJECT NO: 23-0693

PROJECT NAME: City of Brenham Fire Station No. 2
James Nutt Boulevard
Brenham, Texas

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
35												SAND, Silty, Dense to Very Dense, Tan, with clay seams *(continued)*
40	▼			21/35/37			15.4					SAND, Clayey, Very Dense, Tan with calcareous deposits from 38 to 43 feet
45				38/46/ 50-6"	25	13	15.3		20		SC	
50				26/50-2"			22.2					CLAY, Sandy, Hard, Gray and Tan, with sand

GESSNER ENGINEERING

LOG OF BORING NO: BH-2

CLIENT:	Brown Reynolds Watford Architects, Inc.	**BOREHOLE LOCATION:**	30.13989, -96.37097
PROJECT:	City of Brenham Fire Station No. 2	**GROUND SURFACE ELEVATION:**	310 feet
	James Nutt Boulevard	**BOREHOLE TERMINATION DEPTH:**	50 feet
	Brenham, Texas	**INITIAL GROUNDWATER DEPTH:**	40 feet
PROJECT NO:	23-0693	**FINAL GROUNDWATER DEPTH:**	40 feet
DATE:	2/20/2024	**GROUND COVER:**	Moderate Grass
DRILLER:	CME Testing and Engineering, Inc.	***ALL DEPTHS, ELEVATIONS, AND LOCATIONS ARE APPROXIMATE**	

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
0				2/3/3			22.9					CLAY, Firm, Brown and Red, with sand
				3/3/6	58	37	23.8		92		CH	CLAY, Firm to Very Stiff, Brown, Gray, and Tan with trace gravel from 2 to 6 feet
5				2/3/4			22.8					
				4/6/10			24.2					with calcareous deposits from 6 to 8 feet
10				5/7/12	67	46	23.4		99		CH	
15				Ref.-4"			17.1					CLAY, Sandy, Hard, Tan, with sandstone lenses
20				7/26/32			16.1					SAND, Silty, Very Dense, Tan with sandstone lenses from 18 to 28 feet
25				23/27/26	14	2	7.7		32		SM	with trace gravel from 23 to 28 feet
30				16/50-3"			6.9					with clay seams from 28 to 43 feet
35				37/40/ 50-6"			5.8					

(Continued Next Page)

LOG OF BORING NO: BH-2

CLIENT: Brown Reynolds Watford Architects, Inc.
PROJECT NO: 23-0693

PROJECT NAME: City of Brenham Fire Station No. 2
James Nutt Boulevard
Brenham, Texas

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
35												SAND, Silty, Very Dense, Tan *(continued)*
40	▼			Ref.-2"			6.1					
45				Ref.-5"			23.2					SAND, Clayey, Very Dense, Tan
50				20/23/33	21	9	17.5		23		SC	

GESSNER ENGINEERING

LOG OF BORING NO: BH-3

CLIENT:	Brown Reynolds Watford Architects, Inc.	**BOREHOLE LOCATION:**	30.13972, -96.37096
PROJECT:	City of Brenham Fire Station No. 2	**GROUND SURFACE ELEVATION:**	310 feet
	James Nutt Boulevard	**BOREHOLE TERMINATION DEPTH:**	50 feet
	Brenham, Texas	**INITIAL GROUNDWATER DEPTH:**	39 feet
PROJECT NO:	23-0693	**FINAL GROUNDWATER DEPTH:**	39 feet
DATE:	2/19/2024	**GROUND COVER:**	Moderate Grass
DRILLER:	CME Testing and Engineering, Inc.	***ALL DEPTHS, ELEVATIONS, AND LOCATIONS ARE APPROXIMATE**	

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
0				1/3/3	39	24	26.7		81		CL	CLAY, Firm, Brown and Tan, with sand, calcareous deposits and trace gravel
				1/3/5			24.7					CLAY, Firm to Hard, Gray and Tan with calcareous deposits and trace gravel from 2 to 6 feet
5				4/7/9	67	46	19.2		93		CH	
				3/6/11			19.8					with sandstone lenses form 8 to 13 feet
10				5/9/ 50-6"			23.9					
15				6/14/ 50-6"	35	17	23.8		94		CL	CLAY, Hard, Tan
20				17/22/26			5.9					SAND, Silty, Dense to Very Dense, Tan
25				11/22/22			18.3					
30				10/14/23		2	11.0		29		SM	
35				Ref.-6"			4.4					with sandstone lenses from 33 to 38 feet

(Continued Next Page)

GESSNER ENGINEERING

LOG OF BORING NO: BH-3

CLIENT: Brown Reynolds Watford Architects, Inc.
PROJECT NO: 23-0693

PROJECT NAME: City of Brenham Fire Station No. 2
James Nutt Boulevard
Brenham, Texas

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
35												SAND, Silty, Dense to Very Dense, Tan *(continued)*
40	▼			17/22/19			19.0					with trace gravel from 38 to 43 feet
45				37/10/48	34	20	36.2		81		CL	CLAY, Hard, Tan, with sand and sandstone lenses
50				26/50-6"			17.6					SAND, Clayey, Very Dense, Tan

LOG OF BORING NO: PH-1

CLIENT:	Brown Reynolds Watford Architects, Inc.	**BOREHOLE LOCATION:**	30.13990, -96.37134
PROJECT:	City of Brenham Fire Station No. 2	**GROUND SURFACE ELEVATION:**	311 feet
	James Nutt Boulevard	**BOREHOLE TERMINATION DEPTH:**	10 feet
	Brenham, Texas	**INITIAL GROUNDWATER DEPTH:**	Not Encountered
PROJECT NO:	23-0693	**FINAL GROUNDWATER DEPTH:**	Dry at Completion
DATE:	2/20/2024	**GROUND COVER:**	Moderate Grass
DRILLER:	CME Testing and Engineering, Inc.	***ALL DEPTHS, ELEVATIONS, AND LOCATIONS ARE APPROXIMATE**	

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
0				2/3/3	51	33	23.5		87		CH	CLAY, Firm, Brown, Red, and Tan with calcareous deposits from 0 to 2 feet
				2/3/4			26.3					
5				2/3/5			24.4					
				3/3/4	60	38	24.0		86		CH	with sandstone lenses from 8 to 10 feet
10				2/3/4			26.3					

LOG OF BORING NO: PH-2

CLIENT:	Brown Reynolds Watford Architects, Inc.	**BOREHOLE LOCATION:**	30.13967, -96.37064
PROJECT:	City of Brenham Fire Station No. 2	**GROUND SURFACE ELEVATION:**	312 feet
	James Nutt Boulevard	**BOREHOLE TERMINATION DEPTH:**	10 feet
	Brenham, Texas	**INITIAL GROUNDWATER DEPTH:**	Not Encountered
PROJECT NO:	23-0693	**FINAL GROUNDWATER DEPTH:**	Dry at Completion
DATE:	2/20/2024	**GROUND COVER:**	Moderate Grass
DRILLER:	CME Testing and Engineering, Inc.	***ALL DEPTHS, ELEVATIONS, AND LOCATIONS ARE APPROXIMATE**	

DEPTH (ft)	WATER LEVEL	GRAPHIC LOG	SAMPLE TYPE	PENETROMETER OR BLOW COUNT	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT (%)	DRY UNIT WT. (pcf)	FINES CONTENT (%)	UNCONFINED COMPRESSION (tsf)	USCS CLASSIFICATION	MATERIAL DESCRIPTION
0				1/1/3			28.6					CLAY, Soft, to Very Stiff, Brown, Gray, and Tan with calcareous deposits from 2 to 4 feet
				3/4/7	56	36	24.4		92		CH	
5				4/7/9			19.9					
				4/5/10			19.5					
10				4/6/9	74	50	23.6		99		CH	

CME TESTING AND ENGINEERING, INC.

320 GRAHAM ROAD • COLLEGE STATION, TEXAS 77845 • 979.690.3600

Client: Keatyn Gleaves
Gessner Engineering, LLC
401 West 26th Street, Suite 3
Bryan, Texas 77803

Report Date: 2/29/2024
Project No.: 63101
Report No.: 7

PROJECT: GENERAL TESTING SERVICES FOR GESSNER ENGINEERING, LLC

SULFATE CONTENT RESULTS OF SOILS REPORT

Date Delivered:	2/23/2024	**Samples Delivered By:**	Ms. Emily Torres, Gessner Engineering, LLC
No. of Samples Delivered:		2	

CME Lab No.	Sample Identification Note 1	Sulfate Content, PPM Note 2
120	23-0693 PH-2 / 0' – 2'	102
121	23-0693 PH-1 / 2' – 4'	106

Notes:

1. Sample identification provided by Ms. Emily Torres with Gessner Engineering, LLC.
2. The test procedure utilized was the Texas Department of Transportation (TxDOT) test designation Tex-145-E –*Determining Sulfate Content in Soils – Colorimetric Method*. This method determines the soluble sulfate content of soil by using turbidimetric techniques which involves measuring the cloudiness of a liquid and translating it into an average concentration of sulfate in units of parts per million (ppm).
3. Samples will be disposed in thirty (30) days unless storage arrangements are made.

CME Testing and Engineering, Inc.

Paul Evans

SYMBOLS AND TERMS USED ON BORING LOGS

SOIL SYMBOLS AND DESCRIPTION


HIGH PLASTICITY CLAY


SILTY CLAY


SAND


SILTY SAND


GRAVEL


ASPHALT


SHALE


LIMESTONE


LOW PLASTICITY CLAY


SANDY CLAY


CLAYEY SAND


SILTY CLAYEY SAND


SILT


FILL


CONCRETE


SANDSTONE

SAMPLER TYPES


SPLIT SPOON


TEXAS CONE PENETROMETER


SHELBY TUBE


SAMPLE LOST


AUGER


ROCK CORE

GROUNDWATER SYMBOLS AND DESCRIPTION

▽ - GROUNDWATER ENCOUNTERED DURING DRILLING

▼ - GROUNDWATER DEPTH UPON DRILLING COMPLETION

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (Major Portion Retained on No. 200 Sieve): Includes (1) clean gravels and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

Standard Penetration, N-Value, blows/ft	Relative Density
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
>50	Very Dense

FINE GRAINED SOILS (Major Portion Passing No. 200 Sieve): Includes (1) inorganic and organic silts and clays; (2) gravelly, sandy, or silty clays; and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

Standard Penetration, N-Value, blows/ft	Pocket Penetrometer Reading	Consistency	Cohesive Strength, tons/sf
0-2	0-0.25	Very Soft	less than 0.125
2-4	0.25-0.5	Soft	0.125 to 0.25
4-8	0.5-1.0	Firm	0.25 to 0.50
8-15	1.0-2.0	Stiff	0.50 to 1.00
15-30	2.0-4.0	Very Stiff	1.00 to 2.00
>30	>4.0	Hard	2.00 and higher

Note: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above due to planes of weakness or cracks in the soil.

EXPANSION POTENTIAL OF COHESIVE SOILS

Plasticity Index	Degree of Expansive Potential
0-5	Nonplastic
5-10	Low
10-20	Moderate
20-40	High
>40	Very High

ROCK QUALITY DESIGNATION

RQD=Rock Quality Designation
The percentage of intact rock retrieved from a bore hole. All pieces of intact rock core equal to or greater than 4 inches long are summed and divided by the total length of the core run.

REC = Recovery
This is the total percentage of material recovered from a run.

TERMS CHARACTERIZING SOIL STRUCTURE

Slickensided	- having inclined planes of weakness that are slick and glossy in appearance
Fissured	- containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical
Laminated	- composed of thin layers of varying color and texture
Interbedded	- composed of alternate layers of different soil types
Calcareous	- containing appreciable quantities of calcium carbonate
Well graded	- having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Poorly graded	- predominantly of one grain size, or having a range of sizes with some intermediate size missing
Flocculated	- pertaining to cohesive silts that exhibit a loose knit or flakey structure

GLOSSARY OF GEOLOGIC TERMS

Aphanitic - dense, homogeneous rock with constituents so fine that they cannot be seen by the naked eye

Argillaceous - containing, made of, or resembling clay; clayey

Bentonitic - an absorbent aluminum silicate clay formed from volcanic ash and used in various adhesives, cements, and ceramic fillers

Carbonaceous - consisting of, containing, relating to, or yielding carbon

Chert - a siliceous rock of chalcedonic or opaline silica occurring in limestone

Conchoidal - of, relating to, or being a surface characterized by smooth, shell-like convexities and concavities, as on fractured obsidian

Crossbedded - intersecting layers of distinct soil deposits

Fluviatile - produced by the action of a river or stream

Fossiliferous - containing fossils

Friable - readily crumbled, brittle

Glauconitic - a greenish mineral of the mica group, a hydrous silicate of potassium, iron, aluminum, or magnesium found in *greensand* and used as a fertilizer and water softener

Gypsiferous - containing gypsum; a widespread colorless, white, or yellowish mineral, used in the manufacture of various plaster products, and fertilizers

Igneous - rocks formed by solidification from a molten state; pyrogenic

Inclusion - a solid, liquid, or gaseous foreign body enclosed in a mineral or rock.

Indurated - hardened soil that has been changed by extreme climate

Laminated - a soil deposit divided into thin layers

Lateritic - pertaining to red residual soil in humid tropical and subtropical regions that is leached of soluble minerals, aluminum hydroxides, and silica but still contains concentrations of iron oxides and iron hydroxides.

Lenticular - lens-shaped grains of soil or rock

Lignitic - pertaining to soft, brownish-black coal in which the alteration of vegetable matter has proceeded further than in peat but not as far as in bituminous coal; also called *brown coal*

Marl - a loose and crumbling earthy deposit consisting mainly of calcite or dolomite; used as a fertilizer for soils deficient in lime

Metamorphic - rocks changed in structure or composition as a result of metamorphism caused by chemical reaction or heat and pressure

Micaceous - containing mica; any of a group of chemically and physically related aluminum silicate minerals, common in igneous and metamorphic rocks, characteristically splitting into flexible sheets used in insulation and electrical equipment

Montmorillonitic - clays that are comprised mostly of montmorillonite; one of the three types of clay soil grains (illite, kaolinite, and montmorillonite)

Morphology - refers to the geological characteristics, configuration, and evolution of rocks and landforms

Porous - admitting the passage of gas or liquid through pores or interstices

Pyrite - a brass-colored mineral occurring widely and used as an iron ore and in producing sulfur dioxide for sulfuric acid; also called *fool's gold*

Scarp - a long steep slope or cliff at the edge of a plateau or ridge; usually formed by erosion

Siliceous - containing, resembling, relating to, or consisting of silica; a white or colorless crystalline compound occurring abundantly as quartz, sand, flint, agate, and many other minerals and used to manufacture a wide variety of materials, especially glass and concrete

Surficial - of, relating to, or occurring on or near the surface of the earth

Tuffaceous - comprising rocks made of compacted volcanic ash varying in size from fine sand to coarse gravel; also called *tufa*

SECTION 00 43 43 - WAGE RATES

PART 1 - GENERAL

1.01 SUMMARY

A. The Contractor shall utilize current Davis-Bacon Wage Rates for all labor as required on this project.

B. The Contractor shall print and post the current version of the prevailing Davis-Bacon Wage Rate for the county where the project is being constructed:
   1. Wages must be posted in a visible location.
   2. Current Wage Rates for Washington County may be found at the following website.
      a. https://sam.gov/wage-determination/TX20240213/4

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 00 43 43

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section Includes:
   1. Project information.
      a. Project Identification
   2. Owner Information
      a. Architect Information
      b. Architect's Consultants
   3. Contractor's Duties
   4. Weather Days
   5. Work covered by Contract Documents.
   6. Work performed by Owner.
   7. Work under Owner's separate contracts.
   8. Owner-furnished/Contractor-installed (OFCI) products.
   9. Contractor's use of site and premises.
   10. Work restrictions.
   11. Specification and Drawing conventions.
   12. Miscellaneous provisions.

B. Related Requirements:
   1. Division Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
   2. Division Section 01 73 00 "Execution" for coordination of Owner-installed products.

1.03 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.04 PROJECT INFORMATION

A. Project Identification: Brenham Fire Station #2.
   1. Project Location: 3007 James Nutt Blvd., Brenham, Texas 77833.

B. Owner: City of Brenham, 200 W. Vulcan St., Brenham, Texas 77833.
   1. Owner's Representative: Richard O'Malley, Director of Engineering Services.

C. Architect: BRW Architects, 175 Century Square Dr., Suite 350, College Station, Texas 77840.
   1. Architect's Representative: Justin Dreyer, 979-694-1791, jdreyer@brwarch.com.

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
   1. Civil Engineer: Gessner Engineering, 401 W. 26th St., Bryan, Texas 77803.
   2. Structural Engineer: Gessner Engineering, 401 W. 26th St., Bryan, Texas 77803.
   3. Mechanical/Electrical/Plumbing Engineer: DBR Engineering Consultants, 2500 S. Highway 183, Suite 500, Austin, Texas 78744.

1.05 Contractor's Duties

A. Furnish and provide for proper execution and completion of work as required by the Contract Documents all:
   1. Labor, materials and equipment.
   2. Tools, construction equipment and machinery.
   3. Water, heat and utilities required for construction.
   4. Other facilities and services necessary for proper execution and completion of the work.

B. Attain and pay for required permits, licenses, and government fees unless indicated otherwise.
   1. Owner will pay for the Building Permit fee.
   2. Unless specifically indicated otherwise, Contractor is responsible to hire and pay for all third party reviews and inspections required by authorities having jurisdiction.
      a. Architect on behalf of the owner, will retain and pay for handicap accessibility inspection required by TDLR. Coordinate scheduling with Architect to coincide with or to follow after substantial completion.

C. Give required notices.

D. Comply with codes, ordinances, rules, regulations, orders and other legal requirements of public authorities which bear on performance of work.

E. Promptly submit written notice to Architect of observed variance of Contract Documents from legal requirements. It is not Contractor's responsibility to make certain that drawings and specifications comply with codes and regulations.

F. Contractor shall verify all conditions at the site and dimensions in the field prior to starting work. Architect shall be notified in writing of any discrepancies found.

G. The Drawing and Specifications represent the work to be completed not the method of construction. However, the Contractor shall perform all demolition and remedial work in a sequence to where any interruption of the operation of the facilities or utility service occurs at an absolute minimum.

H. Contractor shall use every precaution to prevent damage to roads, landscape, adjacent property, building and utilities above and below ground that are adjacent to or included in the area under contract. The Contractor shall repair and replace, at his expense, any material or building affected, damaged or destroyed because of his operations or work.

I. Safety Requirements: The Contractor has full responsibility for the safety of workers and for all damages to personal property caused by its operations. The Contractor is responsible for following all Federal, State, and Local Regulations and Guidelines with regards to worker and public safety. Unless otherwise indicated on the proposal, the necessary tools, equipment, procedures, etc. for following the appropriate regulations and guidelines will be considered subsidiary to other proposal items.

1.06 WEATHER DAYS

A. The Contractor may be granted an extension of time because of abnormal inclement weather conditions. Contractor shall submit reports on monthly intervals indicating the rainfall and temperature on inclement weather days to document for each month the days in excess of normal inclement weather conditions that may contribute to future time extension requests.
   1. Provide reports each month whether the Contractor believes at that time that time extension will be necessary. In months not exceeding normal inclement weather days and for which additional time will not be requested, reports need not be provided.
   2. Available float shall be used before any request is made for time extension due to inclement weather.

B. For this contract, "abnormal inclement weather" will be interpreted as the occurrence of one or more of the following conditions within a twenty-four (24) hour day that prevents construction activity exposed to weather conditions or access to the site and shall include Drying days:
   1. Precipitation (rain, snow, or ice) in excess of one-tenth inch (0.10") liquid measure.
   2. Temperatures that do not rise above that required for the day's construction activity if such temperature requirement is specified or accepted as standard industry practice.
   3. Sustained wind in excess of twenty-five (25) m.p.h.

C. Weather Conditions: The information in the Standard Baseline table for average climatic range reflects data available from the National Oceanic and Amospheric Administration (NOAA) at the nearest available weather data collection station to the project site, as an average over the past 30 years.

D. Standard Baseline is defined as the normal number of calendar days for each month during which construction activity exposed to weather conditions is expected to be prevented and suspended by cause of adverse weather. Suspension of construction activity for the number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

E. Standard Baseline (including Drying days) is as follows:

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
6	6	6	4	6	6	5	5	5	6	5	6

F. All claims for additional time shall be limited to time extensions only. Except as may be specifically provided for in the Owner-Construction Manager Agreement, claims for additional costs due to time extensions shall not be considered.

1.07 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Project consists of new construction of a 10,335 SF fire station with unseparated Mixed Occupancies and Type IIB construction. Site work will include earthwork, paving, sidewalks, parking, site utilities, storm drainage, and landscaping. Building construction will include structural slab on piers, structural steel superstructure, CFMS and CMU framing, brick/siding/metal panel exterior, metal stud interior partitions, standing seam metal & modified bitumen roofing systems, storefront windows & entry doors, hollow metal & wood doors, hardware, ceilings, flooring, painting, millwork, fire suppression, mechanical systems, plumbing systems, and electrical systems along with other Work indicated in the Contract Documents.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.08 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
   1. [Telephone, Data, and Audio Visual wiring and equipment installation.]

C. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
   1. Furniture, fixtures and equipment installation.

1.09 WORK UNDER OWNER'S SEPARATE CONTRACTS

A. Work with Separate Contractors: Cooperate fully with Owner's separate contractors, so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under Owner's separate contracts.

B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
   1. Access Control and Security Camera System wiring and equipment installation.
   2. Station Alerting System wiring and equipment installation.

1.10 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
   1. Provide for delivery of Owner-furnished products to Project site.
   2. Upon delivery, inspect, with Contractor present, delivered items.
      a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
   3. Obtain manufacturer's inspections, service, and warranties.
   4. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:
   1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
   2. Receive, unload, handle, store, protect, and install Owner-furnished products.

3. Make building services connections for Owner-furnished products.
4. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
5. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:
1. SCBA Compressor, Cascade System, & Fill Station
2. Gear Extractor
3. Appliances: Refrigerators, Washers & Dryers, Microwaves

1.11 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.12 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.
1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
2. Comply with work hour and noise restriction requirements of local authorities, if such exist.

B. On-Site Work Hours: Contractor to coordinate work hours with owner.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:
   1. Quantity allowances.
   2. Contingency allowances.
   3. Adjustment of Allowances

C. Related Requirements:
   1. Division Section 01 22 00 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
   2. Division Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   3. Division Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.
   4. Divisions 02 through 48 Sections for items of Work covered by allowances.

1.03 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.04 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.05 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.06 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.07 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.08 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
   1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.09 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's[overhead, profit, and] related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs. Contractor's costs shall be documented and follow procedures as set forth in the Owner / Construction Manager Agreement.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.10 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs due to a change in the scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of Work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES

A. Allowance No. One (1): Quantity Allowance: Include temporary casing of the following quantities of each diameter of drilled concrete pier: Fifty-One (51) - 18" Diameter Piers, Nineteen (19) - 24" Diameter Piers, & Five (5) - 30" Diameter Piers. Depth of piers shall be 35'-0" below existing ground surface. Refer toDivision Section 31 63 29 "Drilled Concrete Piers and Shafts" and Structural Drawings for requirements.
1. Coordinate quantity allowance adjustment with unit-price requirements in Division Section 01 22 00 "Unit Prices."

B. Allowance No. Two (2): Contingency Allowance: Include a contingency allowance of $250,000.00 for use according to Owner's written instructions.

END OF SECTION 01 21 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:
   1. Division 00 "Proposal Form"
   2. Division Section 01 21 00 "Allowances" for procedures for using unit prices to adjust quantity allowances.
   3. Division Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
   4. Division Section 01 40 00 "Quality Requirements" for field testing by an independent testing agency.

1.03 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part Three (3). Specification Sections referenced in the Part Three (3) "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 SCHEDULE OF UNIT PRICES

A. Unit Price No. One (1): Temporary Casing.
   1. Description: Temporary casing of drilled straight shaft pier to stabilize the shaft until concrete placement can be completed, as required, in accordance with Division Section 31 63 29 "Drilled Concrete Piers and Shafts" and Structural Notes.
   2. Unit of Measurement: Length in feet of drilled pier (per each pier diameter).
   3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Division Section 01 21 00 "Allowances."

END OF SECTION 01 22 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.
   1. Substitutions for Cause
   2. Substitutions for Convenience

B. Related Requirements:
   1. Division Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
   2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.03 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
      a. Contractor's failure to consider and confirm lead time, or to order materials, in time to avoid construction schedule impact, does not constitute a substitution for cause.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.04 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use form acceptable to Architect.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.05 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.06 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.07 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    a. Requested substitution is consistent with the Contract Documents and will produce indicated results including aesthetic intent. The architect will be the sole determiner of product or system compliance with the aesthetic design intent
    b. Substitution request is fully documented and properly submitted.
    c. Requested substitution will not adversely affect Contractor's construction schedule.
    d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    e. Requested substitution is compatible with other portions of the Work.
    f. Requested substitution has been coordinated with other portions of the Work.
    g. Requested substitution provides specified warranty.
    h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 30 days after commencement of the Work . Requests received after that time may be considered or rejected at discretion of Architect, and most likely will be rejected without further review unless substantial benefit to the Owner is identified.
    1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
        a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
        b. Requested substitution does not require extensive revisions to the Contract Documents.
        c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
        d. Substitution request is fully documented and properly submitted.
        e. Requested substitution will not adversely affect Contractor's construction schedule.
        f. Requested substitution has received necessary approvals of authorities having jurisdiction.
        g. Requested substitution is compatible with other portions of the Work.
        h. Requested substitution has been coordinated with other portions of the Work.
        i. Requested substitution provides specified warranty.
        j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:
   1. Division 01 Section - Unit Prices for administrative requirements for using unit prices.
   2. Division Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
   3. Division Section 01 3 100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.03 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on form included in Project Manual.

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Division Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Proposal Request Form: Use form acceptable to Architect.

1.05 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Division Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Division Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.06 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 .

1.07 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 . Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Division Section 01 21 00 "Allowances" for procedural requirements governing the handling and processing of allowances.
   2. Division Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
   3. Division Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   4. Division Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Contractor's Construction Schedule
      b. Submittal Schedule.
      c. Application for Payment forms with continuation sheets.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Owner's name.
      c. Name of Architect.
      d. Architect's Project number.
      e. Contractor's name and address.
      f. Date of submittal.
   2. Arrange schedule of values consistent with format of AIA Document G703.

3. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
        1) Labor.
        2) Materials.
        3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
    a. Include separate line items under principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major overhead cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
11. Schedule of Values Revisions: Revise and resubmit the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Architect by the seventh day of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
   1. Submit draft copy of Application for Payment seven days prior to end of month for review by Architect.

D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
   1. Other Application for Payment forms proposed by the Contractor may be acceptable to Architect and Owner. Submit forms for approval with initial submittal of schedule of values.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
      b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
      c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
   2. If approved by Owner, submit electronic transmission of Pay Application, in lieu of paper copies.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Schedule of unit prices.
   6. Submittal schedule (preliminary if not final).
   7. Copies of building permits.
   8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   9. Initial progress report.
   10. Report of preconstruction conference.
   11. Certificates of insurance and insurance policies.
   12. Performance and payment bonds.
   13. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
      a. Complete administrative actions, submittals, and Work preceding this application, as described in Division Section 01 77 00 "Closeout Procedures."
   2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Certification of completion of final punch list items.
   3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   4. Updated final statement, accounting for final changes to the Contract Sum.
   5. AIA Document G706.
   6. AIA Document G706A.
   7. AIA Document G707.

8. Evidence that claims have been settled.
9. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Proof that taxes, fees, and similar obligations are paid.
12. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:
   1. General coordination procedures.
   2. Conservation.
   3. Correlation of Documents.
   4. Coordination Drawings.
   5. Requests for Information (RFIs).
   6. Digital project management procedures.
   7. Project meetings.
   8. Electrical Box Walk.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
   1. Division 01, Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division01, Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   3. Division 01, Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.04 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

1.05 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.06 CORRELATION OF DOCUMENTS

A. Any discrepancy in the documents shall be interpreted to include the most restrictive or costly solution. In case of discrepancy either in figures or Drawings or Specifications, the matter must be promptly submitted by the Contractor to the Architect, who will promptly make a determination in writing. Any adjustment by the Contractor without such a determination by the Architect will be at the Contractor's own risk and expense. The Architect will furnish, as necessary, additional detailed Drawings and information for clarification.

B. If a document discrepancy is identified prior to bidding, the Architect is to be notified so a written clarification may be issued.

C. Any survey drawing documents included herein are for convenience of the Contractor and Owner. The Architect assumes no responsibility as to their completeness or accuracy.

D. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, is of like effect as if shown or mentioned in both.

E. On any of the Drawings in which a portion of the work is detailed or drawn out and the remainder is shown in outline, the parts detailed or drawn out will apply also to all other like portions of the work.

F. When the word "similar" appears on Drawings, it has a general meaning and must not be interpreted as meaning identical. All details must be worked out in relation to their location and connection with other parts of the work.

G. Refer to Architectural Drawings for verification of locations, sizes and dimensions.

1.07 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
      b. Coordinate the addition of trade-specific information to coordination drawings [by multiple contractors]in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
      c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
      d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
      e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
      f. Indicate required installation sequences.
      g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.08 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
   2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Owner name.
   3. Owner's Project number.
   4. Name of Architect.
   5. Architect's Project number.

6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.
13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
   1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division Section 01 26 00 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Architect.
   4. RFI number, including RFIs that were returned without action or withdrawn.
   5. RFI description.
   6. Date the RFI was submitted.
   7. Date Architect's response was received.
   8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.09 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Architect's Data Files Not Available: Architect will not provide Architect's [BIM model] [CAD drawing] digital data files for Contractor's use during construction.

B. Use of Architect's Digital Data Files: Digital data files of Architect's CAD drawings will be provided by Architect for Contractor's use during construction.
   1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
   2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
   3. Digital Drawing Software Program: Contract Drawings are available in AutoCAD 2024 version.
   4. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
      a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.
   5. The following digital data files will be furnished for each appropriate discipline:
      a. Floor plans.
      b. Reflected ceiling plans.
      c. Site Plans.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
   1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
   3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.10 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner[, Construction Manager,] and Architect, within seven days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:
    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Use of web-based Project software.
    h. Procedures for processing field decisions and Change Orders.
    i. Procedures for RFIs.
    j. Procedures for testing and inspecting.
    k. Procedures for processing Applications for Payment.
    l. Distribution of the Contract Documents.
    m. Submittal procedures.
    n. Preparation of Record Documents.
    o. Use of the premises.
    p. Work restrictions.
    q. Working hours.
    r. Responsibility for temporary facilities and controls.
    s. Procedures for moisture and mold control.
    t. Procedures for disruptions and shutdowns.
    u. Construction waste management and recycling.
    v. Parking availability.
    w. Office, work, and storage areas.
    x. Equipment deliveries and priorities.
    y. First aid.
    z. Security.
    aa. Progress cleaning.
3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other Sections and when required for coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.

i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of Record Documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for completing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for delivery of material samples, attic stock, and spare parts.
g. Requirements for demonstration and training.
h. Preparation of Contractor's punch list.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.
l. Owner's partial occupancy requirements.
m. Installation of Owner's furniture, fixtures, and equipment.
n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings with Owner, Architect, and Contractor, at monthly intervals (OAC Meetings):
   1. Coordinate dates of meetings with preparation of payment requests.
   2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Status of sustainable design documentation.
         5) Deliveries.
         6) Off-site fabrication.
         7) Access.
         8) Site use.
         9) Temporary facilities and controls.
         10) Progress cleaning.
         11) Quality and work standards.
         12) Status of correction of deficient items.
         13) Field observations.
         14) Review recording of changes on record field set.
         15) Safety
         16) Work hours
         17) Status of RFIs.
         18) Status of Proposal Requests.
         19) Pending changes.
         20) Status of Change Orders.
         21) Pending claims and disputes.
         22) Documentation of information for payment requests.
   4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
      a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at an as-needed basis . Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor present, including the following:
        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site use.
        8) Temporary facilities and controls.
        9) Work hours.
        10) Hazards and risks.
        11) Progress cleaning.
        12) Quality and work standards.
        13) Status of RFIs.
        14) Proposal Requests.
        15) Change Orders.
        16) Pending changes.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.11 ELECTRICAL BOXES COORDINATION REVIEW

A. The purpose of the electrical box coordination review is to provide Owner's personnel a final review and confirmation of exact box locations to avoid conflicts with Owner's operational requirements, and conflicts with other wall mounted items whether or not such items are indicated in the Drawings and Specifications. After installing the large majority or all wall boxes in and on walls, and prior to installing conduit and wiring or interior wall board, Contractor shall review all wall box locations with Owner's designated personnel to confirm box locations and to allow to make corrections before such corrections become more difficult or costly.

B. Schedule and conduct a coordination review of all floor boxes and all wall-mounted electrical boxes including electrical power, lighting switches and controls, HVAC and other equipment and systems wall mounted controls, and other electrical systems. Electrical systems is intended to be comprehensive of wall box locations for all electrical systems, which includes but is not limited to: Data, Phone, Audio-Visual, Access Control and Security, Door Bell / Buzzer, Electric generator monitor, apparatus bay door controls components, commercial range hood, radio, fire alarm, station alerting systems and other controls interfacing with the station alerting system.
    1. The Owner's personnel shall include a designated representative and additional Owner's project management personnel as designated by the owner. The Architect's attendance is not required; however the Architect shall be notified of the scheduled review walk at or prior to the previous project review (OAC) meeting
    2. Owner and Contractor shall jointly review the location of each box. Contractor shall either note the use of each box or shall have personnel included in the review walk who are able to identify the use of each box upon Owner inquiry. Contractor shall have a set of current construction documents ready at hand for review. Any boxes not yet installed shall be visibly marked as to their locations and uses.
    3. Contractor shall take notes and indicate on existing construction where possible (by tape marks or similar), the desired locations of boxes not yet installed or that may be requested to be relocated.
    4. Contractor shall account in Owner's presence the number of boxes required to be relocated that are not due to Contractor error, and shall make necessary notes to ensure that all boxes indicated for relocation will be accurately relocated as required.
        a. Boxes that are found to be incorrectly located per Construction Documents shall be properly relocated without additional cost to Owner.
        b. Boxes that are found to be correctly located per Construction Documents, but that are determined not to be in the most preferred location, may be requested by Owner to be relocated at additional cost.
        c. Boxes that were not located or otherwise identified as to location at the coordination review for Owner's confirmation, and that are subsequently found to be installed in incorrect locations, shall be relocated as required by Owner at Contractor's expense including any cost for patching walls.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Contractor's Construction Schedule.
      a. Gantt-Chart Schedule
   2. Submittals schedule
   3. Construction schedule updating reports.
   4. Daily construction reports.
   5. Site condition reports.
   6. As-Built documentation.
   7. Special reports.
   8. Construction photographs.

B. Related Requirements:
   1. Division 01 Section - Project Management and Coordination for submitting and distributing meeting and conference minutes.
   2. Division 01 Section - Submittal Procedures for submitting schedules and reports.
   3. Division Section 01 40 00 "Quality Requirements" for schedule of tests and inspections.
   4. Division Section 01 29 00 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.
   5. Division 01 Section - Closeout Procedures for submitting photographic negatives as Project Record Documents at Project closeout

1.03 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file.
   2. PDF file.
   3. Two paper copies, of sufficient size to display entire period or schedule, as required.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Construction Photographs: Submit electronic copies of each photographic view with Application for Payment.

1. Format: Electronic.
2. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
3. Preconstruction Photographs: Before starting construction, take twelve color photographs of Project site and surrounding properties from different vantage points, as directed by Architect. Show existing conditions adjacent to property.
4. Periodic Construction Photographs: Take twelve color photographs monthly, coinciding with cutoff date associated with each Application for Payment. Photographer shall select vantage points to best show status of construction and progress since last photographs were taken.
    a. Provide electronic copies of photographs to Architect with each Application for Payment.
5. Final Completion Construction Photographs: Take twelve color photographs after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.
6. Identification: Provide an with the following information:
    a. Name of Project.
    b. Name and address of photographer.
    c. Name of Architect.
    d. Name of Contractor.
    e. Date photograph was taken.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
7. Submit a complete set of photographs electronically as a Project Record Document. Identify date photographs were taken.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
1. Scheduled date for first submittal.
2. Specification Division Section number and title.
3. Submittal category (action or informational).
4. Name of subcontractor.
5. Description of the Work covered.
6. Scheduled date for Architect's final release or approval.

G. Daily Construction Reports: Submit at weekly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Unusual Event Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

C. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities including temporary lighting.

1.05 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
      a. At Contractor's option, show submittals on the Preliminary Construction Schedule, instead of tabulating them separately.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

1.06 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
      a. Securing of approvals and permits required for performance of the Work.
      b. Temporary facilities.
      c. Construction of mock-ups, prototypes and samples.
      d. Owner interfaces and furnishing of items.
      e. Interfaces with Separate Contracts.
      f. Regulatory agency approvals.
      g. Punch list.
   3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

4. Submittal Review Time: Include review and resubmittal times indicated in Division Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
   1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
      a. Subcontract awards.
      b. Submittals.
      c. Purchases.
      d. Mockups.
      e. Fabrication.
      f. Sample testing.
      g. Deliveries.
      h. Installation.
      i. Tests and inspections.
      j. Adjusting.
      k. Curing.
      l. Building flush-out.
      m. Startup and placement into final use and operation.
   5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
      a. Structural completion.
      b. Temporary enclosure and space conditioning.
      c. Permanent space enclosure.
      d. Completion of mechanical installation.
      e. Completion of electrical installation.
      f. Substantial Completion.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
   1. Temporary enclosure and space conditioning.
   2. In-Wall Observations prior to two siding partitions.
   3. Above-Ceiling Observations prior to installation of ceiling systems.

F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
   1. See Division Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

G. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered Requests for Information.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.
   5. Pending modifications affecting the Work and the Contract Time.

H. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Final Completion percentage for each activity.

I. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

J. Distribution: Distribute copies of approved schedule to Architect[, Construction Manager,] Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.07 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for the Notice to Proceed.
   1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.08 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Testing and inspection.
   8. Accidents.
   9. Meetings and significant decisions.
   10. Unusual events.
   11. Stoppages, delays, shortages, and losses.
   12. Orders and requests of authorities having jurisdiction.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

C. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
   1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

1.09 AS-BUILT DOCUMENTATION

A. Contractor shall record changes to the Construction Documents where the constructed work deviates from that which is shown. This As-Built documentation shall be recorded in Red • • on a dedicated field set at the trailer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction photographs.
   2. Concealed Work photographs.
   3. Periodic construction photographs.
   4. Final Completion construction photographs.

B. Related Requirements:
   1. Division Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
   2. Division Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
   3. Division Section 02 41 16 "Structure Demolition" for photographic documentation before building demolition operations commence.
   4. Division Section 02 41 19 "Selective Demolition" for photographic documentation before selective demolition operations commence.
   5. Division Section 31 10 00 "Site Clearing" for photographic documentation before site clearing operations commence.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For [photographer] [and] [Web-based photographic documentation service provider].

B. Digital Photographs: Submit image files monthly.
   1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
   2. Identification: Provide the following information with each image description in web-based Project management software site:
      a. Name of Project.
      b. Name and contact information for photographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date photograph was taken.
      f. Description of location, vantage point, and direction.
      g. Unique sequential identifier keyed to accompanying key plan.

1.04 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

C. Metadata: Record accurate date and time and GPS location data from camera.

D. File Names: Name media files with date Project area and sequential numbering suffix.

1.05 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.
   1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   1. Flag excavation areas and construction limits before taking construction photographs.
   2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
   3. Take 20 photographs of existing buildings either on or adjoining property, to accurately record physical conditions at start of construction.
   4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
   1. Underground utilities.
   2. Underslab services.
   3. Piping.
   4. Electrical conduit.
   5. Waterproofing and weather-resistant barriers.

D. Periodic Construction Photographs: Take minimum of 12photographs weekly. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take 50 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
   1. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Three days' notice will be given, where feasible.
   2. In emergency situations, take additional photographs within 24 hours of request.
   3. Circumstances that could require additional photographs include, but are not limited to, the following:
      a. Special events planned at Project site.
      b. Immediate follow-up when on-site events result in construction damage or losses.
      c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
      d. Substantial Completion of a major phase or component of the Work.

e. Extra record photographs at time of final acceptance.
f. Owner's request for special publicity photographs.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section Includes:
   1. Submittal schedule requirements.
   2. Administrative and procedural requirements for submittals.

B. Related Requirements:
   1. Division Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Division Section 01 31 00 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
   3. Division Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   4. Division Section 01 32 33 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
   5. Division Section 01 40 00 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
   6. Division Section 01 77 00 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
   7. Division Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   8. Division Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
   9. Division Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.04 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal Category: Action; informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's[and Construction Manager's] final release or approval.
      g. Scheduled dates for purchasing.
      h. Scheduled date of fabrication.
      i. Scheduled dates for installation.
      j. Activity or event number.

1.05 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Certain Electronic digital data files of the Contract Drawings may be provided by Architect for Contractor's use in preparing submittals.
   1. Architect may furnish Contractor specifically requested digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
      a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. Digital Drawing Software Program: The Contract Drawings are available in PDFs AutoCad or Revit.
      c. Contractor shall execute a data licensing agreement in the form of an Agreement acceptable to Architect, as a prerequisite for Architect providing electronic files. Architect's consultants may require additional agreements as condition for release of their electronic files.

1) Contractor shall bind all parties receiving or using these files to the same agreements.

d. The following digital data files may be furnished for each appropriate discipline:
   1) Site plan.
   2) Architectural floor plans.
   3) Drawings specifically requested by Contractor and agreed to be provided by the Architect and Architect's consultants.

1.06 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:
   1. Project name.
   2. Date.
   3. Name of Architect.
   4. Name of Contractor.
   5. Name of firm or entity that prepared submittal.
   6. Names of subcontractor, manufacturer, and supplier.
   7. Unique submittal number, including revision identifier. Include Specification Division Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
   8. Category and type of submittal.
   9. Submittal purpose and description.
   10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
   11. Drawing number and detail references, as appropriate.
   12. Indication of full or partial submittal.
   13. Location(s) where product is to be installed, as appropriate.
   14. Other necessary identification.
   15. Remarks.
   16. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed .pdf format file, or .pdf files within a .zip file where multiple files cannot be avoided, incorporating submittal requirements of a single Specification Section and transmittal form. Name file according to Submittal number and contents identification.
   2. Architect, and Architect's consultants as applicable, will return electronic submittal with annotations containing their comments as applicable.
   3. Architect retains right to require a paper submittal for shop drawings or other complex submittals that may require substantial notation to be marked on submittal sheets or drawings, at Architect's discretion.

E. Transmittals for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review or discard any submittals received from sources other than the Contractor. Package each submittal individually. Do not group different specification sections together in one submittal. Provide transmittal form transmittal form including the following information:
   1. Submittal number unique identifier, including revision identifier, and with identification of submittal contents as follows:
      a. Submittal number shall use Specification Division Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an revision R with numerical sequence suffix after another decimal point (e.g., 061000.01.R1), or next sequential letter.
      b. Name of Specification Section, with brief description of submittal contents for sections requiring multiple submittals.
   2. Overall sequence number each submittal starting with number 1 for the first submittal transmitted to the Architect, Two (2) for the second and so forth, indicating the chronological submission of each submittal.
   3. Provide means for insertion to permanently record Contractor's review and approval markings. Indicate Contractor's completed review prior to submitting to Architect.
   4. Include the following information for processing and recording:
      a. Project name.
      b. Date of submission to Architect.
      c. Name of Architect.
      d. Name of Contractor.
      e. Additionally, indicate names of the following, as applicable, including indication of the entity that prepared each submittal:
         1) Name of subcontractor.
         2) Name of supplier / vendor.
         3) Name of manufacturer.
      f. Drawing number and detail references, as appropriate.
      g. Location(s) where product is to be installed, as appropriate.
      h. Remarks and other necessary identification.
      i. Signature of transmitter.

1.07 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
      a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
   2. Web-Based Project Management Software: If Contractor utilizes a Web-Based Project Management Software, prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Options: Circle or highlight options to be provided on product data and specification sheets. Identify options requiring selection by Architect with red colored boxes or text.

D. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

E. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Submittals received after 2pm will be logged as the next day.
2. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
3. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
4. Resubmittal Review: Allow 15 days for review of each resubmittal.
5. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
6. Concurrent Consultant Review: Concurrent Review of Submittals: Where two or more submittals require concurrent review, Architect retains the right to hold submittals until all submittals required for concurrent review are received. Architect will notify Contractor of necessity for concurrent submittals after a submittal is received in absence of other related submittals required for concurrent review. The date of receipt of the last submittal required for concurrent review will be considered the date for the start of Architect's review time.
    a. Examples of submittals for concurrent review include, but are not limited to: Roofing and related flashing, accessories, and waterproofing installed by roofer; doors, door frames, and hardware submittals; and window or glazing systems and glass.
    b. Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
    c. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.

F. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.

2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
4. The architect will review the first and a second revised submittal at no cost to the contractor. Additional submittals needed to obtain approval will required time reimbursement from the contractor at the Project Architects standard rate for additional hours spent due to third and subsequent resubmittals of the same product or system.

G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

H. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.08 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Application of testing agency labels and seals.
   g. Notation of coordination requirements.
   h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams that show factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. Paper Sheet Size: Except for templates, patterns, and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format[s]:
    a. PDF electronic file. Architect retains the right, at Architect's sole discretion, to require paper copies for submittals that may require extensive annotation on submittal sheets, and for oversize sheets or other conditions that may be difficult to review in electronic format. In each case, Architect and Architect's consultants involved in review will retain one copy each and return the remainder of copies with annotations.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics and identification information for record.
4. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
5. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Unless otherwise indicated submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
    b. Selector sheets printed by Contractor, and website information, are not acceptable samples for selection. Submit Manufacturer's selector sheets and samples with accurate color and texture representation as applicable.

8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Unless otherwise indicated submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section - Project Management and Coordination.

E. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section - Construction Progress Documentation.

F. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section - Payment Procedures.

G. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
    1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
    2. Manufacturer and product name, and model number if applicable.
    3. Number and name of room or space.
    4. Location within room or space.
    5. Submit product schedule in the following format:
        a. PDF electronic file.

H. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

I. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

J. Certificates:
    1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
    2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

K. Test and Research Reports: Comply with requirements specified in Division 01 Section - Quality Requirements.
1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

L. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section - Closeout Procedures.

M. Maintenance Data: Comply with requirements specified in Division 01 Section - Operation and Maintenance Data.

1.09 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.10 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
   1. Contractor represents by approving and submitting Shop Drawings, Product Data and samples that he has or will coordinate and verify dimensions, all materials, field measurements, field construction criteria, catalog numbers and similar data with requirements of work and of Contract Documents prior to submitting.
   2. Submittals shall bear Contractor's stamp and initials certifying that they have been checked. Submittals without stamp and initials shall be returned un-reviewed.
   3. Contractor's responsibility for deviations or errors and omissions in submittals is not relieved by Architect/ Engineer review of submittals, unless Architect/ Engineer gives specific written acceptance of specific deviations.
   4. Do not proceed with purchasing, fabrication or delivery of work which requires submittals until return of submittals with Architect/Engineer stamp and initials or signature evidencing final review and approval of submittals.
   5. Contractor is responsible for dimensions at job site, quantities, coordinating component parts and trades to effect unified construction and implement construction techniques, safety of incremental units, and satisfactory performance of work in accordance with Contract Documents.
   6. Delays caused by failure of Contractor to check shop drawings and to stamp with this approval shall be Contractor's responsibility.
   7. Coordinate preparation and processing of submittals with performance of work to avoid delays.

B. No extension of time shall be allowed because of failure to properly coordinate and sequence submittals.

C. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section - Closeout Procedures.

D. Approval Stamp: Indicate Contractor's approval for each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
   1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.11 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. No exceptions taken.
   2. Make corrections as noted.
   3. Revise and resubmit.
   4. Rejected.
   5. Other.

B. Submittals or items stamped "No exceptions taken" indicates that Architect does not require resubmittal, and may include comments such as Architect's selection of options.

C. Submittals or items stamped "Make corrections as noted" indicates that Architect does not require resubmittal if the annotated corrections are made. However, items or submittals with this action noted may require resubmittal if:
   1. Contractor believes indicated corrections are not correct responses, and requires subsequent review. Resubmittal should indicate Contractor's reasons for concern and additional supporting information as applicable.
      a. Contractor believes a resubmittal is required to address or confirm additional questions through subsequent review, related to items not considered by the original submittal or that were brought to light by Architect's previous review comments.

D. Revise and resubmit items or submittals stamped "revise and resubmit" and "rejected", to address all comments requiring resubmittal and the reasons for rejection.

E. When "Other" action is indicated, Architect will provide additional comment describing the subsequent action required.

F. Submittals may be stamped with more than one action regarding portions of the submittal, and may note that only portions of the original submittal are required to be resubmitted.

G. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

H. Material Safety Data Sheets (MSDS): Unless submittal of Material Safety Data Sheets is specifically required in Division 02 to 51 Sections to confirm compliance with VOC content of materials, Material Safety Data Sheets are not required submittals and are not subject to Architect's review.

I. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

J. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

K. Architect will return without review submittals received from sources other than Contractor.

L. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   4. Quality Control Inspections Include:
      a. Earthwork and Testing
      b. Drilled Pier Inspection
      c. Concrete Reinforcement Testing and Inspection
      d. Cast-In-Place Concrete Testing and Inspection
      e. Lightweight Structural Concrete
      f. Masonry Mortar and Grouts
      g. Inspecting Structural Steel
      h. Inspection of Open Web Steel Joists
      i. Inspection of Metal Deck
      j. Inspection of Cold Formed Metal Framing

C. Related Requirements:
   1. Division Section 01 21 00 "Allowances" for testing and inspection allowances.
   2. Division Section 01 43 39 "Mockups" for building construction mockups, laboratory mockups and room mockup requirements.
   3. Division 1 Section - Construction Progress Documentation for developing a schedule of required tests and inspections.
   4. Divisions 2 - 48 Sections for additional specific test and inspection requirements.

1.03 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
   1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Mockups: Physical assemblies of portions of the Work constructed to establish the standard by which the Work will be judged. Mockups are not Samples.
   1. Mockups are used for one or more of the following:
      a. Verify selections made under Sample submittals.
      b. Demonstrate aesthetic effects.
      c. Demonstrate the qualities of products and workmanship.
      d. Demonstrate successful installation of interfaces between components and systems.
      e. Perform preconstruction testing to determine system performance.
   2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
   3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect[or Construction Manager].

1.04 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.05 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.06 REGULATORY REQUIREMENTS

A. Copies of Regulations: Obtain copies of the following regulations and retain at Project site to be available for reference by parties who have a reasonable need:
   1. Texas Accessibility Standards.

1.07 INFORMATIONAL SUBMITTALS

A. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
   1. Specification Section number and title.
   2. Entity responsible for performing tests and inspections.
   3. Description of test and inspection.
   4. Identification of applicable standards.
   5. Identification of test and inspection methods.
   6. Number of tests and inspections required.
   7. Time schedule or time span for tests and inspections.
   8. Requirements for obtaining samples.
   9. Unique characteristics of each quality-control service.

B. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.08 REPORTS AND DOCUMENTS

A. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of technical representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement of whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

B. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
   1. Name, address, telephone number, and email address of factory-authorized service representative making report.
   2. Statement that equipment complies with requirements.
   3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   4. Statement of whether conditions, products, and installation will affect warranty.
   5. Other required items indicated in individual Specification Sections.

1.09 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Freestanding Mockups: Before constructing portions of the Work requiring freestanding mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect[or Construction Manager].
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
   7. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   8. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   9. Demolish and remove mockups when directed unless otherwise indicated.

1.10 QUALITY CONTROL

A. Owner Responsibilities: The Owner will hire and pay for tests and inspections, unless explicitly assigned to Contractor. [Tests and inspections, unless explicitly assigned to Owner, are Contractor's responsibility.] Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Contractor shall engage and pay for Mechanical HVAC systems testing adjusting and balancing services. Refer to Division Twenty-Three (23) for Testing, Adjusting and Balancing specifications.
   2. Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   3. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
   4. Costs for retesting and reinspecting construction that replaces or is necessitated by Work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division Section 01 33 00 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents[as a component of Contractor's quality-control plan]. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
   1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.
   2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect[and Commissioning Authority][, through Construction Manager,] with copy to Contractor and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.
   1. Submit log at Project closeout as part of Project Record Documents.

3.02 EARTHWORK TESTING

A. Inspect and approve subgrade prior to placing material.

B. Perform relative compaction testing determined as outlined in ASTM D-1557.

C. Perform moisture density test for each soil type determined as outlined in ASTM D-698.

D. Field density tests shall be made at all fill areas at backfill and at existing subgrade; no less than two tests per lift.

E. Filling and Backfilling:
   1. The Contractor shall make available to the laboratory, adequate samples of each fill and backfill material from the proposed sources of supply not less than 10 days prior to the start of the work.
   2. The Laboratory shall analyze the samples as required to provide a soil description and to determine compliance with the quality requirements.
      a. Test for liquid limit in accordance with ASTM D423.
      b. Test for plastic limit of soils and plasticity index of soils in accordance with ASTM D424.
      c. Test for moisture density relations of soil in accordance with ASTM D698.
   3. Furnish a report for each individual test and state whether sample conforms to the specified requirements or reasons for nonconformance.
   4. Inspect and approve subgrade prior to placement of fill material.
   5. Make in-place compaction tests for moisture content, moisture-density relationship, and density of fill materials.
   6. Perform not less than two compaction tests for each 3,000 SF of surface for each layer of fill under the building and not less than two compaction tests for each 5,000 SF of surface for each layer of fill or undisturbed earth on areas of site to be covered by paving walks or traffic approaches.

3.03 DRILLED PIER INSPECTION

A. The Contractor shall pay for services by a qualified soils laboratory to provide inspection of pier drilling operations as follows:
   1. Qualified soils personnel on site for pier drilling operation inspection.
   2. The laboratory representative shall remain on the site until the Contractor can properly identify the bearing formations with accuracy and without assistance from the laboratory.
   3. Should any unusual conditions be encountered during drilling operations, the laboratory shall be contacted immediately so that additional inspection can be provided.
   4. The lab report shall:
      a. Identify each pier drilled;
      b. The date and time of drilling and concrete placement;
      c. Verify pier and bell diameters;
      d. Depth of pier from surface;
      e. Depth of bearing stratum from surface;
      f. Required and actual penetration;
      g. Depth from top of concrete;
      h. Condition at bottom;
      i. Diameter and length of casing;
      j. Reinforcing used.

B. The Contractor shall allow for a minimum of 2 days notice to be given the laboratory for the inspection work.

3.04 CONCRETE REINFORCEMENT TESTING AND INSPECTION

A. Reinforcing Bar Inspection: Inspect reinforcing bar placement including size, number, configuration, locations, clearances, and related criteria.

B. Reinforcing: Inspect all reinforcing steel prior to placement of concrete for compliance with the Contract Documents and the approved shop drawings. All instances of noncompliance shall be immediately brought to the attention of the Contractor. If uncorrected by the contractor, they shall be listed in the report.
   1. Observe and report the following: number and size of bars; bending; splicing; clearance to forms; clearance between bars; rust, from oil or other contamination; fabrication and installation of embedded metal assemblies, including visual inspection of all welds.

C. Inspector shall have a minimum of three years experience inspecting reinforcing steel in projects of similar size.

3.05 CAST IN PLACE CONCRETE TESTING AND INSPECTION

A. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Architect for final acceptance.

B. Testing agencies shall meet the requirements of "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction", ASTM E-329-70.

C. The following review and testing services shall be performed by the designated laboratory:
   1. The testing laboratory shall review the submitted mix designs for conformance with "Building Code Requirements for Structural Concrete" ACI 318-95.
   2. Secure composite samples in accordance with "Method of Sampling Fresh Concrete" ASTM C172, Current Edition.
   3. Mold and cure five specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexural Specimens in the Field", ASTM C31, Current Edition.
   4. Test specimens in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders", ASTM C39, Current Edition. Two specimens shall be tested at 28 days for acceptance and two shall be tested at 7 days for information. The remaining cylinder shall be tested as directed.
   5. Make one strength test for each 100 cubic yards or fraction thereof, of each mix design or concrete placed in any one day.
   6. Determine slump for each strength test and whenever consistency of concrete appears to vary, using "Method of Test for Slump of Portland Cement Concrete" ASTM C143, Current Edition and air content of normal weight or light weight concrete sample for each strength test.
   7. Determine temperature of concrete sample for each strength test.
   8. Other testing services needed or required shall be paid by the Contractor.
   9. Inspect and control the concrete mixing and loading of transit-mix trucks at the plant at the start of each day's mixing. Check mixing from mixers before mix begins to set and within time limits set forth in ASTM C94. Prevailing conditions shall be compared to the criteria indicated on the appropriate design mix (temperature, moisture, condition of aggregates, etc.).
   10. Any significant deviance shall be immediately reported to the Architect and the design laboratory and corresponding adjustments to the mix made before any materials are discharged.

11. Control the addition of water to the concrete at the job site and the length of time the concrete is allowed to remain in the truck during the pour.
12. Specimens for pumped concrete shall be taken at the discharge and of pumping equipment.
13. Certify each delivery ticket indicating class of concrete delivered (or poured), amount of water added and the time at which the cement and aggregate was discharged into the truck, and the time at which the concrete was discharged from the truck.

D. Provide and maintain for the use of the testing agency adequate facilities for proper curing of concrete test specimens on the project site in accordance with "Methods of Making and Curing Concrete Compression and Flexural Specimens in the Field" ASTM C31, Current Edition.

E. Evaluation and Acceptance:
1. The strength level of the concrete will be considered satisfactory if 90 percent of the strength test results and the averages of all sets of three consecutive strength test results equal or exceed specified strength and no individual test result is below specified strength by more than 500 psi.
2. Completed concrete work will be accepted when the requirements of "Specifications for Structural Concrete for Buildings" ACI 301-84, Chapter 18 have been complied with.
3. In any case, where the average strength of the laboratory control cylinders, as shown by the tests for any portion of the structure, falls below the minimum ultimate compressive strength hereinbefore specified, the Architect shall have the right to require the Contractor to provide improved curing conditions of temperature and moisture to secure the required strength. Also, if the average strength of the laboratory control cylinders should fall so low as to cause the portions of the structure to which the respective unsatisfactory test reports apply to be in question by the Architect, the Contractor shall follow the core procedure set forth in the current edition of ASTM Designation C42. If the results of the core tests indicate, in the opinion of the Architect, that the strength of the structure is inadequate, such replacement, load testing, or strengthening as may be ordered by the Architect shall be provided by the Contractor without cost to the Owner.
4. The testing laboratory shall control field adjustments made to concrete mixes to compensate for field conditions and report same.
5. Wherever the testing laboratory recognizes a trend of decreasing quality in the concrete due to changing reasons, conditions of curing or other cause; this shall be brought to the attention of the Architect, along with a recommendation for corrective action to be taken before the materials fall below the requirements of these Specifications.

F. Reports: In addition, the testing laboratory shall make one copy of the reports to the concrete supplier.

3.06 MASONRY MORTAR AND GROUTS

A. Check mix designs for mortar and grouts. Make tests of mortar and grout to approval for use at project site. Perform four (4) tests in accordance with ASTM C39 for each twenty-five (25) cubic yards of mortar.

B. Submit an additional copy of the laboratory reports to the steel supplier.

C. Compressive Test for Grout:
1. Secure composite samples of grout at the job site in accordance with ASTM C172.

2. Mold and cure three (3) inch diameter by six (6) inch tall cylinders form each sample in accordance with ASTM C31. Supervise the curing protection provided by the contractor for the test specimens in the field and transportation to the laboratory. The test cylinders shall be stored in the field twenty-four (24) hours and then moved to the laboratory and cured in accordance with ASTM C31.
3. Test specimens in accordance with ASTM C39. Two test specimens shall be tested at twenty-eight (28) days for acceptance and one shall be tested at seven (7) days for information.
4. Make one strength test (three cylinders) for each five cubic yards of grout placed, but not less than one strength test for each 5000 square feet of wall area.

3.07 INSPECTING STRUCTURAL STEEL

A. Field Inspection
1. Proper erection of all pieces.
2. Proper installation of all bolts, including checking the calibration of impact wrenches used with high strength bolts.
3. Plumbness of structure and proper bracing.
4. Ultrasonic inspection of all full penetration welds.
5. Record and measure camber of beams upon arrival and before erection with compliance with the specified camber. Measure beam lying flat with web in the horizontal position. Members outside the specified camber tolerance shall be returned to the shop.

B. Qualification of Welders: Before assigning any welder to work covered by this section of the Specifications, the fabricator shall provide the Testing Laboratory with certification that each of the the welders to be employed on the project has passed qualification tests within the last year using procedures covered in the American Welding Society Standard D1.0-63.

C. The contractor shall be responsible for furnishing fabrication and erection inspection and testing of all welds in accordance with AWS D1.1, Chapter Six (6). Submit records of inspections and tests to the Owners testing laboratory for their review.

D. Inspection of shop and field welding shall be "verification inspection" in accordance with Section 6 of AWS D1.1 and as follows:
1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds, and delamination.
2. Ultrasonically test all full penetration welds in accordance with ASTM E164.
3. Root passes shall be thoroughly be inspected for cracks. All cracks shall be gouged out and rewelded to two inches beyond each end of the crack.
4. Mark all welds requiring repairs and make reinspections.
5. The Testing Laboratory inspector shall advise the Owner and Architect of any shop and/or field conditions which, in his opinion, may require further tests and examination. Such further tests shall be performed as authorized by the Owner and Architect.
6. The Owner reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.

E. Inspection of bolted construction shall be in accordance with AISC Specification for Structural Steel Buildings and as follows:
1. All bolts shall be visually inspected to ensure that the plies have been brought into snug contact.

2. High strength bolts shall be inspected in accordance with Section 9 of the AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Bolts are to be fully torqued as required by the AISC specification.
3. For all high strength bolts, the inspector shall observe the required jobsite testing and calibration, and shall confirm that the procedure to be used provides the required tension.

3.08 INSPECTION OF METAL DECK

A. Field Inspection shall consist of the following:
   1. Check types, gages and finishes for conformance with the Contract Documents and shop drawings.
   2. Examination of proper erection of all metal deck, fastenings, reinforcing of holes, miscellaneous deck supports, hanger tabs, shear studs, and deck closures.
   3. Check welder's certificates.
   4. Visual inspection of all welds.

3.09 INSPECTION OF COLD FORMED METAL FRAMING

A. Field Inspection shall consist of the following:
   1. Check types, gages and finishes for conformance with the Contract Documents and shop drawings.
   2. Examination of proper erection of all framing, fastenings, connections and miscellaneous supports.
   3. Check welder's certificates.
   4. Visual inspection of all field and shop welds.

3.10 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.03 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
   1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
   1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
   2.

D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.04 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
   1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
   2. ICC - International Code Council; www.iccsafe.org.
   3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
   1. COE - Army Corps of Engineers; www.usace.army.mil.
   2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
   3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
   4. DOD - Department of Defense; www.quicksearch.dla.mil.
   5. DOE - Department of Energy; www.energy.gov.
   6. EPA - Environmental Protection Agency; www.epa.gov.
   7. FAA - Federal Aviation Administration; www.faa.gov.
   8. FG - Federal Government Publications; www.gpo.gov/fdsys.
   9. GSA - General Services Administration; www.gsa.gov.
   10. HUD - Department of Housing and Urban Development; www.hud.gov.
   11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
   12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
   13. SD - Department of State; www.state.gov.

14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. ABA - Architectural Barriers Act.
   2. ADA - Americans with Disabilities Act.
   3. ADAG - Americans with Disabilities Act Accessibility Guidelines Administered by the United States Access Board; www.access-board.gov.
   4. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
   5. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
   6. DSCC - Defense Supply Center Columbus; (See FS).
   7. FED-STD - Federal Standard; (See FS).
   8. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
      a. Available from Defense Standardization Program; www.dsp.dla.mil.
      b. Available from General Services Administration; www.gsa.gov.
      c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.
   9. MILSPEC - Military Specification and Standards; (See DOD).
   10. PROWAG - Public Right of Way Accessibility Guidelines: https://www.access-board.gov/prowag/
   11. TAS - Texas Accessibility Standards Administered by the Texas Department of Licensing and Registration; www.tdlr.texas.gov.
   12. USAB - United States Access Board; www.access-board.gov.
   13. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
   1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
   2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
   3. CDHS; California Department of Health Services; (See CDPH).
   4. CDPH; California Department of Public Health; Indoor Air Quality Program;www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/Main-Page.aspx.
   5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.

6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.
8. TxDOT; Texas Department of Transportation; www.txdot.gov

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes requirements for temporary facilities and controls, including utilities, support facilities, and security and protection facilities.
   1. Temporary utilities
      a. Sewers and drainage.
      b. Water service and distribution.
      c. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
      d. Heating and cooling facilities.
      e. Ventilation.
      f. Electric power service.
      g. Lighting.
   2. Support facilities
      a. Temporary roads and paving.
      b. Dewatering facilities and drains.
      c. Project identification and temporary signs.
      d. Waste disposal facilities.
      e. Field offices.
      f. Storage and fabrication sheds.
      g. Lifts and hoists.
      h. Temporary stairs.
      i. Construction aids and miscellaneous services and facilities.
   3. Security and protection facilities
      a. Environmental protection.
      b. Stormwater control.
      c. Tree and plant protection.
      d. Pest control.
      e. Site enclosure fence.
      f. Security enclosure and lockup.
      g. Barricades, warning signs, and lights.
      h. Temporary enclosures.
   4. Temporary partitions.
      a. Fire protection.

B. Related Requirements:
   1. Division Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

2. Division Section 01 12 00 "Multiple Contract Summary" for responsibilities for temporary facilities and controls for projects utilizing multiple contracts.
3. Division Section 01 21 00 "Allowances" for allowance for metered use of temporary utilities.
4. Division 1 Section - Submittal Procedures for procedures for submitting copies of implementation and termination schedule and utility reports.
5. Division 1 Section - Execution Requirements for progress cleaning requirements.
6. Divisions 2 through 48 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.03 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.04 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

1.05 INFORMATIONAL SUBMITTALS

A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.06 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Accessible Temporary Egress: Comply with applicable provisions in [the United States Access Board's ADA-ABA Accessibility Guidelines] [and] [ICC/ANSI A117.1].

1.07 PROJECT CONDITIONS

A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
   1. Keep temporary services and facilities clean and neat.
   2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

C. Lumber and Plywood: Comply with requirements in Division 6 Section - Carpentry.

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

E. Paint: Comply with requirements in Division 9 Section - Painting.

F. Tarpaulins: Fire-resistive labeled with flame-spread rating of fifteen (15) or less.

G. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

H. Water: Potable.

2.02 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with lockable entrances, operable windows, and serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents, including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
   3. Drinking water and private toilet.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 degrees F.
   5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
   1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at forty-five (45) to fifty-five (55) degrees F.

E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

F. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

G. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.03 EQUIPMENT

A. General: Provide equipment suitable for use intended.

B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Division Section 01 77 00 "Closeout Procedures."

D. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.01 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.02 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Division Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.03 TEMPORARY UTILITY INSTALLATION

A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to [municipal system] [private system indicated] as directed by authorities having jurisdiction.

C. Water Service: Provide temporary water service as required for construction.
   1. Provide rubber hoses as necessary to serve Project site.
   2. Install water service and distribution piping in sizes and pressures adequate for construction.
   3. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot (30-m) hose. Provide one hose at each outlet.
   4. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
   5. Provide pumps to supply a minimum of 30-psi static pressure at highest point. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
   1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
   2. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

3. Toilets: Install self-contained toilet units or install toilet facilities connected to local water and sewer lines. Shield toilets to ensure privacy. Provide separate facilities for male and female personnel.
    a. Provide lavatories, mirrors, urinals, and water closets. Provide only potable-water connections. Provide individual compartments for water closets. Provide suitable enclosure with nonabsorbent sanitary finish materials and adequate heat, ventilation, and lighting.
4. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
    a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
5. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
    a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at forty-five (45) to fifty-five (55) degrees F.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
    1. Maintain a minimum temperature of fifty (50) degress F in permanently enclosed portions of building for normal construction activities, and sixty-five (65) degrees F for finishing activities and areas where finished Work has been installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
    1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics including receptacles as required for construction operations.
    1. Install electric power service overhead unless otherwise indicated.
    2. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
    3. Provide warning signs at power outlets other than 110 to 120 V.
    4. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
    5. Provide metal conduit enclosures or boxes for wiring devices.
    6. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
3. Provide one 100-W incandescent lamp every 50 feet in traffic areas.
4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
5. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
6. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service throughout construction period in common-use facilities for use by all construction personnel. Install land-based telephone line(s) for each field office.

3.04 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:
1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
2. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. Comply with NFPA 241.
3. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas in accordance with Division Section 31 20 00 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proof rolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course in accordance with Division Section 32 12 16 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads.
2. Protect existing site improvements to remain, including curbs, pavement, and utilities.

3. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Storage and Staging: Use designated areas of Project sitefor storage and staging needs.

F. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction in applicable sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. . Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
   3. Remove snow and ice as required to minimize accumulations.

G. Project Signs: Provide Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
   1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
   2. Prepare temporary signs to provide directional information to construction personnel and visitors.
   3. Construct signs of exterior-type Grade B-B high-density concrete-form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
   4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
   5. Maintain and touchup signs so they are legible at all times.
   6. Identification Signs: Provide Project identification signs as indicated on Drawings.
   7. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   8. Maintain and touch up signs, so they are legible at all times.

H. Waste Disposal Facilities: Comply with requirements specified in Division Section 01 74 19 "Construction Waste Management and Disposal."
   1. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 1 Section - Execution Requirements for progress cleaning requirements. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Division Section 01 73 00 "Execution."
      a. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
      b. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.05 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
   1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
   1. Comply with work restrictions specified in Division Section 01 10 00 "Summary."

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Tree and Plant Protection: Comply with requirements specified in Division Section 01 56 39 "Temporary Tree and Plant Protection."

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals, so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence with lockable gates in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
   1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
   2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
   3. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner. Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

I. Barricades, Warning Signs, and Lights: Comply with standards and code requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
   1. For safety barriers, sidewalk bridges, and similar uses, provide minimum 5/8-inch thick exterior plywood.

J. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
   2. Vertical Openings: Close openings of 25 sq. ft.or less with plywood or similar materials.
   3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
   4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
   5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

L. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
   1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      a. Field Offices: Class A stored-pressure water-type extinguishers.
      b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
      c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Provide temporary key boxes and knox padlocks for gates and secured areas throughout construction as required by authorities having jurisdiction.
   4. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
   5. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
   6. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.

7. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
8. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
9. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.06 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan. Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.07 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Temporary Facility Changeover: Except for using permanent fire protection as soon as available do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
1. Division Section 01 10 00 "Summary" for Contractor requirements related to Owner-furnished products.
2. Division Section 01 21 00 "Allowances" for products selected under an allowance.
3. Division Section 01 25 00 "Substitution Procedures" for requests for substitutions.
4. Division Section 01 42 00 "References" for applicable industry standards for products specified.
5. Division Section 01 7 70 "Closeout Procedures" for submitting warranties.
6. Divisions 2 - 48 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
   1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Division Section number and title and Drawing numbers and titles.
   2. Data indicating compliance with the requirements specified in Part Two (2) "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Division Section 01 33 00 "Submittal Procedures."

F. Substitution: Refer to Division Section 01 25 00 "Substitution Procedures" for definition and limitations on substitutions.

G. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

H. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.04 SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.
      g. Projected delivery date or time span of delivery period.
      h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
4. Completed List: Within thirty (30) days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within fifteen (15) working days of receipt of completed product list if there are objections to the list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement that products comply with the Contract Documents.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section - Submittal Procedures. Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
1. Resolution of Compatibility Disputes between Multiple Contractors:
    a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.
    b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.
3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.06 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:
   1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
   2. Store products to allow for inspection and measurement of quantity or counting of units.
   3. Store materials in a manner that will not endanger Project structure.
   4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
   5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
   6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   7. Protect stored products from damage and liquids from freezing.
   8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.08 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
   3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   7. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
      a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
   1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
   2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
   3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   4. reduction of schedule..
      a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
   5. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
      a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."

b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

6. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
7. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
8. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
   a. For approval of products by unnamed manufacturers, comply with requirements in Division Section 01 25 00 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
   1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   2. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

E. Allowances: Refer to individual Specification Sections and "Allowance" provisions in Division 1 for allowances that control product selection and for procedures required for processing such selections.

2.02 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:
   1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
   2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
   3. Evidence that proposed product provides specified warranty.
   4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
   5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Division Section 01 33 00 "Submittal Procedures."
   1. Form of Approval of Submittal: As specified in Division Section 01 33 00 "Submittal Procedures."
   2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
   1. Pre-Installation Meetings
   2. Construction layout.
   3. Field engineering and surveying.
   4. Installation of the Work.
   5. Cutting and patching.
   6. Coordination of Owner's portion of the Work.
   7. Coordination of Owner-provided, Contractor installed products.
   8. Progress cleaning.
   9. Starting and adjusting.
   10. Protection of installed construction.
   11. Correction of the Work.

B. Related Requirements:
   1. Division Section 01 10 00 "Summary" for coordination of Owner-furnished products, Owner-performed work , Owner's separate contracts, and limits on use of Project site.
   2. Division Section 01 33 00 "Submittal Procedures" for submitting surveys.
   3. Division Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
   4. Division Section 02 41 19 "Selective Demolition" for demolition and removal of selected portions of the building.
   5. Division Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.03 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.04 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Professional Engineer Qualifications: Refer to Division Section 01 40 00 "Quality Requirements."

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.[Operational elements include the following:]
      a. Primary operational systems and equipment.
      b. Fire separation assemblies.
      c. Air or smoke barriers.
      d. Fire-suppression systems.
      e. Plumbing piping systems.
      f. Mechanical systems piping and ducts.
      g. Control systems.
      h. Communication systems.
      i. Fire-detection and -alarm systems.
      j. Conveying systems.
      k. Electrical wiring systems.
      l. Operating systems of special construction.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Exterior curtain-wall construction.
      d. Sprayed fire-resistive material.
      e. Equipment supports.
      f. Piping, ductwork, vessels, and equipment.
      g. Noise- and vibration-control elements and systems.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
   3. In the event of any inconsistency or conflict, between existing conditions and the bidding documents, immediate notice of such inconsistency or conflict shall be given to the Architect. Do not undertake any phase of the work affected by such inconsistency or conflict, pending the issuance of instructions by the Architect.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
   2. List of detrimental conditions, including substrates.
   3. List of unacceptable installation tolerances.
   4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than five days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Division Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect[and Construction Manager] promptly.

B. Engage a land surveyor experienced in laying out the Work, using the following accepted surveying practices:
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect[and Construction Manager] when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Elevations of existing grades, floors, tops of walls, parapets, beams and locations of existing columns, walls and the like are based on survey documents or on drawings of the existing building furnished by the Owner. The Architect assumes no responsibility for the accuracy of the information on existing drawings. It is the intent of the Contract Drawings to integrate new work with existing improvements and for the Contractor to verify actual conditions.

E. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

F. Subcontractors shall verify with the General Contractor the exact field location of all rough-in dimensions, taking into account location of walls, partitions and equipment. Special attention should be paid to clearances as required for compliance with Americans with Disabilities Act Accessibility Guidelines (ADAAG) in the state having jurisdiction, including any applicable revisions. Any cost in relocation of items due to that subcontractor's error, will be borne by him at no additional cost to the Owner.

G. Where equipment involving more than one subcontractor is installed at a common location and no specific location has been determined, it is the Contractor's responsibility to check with the Architect for the actual rough-in dimensions for such equipment. If for some reason the rough-in has not been checked and a subcontractor has installed his equipment, remaining subcontractors shall align their equipment as closely as possible to the installed equipment. Alignment shall mean centered vertically, equally space and centered horizontally. This alignment applies to bells, alarms, thermostats, switches, handles, access panels, etc. Any items not installed in alignment shall be relocated by the Contractor at his own expense with damaged surfaces properly repaired.

H. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect[and Construction Manager].

3.04 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect[or Construction Manager]. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect[and Construction Manager] before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.05 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb, and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Division Section 01 77 00 "Closeout Procedures" for repairing or removing and replacing defective Work.

K. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.06 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Division Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to [minimize] [prevent] interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

B. Owner Supplied, Contractor Installed, products
1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Division Section 01 10 00 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products

C. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Pre-installation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.08 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 degrees F.

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    a. Use containers intended for holding waste materials of type to be stored.
4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division Section 01 50 00 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.09 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Division Section 01 91 13 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Division Section 01 40 00 "Quality Requirements."

3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section - Cutting and Patching.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

C. Restore permanent facilities used during construction to their specified condition.

D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

F. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

G. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work

B. Related Requirements:
   1. Division 01 - Substantial Completion Readiness Checklist.
   2. Division Section 01 29 00 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
   3. Division Section 01 32 33 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
   4. Division 01 Section - Execution Requirements for progress cleaning of Project site.
   5. Division Section 01 78 23 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
   6. Division Section 01 78 39 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   7. Division Section 01 79 00 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.
   8. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.03 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.04 QUALITY CONTROL

A. Closeout Conference: Schedule and conduct a closeout conference, to be held one to three months prior to the anticipated date of substantial completion. Required attendees include Contractor's on-site personnel and Project Manager, Architect, and designated Owners representative(s). Discuss any items that could impede progress to scheduled date of substantial completion, closeout procedures, and the following:

1. Any pending or anticipated time extension requests that may affect the projected date of Substantial Completion.
2. Progress or scheduled progress of Contractor's preparation of project record documents.
3. Current status of Contractors As-Built documents, and plans to address any deficiencies.
4. Required Owner training, and process for scheduling training with Owner's staff.
5. Required submittals to Architect prior to requesting inspection for Substantial Completion, including the Substantial Completion Readiness Checklist.
6. Requirements for testing and balancing and for submitting Test / Adjust / Balance reports.
7. Maximum time allowed between Substantial and Final Completion, and Contractor's plan to ensure that all incomplete work is completed on schedule.
8. Written action plans required to address deficiencies (if any).

B. Contractor shall record Closeout Conference minutes, including all Contractors action items, and distribute to attendees within one week. Contractor shall attach plans to address deficiencies for any items identified in the Closeout Conference that require a written action plan.

1.05 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Substantial Completion Readiness Checklist form: Fully filled out, submitted prior to or concurrent with requesting a date for substantial completion. See attached form.

1.06 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.08 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit a fully filled out Substantial Completion Readiness Checklist (see attachment to this specification Section).
3. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
4. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

5. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section.
6. Submit testing, adjusting, and balancing records.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Review the Substantial Completion Readiness Checklist form (attached). Address habitual punch list items to the extent possible and note remaining items in Contractors List of Incomplete Items. Ensure that other items indicated on the Checklist can or will be complete by the required dates and note any deficiencies on the checklist form prior to submitting it to Architect.
2. Advise Owner of pending insurance changeover requirements.
3. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
4. Complete startup and testing of systems and equipment.
5. Perform preventive maintenance on equipment used prior to Substantial Completion.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division Section 01 79 00 "Demonstration and Training."
7. Advise Owner of changeover in utility services.
8. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Complete final cleaning requirements.
11. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.09 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Division Section 01 29 00 "Payment Procedures."

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect[and Construction Manager] will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.10 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first , listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.
4. Submit list of incomplete items in the following format:
    a. PDF Electronic File: Architect[, through Construction Manager,] will return annotated file.

1.11 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual, with tabs between CSI division sections; i.e.; group all Division-7 building components under one tab, group all Division-8 components under another tab, etc.. Utilize CSI specification sections 2 through 33 for each division tab.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
   1. Submit on digital media acceptable to Architect.

E. Warranties in Paper Form: (If required by Owner)
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
   2. Provide title page, Contractors general One-Year Warranty (corrective period) with agreed upon date and signature of authorized representative, table of contents, and subcontractor list at the beginning of each binder.
   3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   5. Provide three copies of each Final Warranty binder.

F. Provide additional copies of each warranty to include in operation and maintenance manuals. Such copies shall be identical to the warranties included in the warranty binders, but may be photocopies including for warranties that require wet signatures for the original actuated copies.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
i. Vacuum and mop concrete.
j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
l. Remove labels that are not permanent.
m. Wipe surfaces of mechanical and electrical equipment[, elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
p. Clean ducts, blowers, and coils[if units were operated without filters during construction or that display contamination with particulate matter on inspection].
    1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.
q. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
r. Clean strainers.
s. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Division Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste-disposal requirements in Division Section 01 50 00 "Temporary Facilities and Controls."

3.02 REPAIR OF THE WORK

A. Complete repair and restoration operations required by Division Section 01 73 00 "Execution" before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
    1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.

2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
   a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

01 77 01 - SUBSTANTIAL COMPLETION READINESS CHECKLIST

When requesting Architect's Inspection for Substantial Completion, the Contractor shall submit the following checklist and shall provide not less than 7 working days advance notice to the Architect and Owner (unless otherwise mutually agreed). Fill out form completely, including comments indicating reasons for incomplete items and anticipated completion as applicable. Architect will provide an editable version of this form upon request. The Architect will not schedule an Inspection for Substantial Completion without first receiving this completed form from the Contractor. Deficiencies in one or more items does not necessarily indicate that the project is not ready for inspection. However, incomplete items that preclude Owner's beneficial occupancy, or that constitute a lack of readiness for inspection, either individually or in aggregate, are grounds for the Architect to deny scheduling of the inspection. All deficiencies shall be reflected in Contractor's punch list. The Architect's inspection for substantial completion shall not be scheduled on a day when fire alarm testing or other extremely noisy construction activities are scheduled.

Item	Y	N	N/A	Documents / Actions Required
1				Contractor's Punch List (and Habitual Punch List Items Checked) Submit Contractor's Punch List, noting all remaining work items with date scheduled for completion or correction. Contractor shall update and submit / re-submit list as applicable minimum of 2 days and maximum of 5 days prior to the requested date for Architect's Inspection, noting items contractor has corrected and that are still pending. Additionally, Contractor shall field verify the following habitual check list items in preparing the Contractor's Punch List, and indicate that they have been verified by the checklist below:
	Comments:			
				Confirm there are no outstanding items on the Contractor's Punch List that would adversely affect the Owner's beneficial occupancy.
	Comments:			
				Confirm that all outstanding items on Contractor's Punch List can be completed, and are scheduled for completion, within a maximum of 30 calendar days, or other duration as allowed by the Contract Documents or mutually agreed between Contractor, Architect, and Owner.
	Comments:			
				The area of the Facility included in the Contractor's Work has been, or will be by the requested date, completely cleaned and ready for Architect's Inspection.
	Comments:			
				Temporary Facilities have been removed, or will be removed, by requested date of Inspection (except for any items otherwise mutually agreed to remain after the date of Owner's beneficial occupancy).
	Comments:			
				All paving sealants installed, and zip strips removed where applicable.
	Comments:			

				All millwork / cabinets checked that all hardware is installed. Doors, drawers and moving parts checked for smooth operation through full range of motion. Hinges adjusted for alignment of adjacent doors.
	Comments:			
				Remove loose fasteners and debris from roofs, parking lot, and site.
	Comments:			
				All door and window hardware installed by Contractor checked for missing items.
	Comments:			
				All operable windows checked for smooth operation through full range of movement. Locking devices all aligned and properly engage. Screens installed where applicable.
	Comments:			
				All door silencers in place. Soiled / painted silencers replaced with new.
	Comments:			
				All doors / hardware installed by Contractor checked for proper operation. This includes but is not limited to: Proper latching and locking operation, doors not binding on hinges or in door frames, closers and pivots adjusted to self-close and latch, and to operate in compliance with Texas Accessibility Standards, hold-opens verified adjusted for operation and release, hold-open function in closers tested where applicable, flush bolts throw fully into frames and floors, and proper operation of electronic hardware. Contractor's final submission of Contractor's punch list prior to Inspection shall include any observed deficiencies.
	Comments:			
				All overhead doors and other mechanically operated doors, thoroughly checked for proper adjustment and operation of all control functions, binding in tracks, and any other deficiencies. Corrections made as required.
	Comments:			
				Check all ceiling tile for nicks, stains, and other damage, and replace with new as required. Check new ceiling grid for warp and damage and repair as required. Verify all tile is seated in the grid.
	Comments:			
				All interior finishes work complete and ready for Architect's inspection (other than minor touch-up).
	Comments:			
				All interior signage installed and accounted for.
	Comments:			
				All equipment and appliances installed by Contractor tested for proper adjustment and operation.

	Comments:			
				All pipes labeled as required by Contract Documents.
	Comments:			
				All exposed pipe penetrations checked for sealants (fire sealant where applicable), and escutcheons, as required by Contract Documents.
	Comments:			
				Remove all faucet aerators, flush lines of dirt, sand, and debris, and reinstall aerators. Test all faucet handles for correct hot and cold line connection / control.
	Comments:			
				Water closets and urinal fixtures tested for proper flush operation.
	Comments:			
				HVAC is functioning and humidity control is acceptable.
	Comments:			
				Fans operating correctly including their controls.
	Comments:			
				HVAC Filters to be replaced just prior to substantial completion with new filters.
	Comments:			
				HVAC ducts checked for construction dust and debris contamination and cleaned as applicable in compliance with requirements of the Contract Documents.
	Comments:			
				Electrical panels / schedules completely filled out and labeled, in compliance with Contract Documents. (And other devices and circuits labeled where required by Contract Documents)
	Comments:			
				Check all open electrical boxes have cover plates and screws, and painted where applicable.
	Comments:			
				Test all power outlets and switches.
	Comments:			
				Test all data outlets (if installed by this Contract)
	Comments:			
				Verify water heaters are installed with proper disconnects. [Boilers have passed State inspection.]

	Comments:			
				All lighting and lighting control systems have been tested for proper operation. Vacancy and occupancy sensors adjusted to proper duration and tested for sensitivity. Debug / repair as required. Replace burned out or inoperable lamps / modules as required by Contract Documents.
	Comments:			
				All landscaping, turf, and irrigation (or temporary irrigation as applicable) has been or will be installed / seeded by the requested date for Architect's inspection. (Except as otherwise agreed or otherwise required due to planting season. Note any pending installation on Contractor's punch list.)
	Comments:			
2				Final Inspections All required final inspections have or will be passed by date of substantial completion (local and State). Or, if any will be remaining the status will not affect Owner's beneficial occupancy and has been agreed to be acceptable by Owner.
	Comments:			
3				Certificate of Occupancy A Certificate of Occupancy has been or will be issued by the requested date for inspection. Or if not, a Temporary Certificate of Occupancy has been issued, and any outstanding items will not affect beneficial occupancy and are scheduled for correction and final inspection within 30 days or less.
	Comments:			
4				Owner Notification Owner has been notified by Contractor with adequate time of pending changeover in utilities, insurance, and building and site security, in accordance with the Contract Documents.
	Comments:			
5				Extra Materials All extra materials, attic stock, and maintenance tools required by the construction documents to be provided by Contractor have been delivered to Owner (submit transmittals indicating each item, quantities and receipt). Any outstanding extra materials not yet delivered are acceptable to Owner for beneficial occupancy and are noted in Contractor's punch list, with anticipated delivery dates.
	Comments:			
6				Final Keying Final key cores and keys as applicable to project scope have or will be installed, or have been delivered Owner's installer, in time for the requested date of substantial completion. This includes all keys for any locking cabinets, lockers, toilet accessories, etc. as applicable.
	Comments:			

7				Security and Access Control Applicable intrusion detection, security camera, access control, gate operators, and similar systems required for access and security are or will be operational in time for requested date for substantial completion. (Where these systems are not the installed as part of this contract, Contractor has made due effort to coordinate with Owner's separate contract or vendor for timely completion).
	Comments:			
8				Owner Training All Owner training required by the Contract Documents has been scheduled with Owner, or Owner Training Conference has been conducted and Owner has agreed that any training that will not be performed by the date of substantial completion is acceptable to occur later for the purpose of achieving beneficial occupancy.
	Comments:			
9				Testing Adjusting and Balancing Report A copy of the initial HVAC TAB report has been submitted to the Architect. Indicate in comments anticipated schedule for final and opposite season TAB reports. Any deficiencies in the initial report are included in Contractor's punch list, and corrections and re-testing scheduled within the allowable duration for Final Completion.
	Comments:			
10				Commissioning Commissioning required by the Contract Documents has begun (and if required by Contract Documents will be complete) by the requested date of inspection. Confirm coordination with Commissioning Agent. Submit most recent commissioning report to Architect, and include noted deficiencies in Contractor's punch list.
	Comments:			
11				Record Drawings To the best of Contractor's knowledge, annotations on record drawings are up to date. Preliminary review copy of marked up Record Drawings has been or will be submitted to Architect for review prior to the requested date for inspection.
	Comments:			
12				Operations and Maintenance Manuals Preliminary review copy of O&M binders has been or will be submitted to Architect for review prior to the requested date for inspection.
	Comments:			
13				Record Submittals / Product Data Preliminary review copy of project Record Submittals (if required) has been or will be submitted to Architect for review prior to the requested date for

				inspection.
	Comments:			
14				Warranties Binder Preliminary review copy of warranties binder has been or will be submitted to Architect for review prior to the requested date for inspection.
	Comments:			
15				Roofing Manufacturer's Warranty Inspection Roofing manufacturer's inspection has been performed and Roof Warranty has been achieved by requested date for inspection. Or if warranty is not achieved, only minor corrections remain to achieve warranty, and submit Manufacturer's deficiency list/report with Contractor's punch list.
	Comments:			
16				[LEED] [CHPS] [Green Building Program] Requirements Paperwork and submission of data to applicable green building certification program, is up to date and complete and has been submitted to maximum extent possible, and in accordance with the Contract Documents and agreed timeline for submissions by the Contractor.
	Comments:			
17				Owner's Separate Contracts Coordination Confirm Contractor has performed required scheduling and other coordination with Owner's separate contract work as necessary to be ready for beneficial occupancy upon the requested date of Substantial Completion. This may include, but is not necessarily limited to, such things as [structured cabling and telecommunications,][A/V and IT equipment,][radio equipment,][fire station alerting system,][and FF&E delivery and installation].
	Comments:			
18				Indoor Air Quality Program If required by Contract Documents, indoor air quality testing has been performed and passed. Or if allowed in lieu of testing, building flush-out has or will be performed by the requested date for substantial completion to the extent that flush out is required to precede occupancy; and filters will be replaced promptly as required. If testing has been performed and failed, note corrective action and schedule for re-testing as applicable on Contractor's punch list.
	Comments:			

END OF SECTION

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Emergency Operation and Maintenance Manuals
   2. Operation and maintenance documentation directory manuals.
   3. Systems and equipment operation manuals.
   4. Systems and equipment maintenance manuals.
   5. Product maintenance manuals.
   6. Format
      a. PDF electronic files
      b. Paper Copies

B. Related Requirements:
   1. Division Section 01 12 00 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
   2. Division Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   3. Division Section 01 91 13 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
   4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.03 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.04 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.
   2. Submit three paper copies (if required by Owner).

C. Initial Manual Submittal: Submit electronic draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

E. Comply with Division Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.05 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

B. Paper Copies: Submit manuals in the form of hard-copy, bound and labeled volumes (if required by Owner).
   1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name,[and] subject matter of contents[, and indicate Specification Division Section number on bottom of spine]. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment. Enclose title pages and directories in clear plastic sleeves.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
    1. Title page.
    2. Table of contents.
    3. Subcontractor list
    4. Manual contents.

B. Title Page: Include the following information:
    1. Subject matter included in manual.
    2. Name and address of Project.
    3. Name and address of Owner.
    4. Date of submittal.
    5. Name and contact information for Contractor.
    6. Name and contact information for Construction Manager.
    7. Name and contact information for Architect.
    8. Name and contact information for Commissioning Authority.
    9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
    10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
    1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Subcontractor List: Organize subcontractor list by CSI specification section, as listed in the Project Manual table of contents. Provide contact name, street address (no P.O. Box numbers) and contact phone and fax number. If changes were made during the course of the project, utilize final contract company for each component of the work. List all contractors used on project, even if subcontracted to a different subcontractor, i.e; if earthwork subcontractor is contracted by the paving subcontractor, list both subcontractors.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline four (4), "Preparation of Operating and Maintenance Documentation for Building Systems."

G. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

H. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes (if required by Owner).
   1. Binders: Heavy-duty, three-ring, vinyl-covered, [loose-leaf] [post-type] binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
      a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
      b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name,[and] subject matter of contents[, and indicate Specification Section number on bottom of spine]. Indicate volume number for multiple-volume sets.
   2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
   4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

1.07 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate comprehensive manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
   2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
   3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

B. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.08 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.

8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.09 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.

3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.

4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (not used)

PART 3 - EXECUTION (not used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:
   1. Record Drawings.
   2. Record specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Division Section 01 12 00 "Multiple Contract Summary" for coordinating Project Record Documents covering the Work of multiple contracts.
   2. Division Section 01 73 00 "Execution" for final property survey.
   3. Division Section 01 77 00 "Closeout Procedures" for general closeout procedures.
   4. Division Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   5. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.03 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit one set(s) of marked-up record prints.
   2. Number of Copies: Submit copies of Record Drawings as follows:
      a. Initial Submittal:
         1) Submit one paper-copy set(s) of marked-up record prints.
         2) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
         3) Submit Record Digital Data Files and one set(s) of plots.
         4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned Record Prints and three set(s) of file prints.
         2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy(s) and one three thumb drives with PDF electronic files of annotated Project Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit one paper copy(s) and three thumb drives with PDF electronic files of annotated of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
   1. Unless more stringent requirements are called for in other related specifications, include the following:
      a. Two (2) copies of irrigation system laminated zone map and scanned electronic file in PDF or JPEG format.
      b. Electronic copy of Contractor's meeting minutes, and of A/E's field reports.
      c. Electronic copy of Addenda.
      d. Electronic copy of Architects Supplemental Instructions.
      e. Electronic copy of Change Orders, Contingency Expenditures, Change Directives, and similar contract modifications.
      f. Electronic copy of Requests For Information.
      g. Attendance sign-in lists for training sessions.

E. Reports: Submit written reports weekly indicating items incorporated into Project Record Documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.04 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order or Construction Change Directive.
      k. Changes made following Architect's written orders.
      l. Details not on the original Contract Drawings.
      m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

1.05 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
   5. Note related Change Orders[, Record Product Data,] and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file .

1.06 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

C. Format: Submit Record Product Data as annotated PDF electronic file .
   1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.07 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file .

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.08 MAINTENANCE OF RECORD DOCUMENTS

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Division Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.03 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.04 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.05 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.

c. Operating standards.
d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Systems and equipment operation manuals.
   c. Systems and equipment maintenance manuals.
   d. Product maintenance manuals.
   e. Project Record Documents.
   f. Identification systems.
   g. Warranties and bonds.
   h. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.
5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.
7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning.
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.

g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

1.06 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.07 INSTRUCTION

A. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner, through Architect,with at least seven days' advance notice.

B. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

C. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 79 00

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.
   2. Salvage of existing items to be reused or recycled.

B. Related Requirements:
   1. Section 31 10 00 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.
   2. Section 33 05 00 “Common Work Results for Utilities” for abandonment of utilities by removal or in place.

1.03 DEFINITIONS

A. Demolish or Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.04 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
   1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.05 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be selectively demolished.
   2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   4. Review areas where existing construction is to remain and requires protection.

1.06 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:
   1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.
   2. Interruption of utility services. Indicate how long utility services will be interrupted.
   3. Coordination for shutoff, capping, and continuation of utility services.
   4. Use of site stairs

C. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including site items, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 32 33 "Photographic Documentation." Submit before Work begins.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.07 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.08 FIELD CONDITIONS

A. Owner will occupy portions of building or site immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect and Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. Hazardous materials will be removed by Owner before start of the Work.
   2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
   1. Maintain fire-protection facilities in service during selective demolition operations.

G. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.09 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Materials for utility modification shall meet applicable TCEQ, AWWA, and local AHJ requirements and be suitable for use with utility material.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video, and templates.
   1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems.
   1. Arrange to shut off utilities with utility operator.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems.

3.03 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent property, buildings, and facilities to remain.
   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection.

B. Remove temporary barricades and protections where hazards no longer exist.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Proceed with selective demolition systematically.
   2. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic.

D. Removed and Salvaged Items:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area designated by Owner.
   5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:
   1. Clean and repair items to functional condition adequate for intended reuse.
   2. Pack or crate items after cleaning and repairing. Identify contents of containers.
   3. Protect items from damage during transport and storage.
   4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to full depth at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.07 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 03 11 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.01 REFERENCED DOCUMENTS

A. The Drawings, Division 01 Specifications, and General Provisions and General and Supplemental Conditions of the Contract apply to work of this Section.

1.02 WORK INCLUDED

A. Design, fabrication, erection, and stripping of formwork for cast-in-place concrete including shoring, reshoring, falsework, bracing, proprietary forming systems, prefabricated forms, void forms, permanent metal forms, bulkheads, keys, blockouts, sleeves, pockets, and accessories. Erection shall include installation in formwork of items furnished by other trades.

1.03 RELATED SECTIONS

A. Division 01 Section - Quality Requirements for Testing Laboratory Services.

B. Division 03 Section - Reinforcing Steel.

C. Division 03 Section - Cast in Place Concrete.

D. Division 03 Section - Architectural Concrete.

E. Division 32 Section - Portland Cement Concrete Paving.

1.04 REFERENCES

A. The latest adopted edition of all standards referenced in this section shall apply, unless noted otherwise:
   1. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials.
   2. ACI 301 - Specifications for Structural Concrete for Buildings.
   3. ACI 347R - Guide to Formwork for Concrete.
   4. ACI SP-4 - Formwork for Concrete.

1.05 QUALITY ASSURANCE

A. Construct and erect concrete formwork in accordance with ACI 117, 301 and 347R.

B. Forms, shores, reshores, falsework, bracing, and other temporary supports shall be designed by the Contractor to support all loads imposed during construction including weight of construction equipment, live loads, and lateral loads due to wind and imbalance or discontinuity of building components.

C. The Contractor shall be responsible for determining when temporary supports and bracing may be safely removed, but in no case shall the curing time before form removal be less than specified herein.

1.06 TOLERANCES

A. Construct formwork to provide completed concrete surfaces complying with the following tolerances:
   1. Vertical alignment:
      a. Lines, surfaces and arises less than 100 feet in height - 1 inch.
      b. Outside corner of exposed corner columns and control joints in concrete exposed to view less than 100 feet in height - 1/2 inch.

2. Lateral alignment:
    a. Members - 1 inch.
    b. Centerline of openings 12 inches or smaller and edge location of larger openings in slabs - 1/2 inch.
    c. Sawcuts, joints, and weakened plane embedments in slabs - 3/4 inch.
3. Level alignment:
    a. Elevation of slabs-on-grade - 3/4 inch.
    b. Elevation of top surfaces of formed slabs before removal of shores - 3/4 inch.
    c. Elevation of formed surfaces before removal of shores - 3/4 inch.
    d. Lintels, sills, parapets, horizontal grooves, and other lines exposed to view - 1/2 inch.
4. Cross-sectional dimensions: Overall dimensions of beams, joists, and columns and thickness of walls and slabs.
    a. 12 inch dimension or less - plus 3/8 inch to minus 1/4 inch.
    b. Greater than 12 inch to 3 foot dimension - plus 1/2 inch to minus 3/8 inch.
    c. Greater than 3 foot dimension - plus 1 inch to minus 3/4 inch.
5. Relative alignment:
    a. Stairs:
        1) Difference in height between adjacent risers - 1/8 inch.
        2) Difference in width between adjacent treads - 1/4 inch.
        3) Maximum difference in height between risers in a flight of stairs - 3/8 inch.
        4) Maximum difference in width between treads in a flight of stairs - 3/8 inch.
    b. Vertical alignment of outside corner of exposed corner columns and control joint grooves in concrete exposed to view - 1/4 inch in 10 feet.
    c. All other conditions - 3/8 inch in 10 feet.
    d. Offsets between pieces of formwork facing material:
        1) Class A - Architecturally or prominently exposed surfaces - 1/8 inch gradual or abrupt.
        2) Class B - Surfaces to receive plaster or stucco - 1/4 inch gradual or abrupt.
        3) Class C - Exposed surfaces in generally unfinished spaces - ¼ inch abrupt, 1/2 inch gradual.
        4) Class D - Concealed surfaces - 1 inch gradual or abrupt.

1.07 SUBMITTALS

A. See Division 01 Section - Submittal Procedures for submittal procedures.

B. Submittals for Review:
1. Shop drawings for fabrication and erection of forms for concrete surfaces architecturally exposed to view. Show general construction of forms including jointing and special formed joints or reveals, location and pattern of form tie placement, inserts and anchorages, and other items which visually affect exposed concrete.
2. Samples of chamfer strips, form liners, form ties, and other items which visually affect exposed concrete.

C. Submittals for Information:
1. Submit manufacturer's product data and installation instruction for proprietary materials used in exposed concrete work including form liners, release agents, form systems, ties, and accessories.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver form materials in manufacturer's packaging with installation instructions.

B. Store off ground in ventilated and protected area to prevent deterioration from moisture or damage.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Forms for Unexposed Concrete:
   1. Construct formwork of plywood, lumber, metal, or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit.

B. Formed Voids under Grade Beams: Corrugated fiberboard box forms, in size indicated on drawings and rated to sustain a load exceeding the total weight of fresh concrete placed over the voids in addition to anticipated construction loads and as manufactured by;
   1. VoidForm Products, Inc.
   2. approved equal

C. Forms for Exposed Concrete:
   1. Construct formwork with plywood, metal, or other panel type materials designed to provide continuous straight and smooth as-cast surfaces with minimum number of joints. Joints shall be made tight and shall be backed so that edges of adjoining formwork remain flush. Joints shall be vertical or horizontal, unless noted otherwise.
   2. Wood forms shall be constructed of 3/4 inch, APA B-B Plyform, Class 1, Exterior conforming to PS-1. Panels shall be mill oiled and all edges shall be sealed.

D. Forms for Architecturally Exposed Concrete:
   1. Construct formwork with plywood, metal, or other panel type materials designed to provide continuous straight and smooth as-cast surfaces with minimum number of joints. Joints shall be made tight and shall be backed so that edges of adjoining formwork shall remain flush and true. Joints shall be vertical or horizontal, unless noted otherwise.
   2. Forms shall be constructed from one of the following:
      a. Plywood: 3/4 inch, APA High Density Overlay (HDO), Exterior conforming to PS-1. All edges shall be sealed.
      b. Plastic Faced Plywood: 3/4 inch, APA A-C, Class 1, Exterior conforming to PS-1 faced with high density polyethylene or PVC sheet. All edges shall be sealed.
      c. Steel: 3/16 inch smooth blue mill plate steel, well matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces. All joints shall be welded full and ground smooth and flush with surrounding surfaces.
      d. Glass Fiber Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

E. Cylindrical Forms:
   1. Forms to be used at exposed columns, light pole bases and other exposed cylindrical concrete locations, shall be constructed from one of the following:
      a. Paper or Fiber Tubes: Standard ((Seamless)) plastic-lined units furnished full length without splices.
      b. Steel: Thickness and sufficient backing to prevent bulges and warps. Provide units to minimize joints. Seal and finish joints so joints are not visible in finished concrete. Units shall be free of bends, dents, holes, and rust.
      c. Glass Fiber Reinforced Plastic Forms: Thickness and sufficient backing to prevent bulges and warps. Provide units to minimize joints. Seal and finish joints so joints are not visible in finished concrete. Units shall be free of bends, dents, and holes.

2.02 FORMWORK ACCESSORIES

A. Form Ties: Removable or snap-off metal of adjustable length; cone type; one inch break back dimension; free of defects that will leave holes larger than one inch diameter in concrete surface.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of coating intended for use on concrete.

C. Rustications, Bevels and Chamfers: Steel, polyvinyl chloride, or milled and sealed wood of size and shape shown on the Drawings.

D. Protection Board: For use over void forms under structural slabs. Hard-pressed cellulose fiber board, 1/4 inch minimum thickness, or "SureCover Board", as manufactured by VoidForm Products, Inc.

E. Sleeves and Blockouts: Formed with galvanized metal, galvanized pipe, polyvinyl chloride pipe, fiber tubes, or wood.

F. Nails, Spikes, Lag Bolts, Through Bolts, and Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 - EXECUTION

3.01 FORM CONSTRUCTION

A. General: Construct forms to the sizes, shapes, lines and dimensions shown on the Drawings. Provide for openings, offsets, keyways, rustications, reglets, chamfers, blockouts, bulkheads, anchorages, inserts, and other features as required. Form all openings in concrete slabs as required for the vertical passage of ducts, pipes, conduits, etc.. The design and engineering of the formwork, as well as its construction, shall be the responsibility of the Contractor. Adequately shore all concrete members to safely support all loads and lateral pressures outlined in "Recommended Practice for Concrete Formwork" (ACI 347) without distortion, excessive deflection or other damage.

B. Construction forms shall be provided for any and all items of concrete work required for or in connection with the satisfactory completion of the project, whether each such item is specifically shown or referred to or not.

C. Fabricate formwork for easy removal without hammering or prying against concrete surfaces. Form removal shall be accomplished as a hand operation, with due care to avoid damage to any finished concrete work or any reinforcing passing through forms being removed.

D. Kerf wood inserts as required for ease of removal.

E. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

F. Fit forms placed for successive concrete placements for continuous surfaces, to accurate alignment, and within allowable tolerances.

G. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar. Should construction joints prove to be absolutely unavoidable, locate such joints within the middle third of spans or as detailed on the drawings. Make no additional construction joints under any circumstances without the written approval of the Architect. Provide appropriate keys in all construction joints, whether horizontal or vertical.

H. Form intersecting planes to provide true corners with edge grain of plywood not exposed as form for concrete.

I. Erect, support, brace, and maintain falsework to safely support all applied loads until such loads can be supported by the concrete structure.

J. Construct formwork to cambers shown or specified on the Drawings to allow for structural deflection of the hardened concrete. Provide additional elevation or camber in formwork as required for anticipated formwork deflections due to weight and pressures of concrete and construction loads.

K. Forms for Exposed Concrete:
   1. Drill forms from the contact face to the outside to suit form ties used. Do not splinter forms by driving ties through improperly prepared holes.
   2. Provide sharp, clean corners at intersecting planes without visible edges or offsets. Back joints with extra studs or girts if required to maintain corners.
   3. Provide extra studs, girts, walers, and bracing to prevent bowing of forms.
   4. Form shapes, recesses and projections with smooth finish materials, and install in forms with sealed joints.
   5. Locate form ties in level horizontal rows, plumbed vertically, and in symmetrical arrangements, unless noted otherwise.
   6. Special care shall be given to formwork, ties, bracing, etc. for any concrete surface to be left exposed to permanent view. Waves, bulges, form marks, staining, joint marks or irregularities shall be considered unacceptable.

L. Corner Treatment: Form exposed corners of beams, walls and columns with chamfered edges, unless noted or shown otherwise.
   1. Form chamfers with 3/4 inch by 3/4 inch strips, unless noted otherwise.
   2. Unexposed corners may be formed square or chamfered.

M. Foundation Elements: The sides of all below grade portions of beams, pier caps, walls, and columns shall be formed straight and to the lines and grades specified.

3.02 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

B. Do not apply form release agent where concrete surfaces are scheduled to receive subsequent finishes which may be affected by agent. Soak contact surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete.

3.03 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete. In case of conflict with reinforcing steel or structural embeds, consult Architect before placement.

B. Coordinate work of other Sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts.

C. Install accessories in accordance with manufacturer's instructions, level and plumb. Ensure items are not disturbed during concrete placement.

3.04 FORM REMOVAL

A. Formwork not supporting concrete, such as side forms for beams, walls, and columns, may be removed after cumulatively curing at not less than 50 degrees Fahrenheit (10 degrees Celsius)

for 12 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal, and provided curing and protection operations are maintained.

B. Formwork supporting conventionally reinforced concrete shall not be removed until concrete has attained 85 percent of its specified 28 day compressive strength as established by tests of field cured cylinders. In the absence of cylinder tests, supporting formwork shall remain in place until the concrete has cured at a temperature of at least 50 degrees Fahrenheit (10 degrees Celsius) for the minimum cumulative time periods given in ACI 347, Section 3.7.2.3. When the surrounding air temperature is below 50 degrees Fahrenheit (10 degrees Celsius), that time period shall be added to the minimum listed time period. Formwork for two-way conventionally reinforced slabs shall remain in place for at least the minimum cumulative time periods specified for one-way slabs of the same maximum span.

C. Minimum cumulative curing times may be reduced by the use of high-early strength cement or forming systems which allow form removal without disturbing shores, but only after the Contractor has demonstrated to the satisfaction of the Architect that the early removal of forms will not cause excessive sag, distortion or damage to the concrete elements.

D. Wood forms shall be completely removed. Provide temporary openings if required.

E. Provide adequate methods of curing and thermal protection of exposed concrete if forms are removed prior to completion of specified curing time.

F. Areas required to support construction loads in excess of 20 psf shall be reshored to properly distribute construction loading. Construction loads up to the rated live load capacity may be placed on unshored construction provided the concrete has attained the specified 28 day compressive strength.

G. Obtaining concrete compressive strength tests for the purposes of form removal shall be the responsibility of the Contractor.

3.05 SHORES AND RESHORES FOR MULTILEVEL STRUCTURES

A. Comply with ACI 347 and these specifications regarding shoring and reshoring.

B. The Contractor shall be solely responsible for proper shoring and reshoring.

C. Extend shores or reshores from ground to top level in structure three stories or less in height, unless noted otherwise.

D. In crawl spaces or basements, shores or reshores shall extend to mud pads seated firmly on the soil or to on-grade construction.

E. All levels of reshores may be removed after formwork for the uppermost floor has been removed in accordance with these specifications.

3.06 REUSE OF FORMS

A. Clean and repair surfaces of forms to be reused. Damaged forming material shall not be replaced and shall not be used in construction.

B. Apply form release agent to concrete contact surfaces prior to each reuse of the forms.

3.07 CLEANING

A. Upon completion of work of this section, remove related debris from job site.

END OF SECTION 03 11 00

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Includes furnishing all materials, equipment, transportation and facilities and performing all labor necessary for the following:
   1. Prepare shop drawings of reinforcing steel.
   2. Furnish and place reinforcing steel.
   3. Fabrication and installation of embedded metal assemblies.

B. Related Documents: The Contract Documents, as defined in Division 01 Section - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections include the following:
   1. Division 01 Section - Quality Requirements.
   2. Division 03 Section - Concrete Formwork.
   3. Division 03 Section - Cast-in-Place Concrete.
   4. Division 03 Section - Tilt-Up Concrete.
   5. Division 31 Section -"Drilled Piers.

1.03 SUBMITTALS

A. Division 01 Section - Submittal Procedures: Procedures for submittals.

B. Shop Drawings: Submit shop and installation drawings of reinforcement and embedded metal assemblies for review by the Engineer. Reproduce the bar bending diagram, the beam, slab and joist notes and cast-in-place concrete notes that concern the proper placing of reinforcing and submit it with each set of shop drawings for field use. Use same bar marks on bar bending diagrams as used on the beam, and slab schedule. Use same beam, and wall marks as Contract Documents.

C. Mill Test Reports: Deliver certified copies, evidencing compliance with all requirements of these specifications to the Engineer with all deliveries of reinforcing steel.

D. Submit copies of laboratory inspection reports as follows:
   1. Steel Supplier - 1 Copy
   2. General Contractor - 1 Copy
   3. Owner - 1 Copy
   4. Architect - 1 Copy
   5. Structural Engineer - 1 Copy

1.04 LABORATORY TESTING AND INSPECTION

A. Inspect welding of deformed bar anchors at the beginning of each period of production for size, length and quality. Re-inspect corrected welds.

B. Reinforcing: inspect all reinforcing steel prior to placement of concrete for compliance with the Contract Documents and the approved shop drawings. All instances of noncompliance shall

be immediately brought to the attention of the Contractor. If uncorrected by the contractor, they shall be listed in the report.

1. Observe and report the following: number and size of bars; bending; splicing; clearance to forms; clearance between bars; rust, form oil or other contamination; fabrication and installation of embedded metal assemblies, including visual inspection of all welds.

C. Inspector shall have a minimum of three years of experience inspecting reinforcing steel in projects of similar size.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing: All of domestic manufacturers.
   1. Bars: New deformed billet steel, ASTM A-615, grade 60.
   2. Reinforcing bars to be welded: ASTM A706; Bars shall have a carbon content not exceeding 0.30% and a manganese content not exceeding 0.60%. Provide certified copies of the ladle analysis for each lot of bars to be welded.
   3. Welded Wire Fabric: "Specification for Steel Welded Wire Fabric" (ASTM A185) with yield strength Fy=60,000 psi.
   4. Epoxy coated reinforcing bars: Not used

B. Fiber reinforcing: Not Used

C. Concrete accessories including bar supports, chairs, spacers, etc.: Cold-drawn wire and fabricated in accordance with the requirements of Chapter Seven of the ACI Standard 315 with heights as required.

D. Bar supports for concrete resting on earth: Precast concrete briquettes having tie wires embedded therein, or individual high chairs. Provide bar supports, hot-dipped galvanized after fabrication, where concrete will be exposed including ceilings of flat slabs.

E. Bar supports for reinforcing placed over carton forms to be of type to prevent puncturing the carton form.

2.02 METAL ANCHORAGE & CONFINEMENT ASSEMBLIES

A. Steel bars, plates, angles and miscellaneous steel: ASTM A36

B. Welded Deformed Bar Anchors: Welded by full-fusion process; "Nelson" Anchors Type D2L or approved equal conforming to ASTM A496 and AWS D1.1

C. Headed Stud Anchors: Headed Studs welded by full fusion process as furnished by Nelson Stud Welding Company or approved equal, conforming to AWS D1.1Section 7, Type A.

D. Bolts: Conform to ASTM F1554 with regular hexagon nuts and carbon steel washers.

E. Straps: Conform to ASTM A245 or A284.

F. Welding Electrodes: ASTM Designation A233, Series E70 - AWS 5.5.

2.03 FABRICATION

A. Fabricate reinforcing steel in compliance with the CRSI "Manual of Standard Practice".

B. All bar splices shall be a minimum of Class "B" lap unless specified otherwise on drawings.

C. Shop-fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

D. Deliver all reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

E. Reinforcing with any of the following defects will not be permitted in the work: Bar lengths, depths, and bends exceeding the specified fabrication tolerances, bends or kinks not indicated on drawings or final shop drawings, bars with reduced cross-section due to excessive rusting or other cause.

2.04 COATING

A. Rust inhibitor for field application to metal accessories shall be Hi-Build Epoxoline manufactured by the TNEMEC Co., Kansas City, Missouri or approved equal.

B. Hot dip galvanizing shall conform to ASTM A123.

C. Cold Galvanizing Compound for field repair of galvanizing shall be "ZRC Cold Galvanizing Compound" by ZRC Chemical Products Company, Quincy, Massachusetts, or approved equal.

PART 3 - EXECUTION

3.01 MATERIAL STORAGE

A. Stack reinforcing steel in tiers. Exercise care to maintain all reinforcement free of dirt, mud, paint, rust, etc.

3.02 GENERAL

A. Place reinforcing steel of the sizes, shapes, lengths, spacing and other dimensions where shown on the drawings. Details of reinforcing shall conform to the ACI Building Code Requirements for Structural Concrete (ACI 318).

3.03 MARKING

A. Mark bars plainly. Limit bundles to 1 size and 1 length and tag each bundle with metal tags.

3.04 CLEANING

A. Clean reinforcement thoroughly of rust, mill scale, dirt, oil or other coatings which might tend to reduce the bonding to the concrete.

3.05 BENDING

A. Bend bars cold. Heating of reinforcement, or handling by makeshift methods, will not be permitted and bars having kinks or bends not required will be rejected.

3.06 PLACING

A. Comply with the specified codes and standards, and the Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Place reinforcement accurately, securely saddle tie at every other intersection with No. 18 gauge black annealed wire, and rigidly hold in place during the placing of the concrete by means of metal chairs or spacers.

C. Hold bars in position and to proper clearance of concrete surface by spacers, chairs, or other necessary supports with the following tolerances:
   1. Top bars in slabs and beams:
      a. Members 8" deep or less: $\pm$ 3/8"

b. Members more than 8" but not over 2' deep: ± 1/2"
c. Members more than 2': ± 3/4"
2. Lengthwise of members: ± 2"
3. Concrete cover to formed surfaces: ± 1/4"
4. Minimum spacing between bars: ± 1/4"

3.07 CONCRETE PROTECTION

A. Minimum protection for reinforcing steel shall be as follows:
1. Concrete cast against and permanently exposed to earth: 3”
2. Concrete exposed to earth or weather or cast in place against a vapor retarder
a. #6 thru #18 bars: 2”
b. #5 bars and smaller: 1 ½”
3. Concrete not exposed to weather or in contact with the ground:
a. Slabs, walls, joists with #14 & #18 bars: 1 ½”
b. Slabs, walls, joists with #11 bars and smaller: ¾”
c. Beam and column primary reinforcement, ties, stirrups, and spirals: 1 ½”

3.08 EMBEDDED METAL ASSEMBLIES

A. Fabricate and assemble structural steel items in the shop. Shearing, flame cutting, and chipping shall be done carefully and accurately. Holes shall be cut, drilled, or punched at right angles to the surface of the metal and shall not be made or enlarged by burning. Welded construction shall conform to the AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings and AWS D1.1. Welding shall be done by AWS certified welders.

B. Welding of deformed bar anchors and headed stud anchors shall be done by full-fusion process equal to that of Nelson Stud Welding Company.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cast-in-place (CIP) concrete in building frame elements, walls, foundations, foundation walls, slabs-on-ground, and mechanical equipment pads.
   2. Finishing of concrete floor slabs and toppings. Concrete liquid surface treatment, sealer, and slip-resistant coatings.
   3. Mix Designs
   4. Expansion and contraction, control joints in CIP concrete.
   5. Concrete curing and protection.
   6. Non-shrink grout including installation and forming.

B. Related Sections:
   1. Division 03 Section - Concrete Forms and Accessories.
   2. Division 03 Section - Concrete Reinforcement.
   3. Division 03 Section - Polished Concrete Floor Finishing, for additional requirements for slabs to receive polished finish.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO)
   1. AASHTO M182

B. American Concrete Institute (ACI):
   1. ACI 121R, "Quality Assurance Systems for Concrete Construction."
   2. ACI 301, "Specification for Structure /Concrete."
   3. ACI 302.1R, "Guide for Concrete Floor and Slab Construction."
   4. ACI 304.2-R, "Placing Concrete by Pumping Methods."
   5. ACI 305, "Hot Weather Concreting."
   6. ACI 306, "Cold Weather Concreting."
   7. ACI 315, "Manual of Standard Practice for Detailing Concrete Structures."
   8. ACI 347, "Recommended Practice for Concrete Formwork."
   9. ACI 503.2, "Standard Specification for Bonding Plastic Concrete to Hardened Concrete with a Multi-Component Epoxy Adhesive."
   10. ACI SP-15, "Field Reference Manual" which includes ACI 301 "Specifications for Structural Concrete for Buildings" and reference standards specified therein.
   11. ACI 318-08, "Building Code Requirements for Structural Concrete."

C. American Welding Society (AWS)
   1. AWS D1.4, "Structural Welding Code Reinforcing."

D. American Society for Testing and Materials (ASTM).
   1. ASTM A615, "Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement."
   2. ASTM C33, "Specification for Concrete Aggregates."

3. ASTM C39, "Test Method for Compressive Strength of Cylindrical Concrete Specimens."
4. ASTM C94, "Specification for Ready-Mixed Concrete."
5. ASTM C114, "Test Method for Chemical Analysis of Hydraulic Cement."
6. ASTM C138, "Test Method for Unit Weight, Yield, and Air Content of Concrete."
7. ASTM C143, "Test Method for Slump of Hydraulic Cement."
8. ASTM C150, "Specification for Portland Cement."
9. ASTM C156, "Test Method for Water Retention by Concrete Curing Materials."
10. ASTM C171, "Specification for Sheet Materials for Curing Concrete."
11. ASTM C173, "Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method."
12. ASTM C227, "Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations."
13. ASTM C231, "Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method."
14. ASTM C260, "Specification for Air Entraining Admixtures for Concrete."
15. ASTM C309, "Specification for Liquid Membrane-Forming Compounds for Curing Concrete."
16. ASTM C311, "Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete."
17. ASTM C387, "Specification for Packaged, Dry, Combined Materials for Mortars and Concrete."
18. ASTM C494, "Specification for Chemical Admixtures for Concrete."
19. ASTM C618, "Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete."
20. ASTM C685, "Specification for Concrete Made by Volumetric Batching and Continuous Mixing."
21. ASTM C989, "Specification for Ground Iron Blast-Furnace Slag for Use in Concrete and Mortars."
22. ASTM E154, "Test Methods for Water Vapor Retarders Used in Contact with Earth Under Slabs, On Walls, or as Ground Cover."
23. ASTM E1155, "Test Method for Determining Floor Flatness and Levelness Using The F-Number System."
24. ASTM D2240, "Standard Test Method for Rubber Property-Durometer Hardness."

E. Concrete Reinforcing Steel Institute (CRSI),
1. CRSI "Manual of Standard Practice."

1.04 SUBMITTALS

A. Product Data:
1. Manufacturers' literature containing product and installation specifications and details.
2. Where Manufacturer's specifications, recommendations, and/or directions are required by this specification, include Manufacturer's specifications, recommendations, and/or directions.

B. Shop Drawings: All shop drawings and calculations must bear the seal and signature of an engineer registered in the jurisdiction where project is being constructed.
1. Cast-in-place concrete shown on structural drawings, prepared under the supervision of a registered Professional Engineer, including:
a. Rebar placing drawings (ACI 315, ACI Detailing Manual SP-66 or CRSI "Manual of Standard Practice"): Show bar sizes, spacing, locations, and quantities of reinforcing and wire fabric and supporting and spacing accessories. Provide steel order lists including bending and cutting details for all reinforcement shown on the structural

design drawings. Provide plans showing beam and pier marks associated with schedules.
    b. Form construction details, including jointing, special formed joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
    c. Calculations for any formwork, shoring and/or reshoring.
  2. Slab Construction Joint Layout: Unless all concrete control and expansion joints in paving are specifically indicated in Drawings, submit complete joint layout indicating proposed construction joint locations to comply with spacing requirements.
    a. Location of joints is subject to approval of Architect and Structural Engineer.
  3. Concrete Paving Joint Layout: Unless all concrete control and expansion joints in paving are specifically indicated in Drawings, submit complete joint layout indicating proposed construction joint locations to comply with spacing requirements.
    a. Location of joints is subject to approval of Architect and Civil Engineer.

C. Concrete design mixes: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  1. Indicate amounts of mixing water to be withheld for later addition at Project site.

D. Informational Submittals:
  1. Test Reports: Submit the following reports directly to Architect from Testing Laboratory, with copy to Contractor. Prepare reports in conformance with Division 01 Section - Quality Requirements:
    a. Submit laboratory test reports for concrete materials and mix design test, including certified copy of results of aggregate tested by ASTM C227.
  2. Certificates: Manufacturer's certificate that Products meet or exceed specified requirements.
  3. Qualification Documentation: Submit documentation of experience indicating compliance with specified qualification requirements.
  4. Failure by the contractor to submit the shop drawings, test reports and/or mix designs required above shall release the architect and the engineer from any liabilities due to the negligence on the part of the contractor to comply with the construction documents.

1.05 QUALITY ASSURANCE

A. Qualifications:
  1. Manufacturer: Company specializing in manufacturing Products specified with minimum 5 years documented experience.
  2. Installer: Company specializing in performing the Work of this Section with minimum 5 years documented experience.
  3. Testing Agency: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  4. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4.

B. Pre-Installation Meetings: Convene a pre-installation meeting at least one week prior to commencing Work of this Section. Require attendance of parties directly affecting Work of this Section.
  1. Review conditions of operations, procedures and coordination with related Work.
  2. Agenda shall include the following, as applicable to project scope:
    a. Tour, inspect, and discuss conditions of concrete work.
    b. Review concrete testing and their requirements.
    c. Review required submittals, both completed and yet to be completed.
    d. Review Drawings.

e. Review tolerances and slab flatness requirements.
f. Review any special conditions.
g. Review requirements for concrete finishes.
h. Approve proposed equipment.
i. Review and finalize construction schedule related to concrete work and verify availability of materials, personnel, equipment, and facilities needed to make progress and avoid delays.
j. Review required inspections, testing, certifying, and material usage accounting procedures.
k. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.
l. Review safety precautions relating to concrete work operations.
m. Environmental procedures.

3. General Contractor shall record minutes to include decisions made, action items, and other important points of discussion. Contractor shall distribute minutes to meeting participants, Architect, and other affected parties within 3 business days of the meeting.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect Products in accordance with Manufacturers' and Division 01 requirements.

B. Deliver materials in unopened containers with labels identifying contents.

C. Store powdered materials in dry area and in manner to prevent damage. Protect liquid materials from freezing.

1.07 PROJECT CONDITIONS

A. Testing: Owner will engage a qualified testing agency to perform pre-construction testing on concrete mixtures. Contractor shall coordinate construction and testing activities with testing agency as required.

B. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

C. Hot-Weather Placement: Comply with ACI 305.1 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with project requirements, manufacturers offering Products which may be incorporated in the Work include the following:
   1. Applied Concrete Technology, Incorporated, Grayslake, IL (800) 228-6694.
   2. The Euclid Chemical Company, Cleveland, OH (800) 321-7628.
   3. Fortifiber Corporation, Reno, NV (800) 773-4777.
   4. ChemREX Inc, Shakopee, MN (800) 433-9517.
   5. Master Builders Construction Products, Cleveland, OH (800) 227-3350.
   6. Sika Corporation, Lyndhurst, NJ (201) 933-8800, (800) 933-7452.
   7. WR Meadows, Hampshire, IL (800) 342-5976.
   8. Reef Industries, Houston, TX (800) 231-2077.
   9. STEGO Industries LLC, San Juan Capistrange, CA (877) 464-7834.
   10. L&M Construction Chemicals, Inc., Omaha, NE (402) 453-6600.
   11. Curecrete Chemical Company, Inc., Springville, UT (801) 489-5663.
   12. Midwest Floor Care Inc., Lincoln, NE (402) 477-2701.

B. Division 01 Section - Product Requirements: Product options and substitutions. Substitutions: Permitted.

2.02 CONCRETE MATERIALS

A. Portland Cement: ASTM C150 - Type I, gray**,** unless otherwise approved.
   1. Assume full responsibility for the quality and soundness of cement. Cement is to be of one type and from the same mill; it is to be of uniform color for all concrete with permanently exposed concrete finishes.

B. Requirements for concrete to receive densifier / hardener (but not polished): Comply with the most stringent requirements specified herein, or in structural notes, including:
   1. Limit fly ash and slag as a replacement for portland cement, as indicated for application.
   2. Limit use of curing compounds as indicated.
   3. Do not use incompatible admixtures.

C. Requirements for concrete to receive polished finish: Refer to Division 03, Section "Polished Concrete Floor Finishing", and notes in Structural Drawings as applicable, for additional information and requirements for concrete to receive polished finish. The most stringent requirements shall apply, including but not limited to the following:
   1. Air entrainment is not allowed in concrete to receive polished finish.
   2. Chemical admixtures, curing compounds, and other topical applications shall be used with concrete to receive polished ONLY IF they are chemically compatible with the polishing products and process and are specifically approved by the Architect and by the polishing system Manufacturer.
      a. Concrete to be polished shall be only wet cured with potable water, unless otherwise approved by Architect.
   3. Protection Requirements; Refer to Division 3, Section “Polished Concrete Floor Finishing.”

D. Admixtures: Admixtures are permitted when approved in writing prior to use or are required as specified herein and shall be used in strict accordance with the manufacturer's specifications or recommendations.

E. Calcium chloride: Conform to ACI 301. The chloride ion level shall not exceed 0.3 percent.

F. Air-entraining admixtures: ASTM C260 shall be used to achieve the specified air content in all permanently exposed exterior concrete. For steel trowel interior slab finish, do not use air entrainment admixtures and total air entrainment must not exceed 3%. For steel trowel exterior slab finish, comply with ACI 318 and ACI 302.

1. Euclid: AEA-92 or Air Mix 200.

G. Water-reducing admixtures: Conform to ASTM C494, Type A, containing not more chloride ions than allowed in paragraph C., above.
   1. Euclid: Eucon WR series or Eucon MR.

H. Water-reducing/accelerating admixtures: Conform to ASTM C494, Type C or E having long-term test results showing non-rusting on metal deck and reinforcing steel.
   1. Euclid: Accelguard series.

I. Water-reducing/retarding admixtures: Conform to ASTM C494, Type D containing not more than 1 percent chloride ions.
   1. Euclid: Eucon Retarder series.

J. High-range/water-reducing (HRWR) admixtures: Conform to ASTM C494, Type F or G super plasticizers containing 1 percent maximum chloride ions may be used with low slump (3 inches maximum) concrete to produce flowable concrete (up to 8 inches slump) with early strength gain and 28-day strengths equal to reference concrete. HRWR admixture may be used providing not more than 60 minutes is allowed from addition of admixture to final placement of concrete. HRWR admixture shall be used in concrete with a maximum water/ cement ratio of 0.50 or less and is suggested in the following:
   1. In pumped concrete.
   2. In concrete topping slabs
   3. In lieu of the specified water-reducing admixture (Type A) where confinement of placing due to heavy reinforcement or narrow space requires flowable concrete.
   4. Where more than 30 minutes is required between the addition of admixtures to final placement of the concrete, a combination of water-reducing, set controlling admixtures (ASTM C494, Types A, D, & E) as in Master Builders Company "Synergized Performance System" may be used.
      a. Euclid: Eucon 37 or Eucon 537.

K. Fly ash or granulated blast furnace slag may be used as a substitute for 25 percent of Portland cement, except where limited by other applications, including the following:
   1. Polished slabs – Limited to 15% replacement
   2. As noted on the Structural Drawings.

L. Certification: Certification of the above requirements is required from the admixture manufacturer prior to mix design review and approval by the Architect. Upon request by the Architect, a qualified representative is to be provided to assure proper use of admixtures. Use of admixtures, other than listed above will be permitted only when approved.

M. Aggregates:
   1. Normal-weight concrete - ASTM C33. For slabs, also conform to combined aggregate grading recommendations of ACI 302 and ACI 302.1R, unless otherwise permitted.
   2. All concrete exposed to the weather shall conform to the limits of deleterious substances and physical properties of Table 3, ASTM C 33.
   3. Local aggregates: Local aggregates not complying with ASTM C33 but which have been shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Architect.
   4. Maximum size of coarse aggregates: ACI 301.
   5. Abrasive aggregates non-slip finishes: Fused aluminum oxide grits, or crushed emery, as abrasive for non-slip finish with emery aggregate containing not less that 40 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rustproof, non- glazing, and unaffected by freezing, moisture, and cleaning materials.

N. Water: Clean and not detrimental to concrete; drinkable.

2.03 FINISHING MATERIALS

A. Cement Floor Leveling Compound: Camp's "Latex Mix" (Liquid Felt up to 1/8" over 1/8" mix with Portland Cement and Sand), as distributed by the Tichenor Company, Dallas, Texas or approved equal. Floor leveling compound may only be used where floor will not be exposed.

2.04 GROUT / MORTARS

A. Cement grout: Conform to ASTM C387 "Dry packaged mixtures" or:
   1. Mix at the site, in composition of one volume of Portland cement to 2-1/2 volumes of fine aggregate.
   2. Mix the materials dry; then add sufficient water to make the mixture flow under its own weight.
   3. Submittals: The following laboratory test results shall be submitted to show compliance with the requirements of this specification:
      a. Initial setting time: 8 hours maximum
      b. Vertical shrinkage: 0
      c. Compressive strength: 5000 psi 7 days
      d. Compressive strength: 7000 psi 28 days
   4. Field service: When required by the Architect, provide a qualified concrete technician employed by the Grout Manufacturer to assist in the initial grouting operations.
      a. Euclid: NS Grout or Hi Flow Grout or E3 Grout series.
      b. Sika: Sika Grout #212.

2.05 CURING MATERIALS

A. Method of curing shall be approved by the finish flooring applicator where finishes are indicated.

B. Wet Cure Blanket: Waterproof covering, for curing exposed finish concrete floors, shall be non-staining, reinforced with fibers, and conforming to the requirements of the current edition of ASTM C171-03, ASTM C171-97a, and AASHTO M171-00, standard specifications for sheet material for curing concrete slabs. McTech Group, Inc.; "UltraCure NCF", Loganville, GA (866) 913-8363, or comparable product by another Manufacturer.

C. Curing Compounds:
   1. For Slabs not scheduled for Chemical Hardener: Clear Bond as made by Guardian Chemical Co., Acri-Seal as made by Toch Bros., Dress and Seal as made by L & M Construction Chemicals, MasterKure as made by Sonneborn, or Res-X Cure by Burke Concrete Accessories.
   2. For Slabs to be Chemically Hardened: Do not use film-forming curing compounds. Where curing compound is required, a non-film-forming curing compound chemically compatible with the hardener may be used, if first approved by the chemical hardener Manufacturer Dissipating liquid membrane-forming compounds for curing concrete; Conform to ASTM C309, Type 1. Curing compound shall be compatible with floor sealer or finish used. Low VOC. At polished concrete finishes, use of curing compounds is not allowed unless specifically approved by the Architect and polishing system Manufacturer.
      a. Euclid: VOX Kurex DR series; waterborne products.
      b. W.R. Meadows: 1100 series.
      c. L&M Construction Chemicals: Cure R.
      d. Division 01 Section - Product Requirements: Product options and substitutions. Substitutions: Permitted.

D. Evaporation retarder: "MasterKure ER 50" by BASF or equal; spray applied liquid film for hot weather finishing.
   1. Do not use evaporation retarder at slabs to be densified, unless specifically approved for compatibility by the densifier manufacturer.

E. Water: Potable.

2.06 SEALERS AND DENSIFIER / HARDENERS

A. Exterior Sealers: applied to horizontal concrete surfaces permanently exposed to salts, deicer chemicals and moisture, including parking decks. The manufacturer shall provide a 5-year labor and materials Warranty on performance of the sealer. Sealer shall be compatible with the curing compound used.
   1. Euclid: Eucoguard or Diamond Clear or Super Diamond Clear.
   2. ChemREX: Hydrozo Clear 40.
   3. Substitutions: Permitted.

B. Floor Sealing Compound: "Master Seal 330" by Master Builders, Cleveland, Ohio or approved equal.

C. Concrete Densifier / Sealer for Interior Concrete: Coordinate requirements of hardener/densifier products with concrete mix designs and chemical admixtures and curing methods. These products are chemically reactive with the free lime in concrete and performance and appearance will be adversely affected by chemicals that react with lime or that impede the ability of the hardener/densifier to react. Do not use chemical admixtures or curing compounds unless specifically approved in writing.
   1. Exposed concrete floor slabs, not indicated for polished finish or with light broom finish: Two- or Multiple-Coat, spray-applied, hardener/densifier. Chemical reactive magnesium fluorosilicate formulation with chemical resistant properties to alkali, acids, oils and salts, and does not substantially change appearance of concrete surfaces. Provide one of the following or approved equal product by another Manufacturer:
      a. BASF; "MasterKure HD 300 WB".
      b. Euclid Chemical Co; "Surf-Hard".
   2. Exposed concrete floor slabs with smooth troweled finish: One coat flood-applied, hardener/densifier. Chemical reactive silicate / siliconate formulation that enhances sheen level of troweled concrete and is designed to mainatin or increase sheen level over time with normal wear. Provide one of the following or approved equal product by another Manufacturer:
      a. CureCrete Chemical Company; "Ashford Formula", www.ashfordformula.com.
      b. Dayton Superior; "Sure-Hard Densifier J17", www.daytonchemical.com.
      c. Euclid Chemical Company; "Euco Diamond Hard", www.euclidchemical.com.
      d. L&M Construction Chemicals: "Seal Hard", www.lmmc.com.
   3. Refer to Division 03 "Polished Concrete Floor Finishing" for floor polishing system.

2.07 JOINTS AND EMBEDDED ITEMS:

A. Construction and Contraction Joints: Comply with ACI 301 and recommendations of ACI 302.1R. Sealant shall be two-part semi- rigid epoxy, and shall have minimum Shore A Hardness of 80 when measured with ASTM D2240. A product that complies with these requirements is "Euco 700", as manufactured by The Euclid Company, Cleveland, OH (800) 321-7628.

B. Isolation Joints: Fillers shall consist of 1/8 inch width strips of neoprene, synthetic rubber, or approved substitute, extending the full depth of the slab. Sealant shall be two-part elastomeric type, polyurethane base.

2.08 MISCELLANEOUS MATERIALS

A. Expansion Joint Material: Preformed expansion joint material conforming to ASTM D-1751.

B. Drilled Anchor Bolts: Shall be “Titen HD" bolts as manufactured by Simpson Strong-Tie.; "Kwik HUS-EZ", by Hilti Fastening Systems; or approved equal.

C. Rust Inhibitor: For field application to metal accessories shall be Hi-Build Epoxoline manufactured by the Tnemec Co., Inc., Kansas City, Missouri or approved equal.

D. Epoxy for Patching: Shall be a two-component polymer modified cementitious system equal to Sikatop series as manufactured by Sika Chemical Corp., Lyndhurst, New Jersey or approved equal. Sikatop product selected shall be appropriate for intended repair and shall be approved by Architect.

E. Accessories: AC315 Galvanized chairs, stools, spacers, etc. shall be by Superior Manufacturing Co., or equal.

F. Waterstop: Preformed flexible PVC CRD-C-572-74. waterstop for embedding in concrete to prevent passage of fluids through joints. Factory-fabricate corners, intersections and directional changes. Acceptable manufacturers include:
   1. Sika Corporation
   2. W. R. Meadows
   3. Or approved equal.

2.09 VAPOR RETARDER

A. Provide cover over prepared soil, below aggregate base material at slabs-on-ground and over void forms unless otherwise noted on the plans. Use only materials which are resistant to decay when coated in accordance with ASTM E154.

B. Reference Section 07 26 00. Vapor Barrier Membrane.

2.10 PROPORTIONING

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If laboratory trial batch method is used, use an independent testing facility acceptable to Architect for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing and inspection unless otherwise acceptable to Architect.

B. Submit written reports to the testing laboratory of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed and approved. Include the following information for each concrete mix design:
   1. Method used to determine the proposed mix design.
   2. Gradation of fine and coarse aggregates, plus combined aggregate gradation for slabs, ACI 302.
   3. Proportions of all ingredients including all admixtures added either at the time of batching or at the job site.
   4. Water-cement ratio.
   5. Slump, ASTM C143.
   6. Certification of the chloride content of individual admixtures and of the mixes as proposed.
   7. Air Content: ASTM C173 (Volumetric Method).
   8. Unit weight of concrete, ASTM C138.
   9. Strength at 4, 7, and 28 days, ASTM C39.
   10. Method of recording batch proportions.

11. Substantiating test reports.

C. Concrete types and strengths: Minimum 28 Day Compressive Strength shall be per design requirements but not less than:
   1. Footings, on ground grade beams, drilled piers: 3,000 psi.
   2. Slabs on ground, walls: 3,000 psi
   3. Slabs on void forms: 4,000 psi
   4. Normal or Lightweight concrete on metal deck: 4,000 psi.
   5. All concrete exposed to weather shall be air entrained (ASTM C260).
      Also, see general and specific notes on structural drawings.

D. Weights: All concrete shall be normal-weight concrete unless otherwise designated on the structural drawings.

E. Durability: Conform to ACI 301.
   1. All concrete exposed to potentially destructive weathering, such as freezing and thawing, or to de-icer chemicals is to be air-entrained, 4.5% ± 1.5%, six sacks cement/cu. yd. min., 4" max. slump.
   2. Water-cement ratio: For concrete subject to freezing and thawing or deicer chemicals, the water-cement ratio shall not exceed 0.53 by weight including any water added to meet specified slump in accordance with the requirements of ASTM C94 unless otherwise noted.

F. Slump: Conform to ACI 301 and structural drawings. Where not provided, the following limits shall be used:
   1. 4 ½ inch maximum for consolidation by vibration
   2. 5 inch maximum for consolidation by other methods
   3. 8 inch maximum for flowable concrete. Concrete containing HRWR admixture (super plasticizer): 3 inch maximum before addition of HRWR
   4. Where field conditions require slump to exceed that specified above, the increased slump shall be obtained by the use of a superplasticizer only, and the Contractor shall obtain written approval from the Architect who may require an adjustment to the mix.

G. Production of concrete: Conform to ACI 301:
   1. Ready-mixed concrete:
      a. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C94.
      b. All concrete shall be proportioned conforming to the approved mix designs and of the materials contained in those approved mixes. A certified copy of the design weights for each mix shall be kept at the producing plant for each class of concrete used on the project.
      c. Plant equipment and facilities are to conform to the "Check List for Certification of Ready -Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association and have NRMCA or approved certification within the past year.
   2. All other concrete: Conform to ACI 301
   3. Concrete produced by on-site volumetric batching and continuous mixing if approved shall conform to ASTM C685.
   4. Use of accelerating admixtures in cold weather and retarding admixtures in hot weather shall not relax placement requirements specified herein.
   5. Admixtures: ACI 301. All concrete placed at ambient temperatures below 50˚F is to contain an approved accelerator. All concrete placed at ambient temperatures above 80˚F is to contain an approved retarder. All concrete required to be air-entrained is to contain an approved air-entraining admixture. When improved workability, pumpability, lower water-

cement ratio, or high ultimate and/or early strength is required, the HRWR admixture (super plasticizer) may be used.

6. Ensure air content for slabs with steel trowel finish is less than 3%. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements, adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. Maintain on the job at all times adequate extra cement to be used at rate of 1/2 sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct awareness of the project inspector.
7. Adjustments to concrete mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant at no additional cost to Architect. Laboratory test data for revised mix design and strength results must be submitted and accepted before using in work.

2.11 FORMWORK

A. Division 03 Section - Concrete Forms and Accessories

2.12 REINFORCING MATERIALS

A. Division 03 Section - Concrete Reinforcement

PART 3 - EXECUTION

3.01 EXAMINATION

A. Division 01 Section - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Architect prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.02 INSTALLATION - GENERAL

A. Install all cast-in-place concrete work in accordance with ACI 301 except as herein specified.

3.03 INSTALLATION - FORMWORK

A. Division 03 Section - Concrete Forms and Accessories

B. Construction and Contraction Joints: Conform to ACI 301 and recommendations of ACI 302.1R.

3.04 REINFORCEMENT

A. Placement: Division 03 Section - Concrete Reinforcement

3.05 CONCRETE (CONVEYING AND DEPOSITING)

A. Placement: Conform to ACI 301:

1. Maintain concrete cover around reinforcing as specified herein and ACI 301.
2. Pumping concrete: ACI 304.2-R.
3. Cold-Weather Placement: Comply with provisions of ACI 306.1 "Standard Specifications for Cold-Weather Concreting" and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
4. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C) and not more than 80 deg F (27 deg C) at point of placement.
    a. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
    b. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs.
5. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305R "Standard Specification for Hot-Weather Concreting" and as specified.
    a. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F (32 deg C). Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
    b. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
    c. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
    d. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

B. Protection of cast concrete: Conform to ACI 301.

C. Where the use of synthetic fibers is specified, fibers shall be added at a rate of 5.0 million fibers per cubic yard.

D. Repair of surface defects: ACI 301.
1. Inspect concrete surfaces immediately upon removal of forms. Patch imperfections as needed or as directed by the Architect.
2. Modify or replace concrete not conforming to required thickness, lines, details, and elevations.
3. Repair or replace concrete with excessive honeycombing and other defects due to improper placement. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.
4. Tie holes shall be filled solid with patching mortar.

3.06 FINISHING

A. Finishing of formed surfaces: ACI 301:
1. Tops of forms:
    a. Strike concrete smooth at tops of forms.
    b. Float to texture comparable to formed surfaces.
2. Formed surfaces:
    a. Permanently exposed surfaces and surfaces to be painted: ACI 301 - "Smooth Form Finish" with the fins ground smooth and air holes or honeycomb filled with mortar.

b. Surfaces in unfinished areas unexposed to public view: ACI 301- "Rough Form Finish".

B. Slabs: Minimum slab surface tolerance must satisfy ACI 301 and ACI 302.1R as measured in accordance with ASTM E1155.
   1. Slabs-on- ground:
      a. Preparation of sub-grade: Compact stone base aggregate to thickness indicated on drawings. Roll poof stone screenings topping to provide smooth hard surface on which to place slab. Surface should not show footprints or truck tracks when driven over.
      b. Place floor slabs-on- ground by "strip cast" method. Contraction joints where shown on drawings shall be saw-cut (as soon as slab has set enough to allow working on but not before it has set enough to prevent raveling) 1/4 of the depth of slab thickness. It is recommended to use a SOFF-CUT saw and blades (between 1 to 4 hours after finish typically with 1 inch minimum depth) for all contraction joints as per manufacturer recommendations.
      c. For exposed slabs, install semi-rigid epoxy sealant in construction and contraction joints after slab has fully dried.
      d. Separate slabs-on- ground from vertical surfaces with 1/2 inch-thick joint filler. Extend joint filler from bottom of slab to within 1/8 inch of finished slab surface.
      e. Allowable tolerance for slab on grade surfaces, measured in accordance with ACI 117 and ASTM E1155, shall meet or exceed an overall value of FF35/Fl25, with minimum local value of FF24/FL17.
   2. Suspended Floor Slab:
      a. Minimum surface tolerances: FF25 & FL20 overall FF20 & FL15 local.

C. Float Finish:
   1. Locations: All concrete surfaces under mud-set tile or pavers.
   2. Finishing: After concrete has stiffened sufficiently and bleed water has evaporated, the surface shall be wood floated to produce a uniform texture with no coarse aggregate visible. Apply sufficient pressure to bring the moisture to the surface.

D. Trowel Finish:
   1. Locations: All concrete surfaces under:
      a. Thin set tile
      b. Carpets
      c. Vinyl floor tile
      d. Exposed concrete
      e. Typical unless noted otherwise
   2. Troweling: Steel trowel not less than two passes. Begin troweling with power trowel as soon as little or no cement sticks to the blades. Dusting with dry cement or aggregate to stiffen mix or absorb moisture is not allowed. The concrete shall then be hand troweled or machine troweled to produce a smooth impervious surface for the purpose of burnishing.

E. Broom Finish:
   1. Locations: Exterior stairs, ramps, walks and other locations where noted on the drawings.
   2. Finishing: Same method as specified for trowel finish, except after initial troweling brush concrete surfaces with a soft brush or broom to texture as specified by the architect.

F. Power Machine Finishing: In place of hand finishing, the Contractor may use a power machine approved by the Architect for finishing the concrete surfaces for finishing the concrete surfaces. However, the preparation of concrete surfaces for finishing by machine shall be, in general, as hereinbefore required for hand finishing.

G. Non-slip Finish: Apply abrasive aggregate at the rate of 25 lbs. per 100 SF per manufacturer's instructions in areas specified.

3.07 CURING AND PROTECTION

A. Protect all freshly placed concrete from washing by rain, flowing water, etc. Do not allow concrete to dry out from the time it is deposited in the forms until the expiration of the curing period hereinafter specified. The methods of curing shall be as specified in the following paragraphs, unless otherwise authorized by the Architects.

B. Concrete surfaces, not otherwise specified, shall be cured by being kept wet with clean water for a period of not less than seven (7) days after placing. Each day the forms are left in place and kept wet enough to prevent the opening of joints in the forms and the drying out of the concrete, will be counted as one (1) day of curing.

C. In lieu of the wetting specified above, the Contractor may, use a non-bituminous liquid sealing and curing compound to seal the moisture in the concrete. Such material shall not, however, be applied to surfaces which are to receive further concrete, mortar, resilient tile or liquid vinyl coating. Curing liquid, if used, shall be applied in conformity with the recommendations of the manufacturer of the material approved for use, and to sufficient extent to effectively hold the moisture in the concrete. The use of such material shall not relieve the Contractor of the responsibility of protecting all floor slabs, platforms, and steps whenever any scaffolding, shoring, form work, masonry, concrete or other work is being done over or above finished concrete slabs. Material shall be colorless and not leave any tinting or residual color.

D. Permanently exposed concrete floors shall be cured by covering the entire surface, as soon as practical after finishing, with waterproof paper, laid with four-inch (4") lapped joints. The joints shall be covered with gummed tape or be glued with waterproof glue. Such covering shall remain in place until completion of the building, except on surfaces where ceramic tile is to be applied, in which cases the covering shall be removed after a period of seven (7) days has elapsed after the placing and finishing of the concrete. Tears in paper shall be repaired.

E. Imperfect or damaged work, or any material damaged or determined to be defective before final completion and acceptance of the entire job, shall be satisfactorily replaced at the Contractor's expense, and in conformity with all of the requirements of the Drawings and Specifications. Removal and replacement of concrete work shall be done in such manner as not to impair the appearance or strength of the structure in any way.

F. Cleaning: Upon completion of the work, all forms, equipment, protective coverings and any rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces shall be left in a clean condition, satisfactory to the Owner. After sweeping with an ordinary broom and removing all mortar, concrete droppings, loose dirt, mud, etc., wash all concrete floors and platforms with soapsuds and scrub with a stiff fiber brush. Mop up the suds and flush the surfaces with clean water. Provide adequate measures during scrubbing, mopping, and flushing operations to keep excessive or injurious amounts of water off resilient tile floors. Any damage to such floors shall be promptly, effectively and satisfactorily repaired.

3.08 PATCHING AND REPAIR

A. Comply with ACI 301 and ACI 503.2 for standard specifications for bonding plastic concrete to hardened concrete with a multiple component epoxy adhesive.

B. Remove honeycomb voids, cracks, and irregularities. Where repair is required, cut back defects not less than 1/2" with square edges, brush out, drench with water and fill with concrete of same mix from which coarse aggregate is removed. When cut-outs have been filled, trowel

surface smooth, remove excess grout and after set, grind slightly to uniform color and appearance using neat Portland Cement applied with a power grinder wheel.

3.09 GROUTING

A. After steel columns have been installed and leveled, grout the space between the bottom of the plate and concrete, using cement grout completely filling the space and forming solid bearing for the column base plate.

3.10 EVALUATION AND ACCEPTANCE OF CONCRETE

A. Comply with ACI 301.

3.11 ACCEPTANCE OF STRUCTURE

A. Comply with ACI 301.

3.12 MISCELLANEOUS CONCRETE

A. Curbs: Provide monolithic finish to interior surface of curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

B. Equipment bases and foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

3.13 FIELD QUALITY CONTROL

A. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate the Architect for final acceptance.

B. Testing agencies shall meet the requirements of "Recommended Practice for Inspection and Testing Agencies for Concrete and Steel in Construction" ASTM E 329.

C. The following testing services shall be performed by the testing laboratory:
   1. Secure concrete samples in accordance with "Method of Sampling Fresh Concrete" ASTM C172-.
   2. Mold and cure four specimens from each sample in accordance with "Method of Making and Curing Concrete Compression and Flexural Specimens in the Field" ASTM C31-. The cylinders shall be stored in the field for 24 hours and then transported to the laboratory to be cured.
   3. Test specimens in accordance with "Method for Test for Compressive Strength of Molded Concrete Cylinders" ASTM C39-. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. One specimen shall be held for future testing, if required.
   4. Make one strength test (four cylinders) for each 100 cu. yd. or fraction thereof, of each mix design of concrete placed in any one day.
   5. Determine total air content of air entrained normal weight concrete for each strength test in accordance with ACI 231.
   6. Report test results in writing to the Architect and Structural Engineer on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete type and class, location of concrete batch in the structure, design compressive strength at 28

days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day test and 28-day tests, air content.

7. Determine slump for each strength test and whenever consistency of concrete appears to vary, using "Method of Test for Slump of Portland Cement Concrete" ASTM C143.
8. Determine temperature of concrete sample for each strength test.

D. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained. Test to determine adequacy of concrete will be by cored cylinders complying with ASTM C42. Contractor shall pay for such test conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

E. Monitor the addition of water at the jobsite and the length of time concrete is allowed to remain in the truck before placement.

F. Testing non-shrink grout: Make one strength test for every 10 baseplates grouted.

G. The Contractor shall provide and pay for the necessary testing services of the following:
   1. Qualification of proposed materials and the establishment of mix designs in accordance with "Building Code Requirements for Structural Concrete" ACI 318.
   2. Other testing services needed or required by the Contractor.

H. To facilitate testing and inspection, the contractor shall:
   1. Furnish necessary labor to assist testing agency in obtaining and handling samples at the job site.
   2. Advise the testing agency in advance of operations to allow for the assignment of testing personnel and testing.
   3. Provide and maintain for the use of the testing agency adequate facilities for proper curing of concrete test specimens on the project site in accordance with "Methods of Making and Curing Concrete Compression and Flexural Specimens in the Field" ASTM C31.

I. Evaluation and acceptance:
   1. The strength level of the concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed specified strength and no individual test result (average of two cylinders) is below specified strength by more than 500 psi.
   2. Completed concrete work will be accepted when the requirements of "Specifications for Structural Concrete for Buildings" ACI 301, Chapter 18 have been complied with.
   3. In any case, where the average strength of the laboratory control cylinders, as shown by the tests for any portion of the structure, falls below the minimum specified ultimate compressive strength, the Architect shall have the right to require the Contractor to provide improved curing conditions of temperature and moisture to secure the required strength. Also, if the average strength of the laboratory control cylinder should fall so low as to cause the portions of the structure to which the respective unsatisfactory test reports apply to be in question by the Architect, the Contractor shall follow the core procedure set forth in the current edition of ASTM C42. If the results of the core tests indicate, in the opinion of the Architects, that the strength of the structure is inadequate, such replacement, load testing, or strengthening as may be ordered by the Architects shall be provided by the Contractor without cost to the Owner.

J. Reports: The testing laboratory shall make reports to the following:
   Concrete supplier - 1 copy
   Contractor - 1 copy
   Owner - 1 copy

Architect - 1 copy
Structural Engineer - 1 copy

1. Reports shall be made and distributed immediately after the respective tests or inspections are made.
2. Where reports indicate deviations from the Contract Documents, they shall also include a determination of the probable cause of the deviation and where applicable, a recommendation for corrective action.
3. Wherever the testing laboratory recognizes a trend of decreasing quality in the concrete due to changing reasons, conditions of curing or other cause; this shall be brought to the attention of the Architect, along with a recommendation for corrective action to be taken before the materials fall below the requirements of these Specifications.

K. Authority & Responsibilities of the Testing Laboratory

1. The laboratory representative shall immediately notify the Architect and the Contractor of any deviance from Specifications and approved design mixes observed at the mixing plant or the job site.
2. If, in the opinion of the laboratory representative, the deviance observed will be probable cause for subsequent rejection of the material, he shall so inform the Contractor and Architect so that a timely decision as to whether or not to continue operations can be made.
3. Subsequent to on-the-spot verbal notification, the laboratory shall file a written report of any deficiencies or deviance noted including a summary of conversations and decisions made and action taken at the time in accordance with Paragraph 1.
4. The testing laboratory shall control field adjustments made to concrete mixes to compensate for field conditions and report same in accordance with Paragraph H.

END OF SECTION 03 30 00

SECTION 03 30 53 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
1. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

1.04 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. Comply with the following sections of ACI 301 unless modified by requirements in the Contract Documents:
1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

B. Comply with ACI 117.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Wire: Not Allowed.

C. Plain-Steel Welded-Wire Reinforcement: Not Allowed.

D. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.03 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:
   1. Portland Cement: conforming to ASTM C 150, Type I, Type II, Type III.
   2. Fly Ash: ASTM C 618, Class C or F.

C. Normal-Weight Aggregate: ASTM C 33, 1-1/2-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
   3. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

F. Water: ASTM C 94.

2.04 RELATED MATERIALS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.06 CONCRETE MIXTURES

A. Comply with ACI 301.

B. Normal-Weight Concrete:
   1. Minimum Compressive Strength: 3000 psi or as indicated at 28 days.
   2. Maximum W/C Ratio: 0.45 or as indicated.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: Maintain within range permitted by ACI 301.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is above 75 deg F and below 90 95 deg F, reduce mixing and delivery time to a maximum of 60 minutes
   2. When air temperature is above 90 95 deg F, reduce mixing and delivery time to 45 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 VAPOR-RETARDER INSTALLATION

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
   1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.04 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Reinforcement shall be accurately positioned and, unless otherwise shown or specified, shall be secured against displacement by using at intersection, annealed iron wire of not less than No. 18 gauge or suitable metal clips. It shall be supported by plastic or metal chairs or spacers.
   2. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction/Expansion Joints: Install so strength and appearance of concrete are not impaired, at a spacing equal to twenty-four (24) times the thickness of the concrete in inches or at locations indicated or approved by Engineer.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

3.06 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

D. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 6 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 3500 psi or as indicated at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor them into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.07 FINISHING FORMED SURFACES

A. Chamfer edges by grinding or dry rubbing.

B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch.
   1. Apply to concrete surfaces not exposed to public view.

C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

D. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-rubbed finish.
   2. Grout-cleaned finish.
   3. Cork-floated finish.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleed-water appears on surface.
   1. Do not further disturb surfaces before starting finishing operations.

C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes unless otherwise indicated.

D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

G. Slip-Resistive Broom Finish: Apply a slip-resistive finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.09 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.010 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 1 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

END OF SECTION 03 30 53

SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Concrete Masonry Units, (CMU).
      a. Load Bearing CMU
      b. Non-Load Bearing CMU
   2. Pre-faced concrete masonry units.
   3. Clay face brick.
      a. Basis of Design
   4. Glazed brick.
   5. Mortar and grout.
   6. Steel reinforcing bars.
   7. Masonry-joint reinforcement.
   8. Ties and anchors.
   9. Embedded flashing.
      a. Flexible Flashing
         1) Copper Laminated
   10. Miscellaneous masonry accessories.
      a. EJ Compressible Filler
      b. EJ Preformed Control-Joint Gaskets
   11. Seismic Requirements
   12. Below Grade Parging
   13. PreInstallation Meeting
   14. Free Standing Mock-Up
   15. Sample Wall Panels
   16. Field Quality control

B. Products furnished, but not installed, under this Section include the following:
   1. Dovetail slots for masonry anchors, installed under Division 03 Section - Cast-in-Place Concrete.
   2. Anchor sections of adjustable masonry anchors for connecting to structural frame, installed under Division 05 Section - Structural Steel.

C. Products Installed but not Furnished under This Section:
   1. Cast-stone trim in unit masonry.
   2. Steel lintels in unit masonry.
   3. Steel shelf angles for supporting unit masonry.
   4. Manufactured reglets in masonry joints
   5. Cavity wall insulation.

6. Water and Vapor Barriers

D. Related Requirements:
   1. Section 04 72 00 "Cast Stone Masonry" for cast stone trim units.
   2. Section 05 40 00 "Cold-Formed Metal Framing"
   3. Section 05 50 00 "Metal Fabrications" for steel lintels, shelf angles and bearing plates.
   4. Section 07 62 00 "Sheet Metal Flashing and Trim" for [exposed] sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.
   5. Division 07 Section "Water and Vapor Barriers".
   6. Division 07 Section - Firestopping for firestopping at openings in masonry walls.
   7. Division 07 Section - Joint Sealants for sealing control and expansion joints in unit masonry.

1.03 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

C. MCAA: Masonry Contractors Association of America

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site to comply with the requirements of Division 01 Section - Project Management and Coordination.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

C. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
   3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.

D. Samples for Verification: For each type and color of the following:
   1. Pre-faced CMUs.
   2. Concrete face brick.
   3. Clay face Brick.
   4. Unglazed structural clay tile.
   5. Stone trim.
   6. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   7. Flashing Materials
   8. Ties and Anchors
   9. Weep holes and cavity vents.
   10. Accessories embedded in masonry.

1.06 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Installer Qualifications: Submit evidence of contractor state license, MCAA company certification and personnel training and experience in constructing masonry structures of similar nature to this project, with a minimum of five (5) years of on the job successful construction experience. List project superintendent for masonry works, experience, training and certifications.

D. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include data on material properties.
      b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
      c. For exposed brick, include test report for efflorescence according to ASTM C67.
      d. For surface-coated brick, include test report for durability of surface appearance after fifty (50) cycles of freezing and thawing according to ASTM C67.
   2.
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Grout mixes. Include description of type and proportions of ingredients.
   7. Reinforcing bars.
   8. Joint reinforcement.
   9. Anchors, ties, and metal accessories.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

F. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

G. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.07 QUALITY ASSURANCE

A. Applicator's Qualifications:
   1. Supervision: Maintain competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
   2. Experience: Company licensed in the State where the work will be preformed and a MCAA certified company in good standing with not less than 5 years continuous experience under the current name in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

3. Upon request, submit list of a minimum of 5 completed projects of comparable or greater size and complexity to this Work. Include for each project:
    a. Project name and location.
    b. Name and contact information for Owner.
    c. Name and contact information of General Contractor (if applicable).
    d. Name and contact information of Architect.

B. Preconstruction Testing Service: Owner will engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.
    1. Prism Test: For each type of construction required, per ASTM C 1314.

C. Mockups: Build free standing pre-construction mockup to verify selections made under Sample submittals, demonstrate understanding of the complete wall construction, demonstrate typical construction and waterproofing details, demonstrate aesthetic effects, and to set quality standards for materials and execution.
    1. Build mockup as shown on drawings, including face and backup wythes, fenestrations, flashings and accessories.
        a. Prior to product installation a field-constructed mock-up shall be provided under the provisions of Division 1 Section - Submittals, Product Data, Samples and Mock-ups, to verify details and tie-ins, and to demonstrate the required quality of materials and installation.
        b. Construct a typical exterior wall section, incorporating back-up wall, cladding, window and sill, insulation, flashing and any other critical junctions (roof, foundation, etc.) as detailed in Drawings at typical wall locations as located by Architect.
        c. Locate mockups as directed by Architect.
        d. Build mockups as indicated in Drawings.
            1) Show typical components, attachments to building structure, and methods of installation.
            2) Include a sealant-filled joint at least 16 inches
        e. Obtain Architect's approval of mockups before starting installation.
        f. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
        g. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
        h. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of twenty-four (24) inches down both sides of walls, and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of twenty-four (24) inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least twelve (12) hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 degree F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.02 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at twenty-eight (28) days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.03 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, are exposed in the completed masonry.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated, as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.
   1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.04 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square edged units at all exposed interior outside corners, including corners of door and window openings, of finished CMU walls and square edged blocks with solid top at CMU window sills not indicated to receive other sill material on top of the CMU sill.
      a. Provide square-edged units for other outside corners, unless otherwise indicated.

B. Load Bearing CMU: ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi or more in accordance with use, per the structural drawings.
   2. Density Classification: Normal weight unless otherwise indicated.
   3. Size as indicated on the drawings: Manufactured to dimensions 3/8 inch less than nominal dimensions.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

C. Non-Load Bearing CMU: ASTM C129.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
   2. Weight Classification: Normal weight, unless otherwise indicated.
   3. Size as indicated on the drawings: Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.05 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 BRICK

A. General: Provide shapes indicated and as follows with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
   4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
   5. Provide custom shapes at all outside, non-ninety degree corners.

B. Face Brick: ASTM C 216, Grade MW or SW, Type FBS.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3000 psi.
   2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.
   3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   4. Application: Use where brick is exposed, pattern as indicated on the drawings, unless otherwise indicated.
   5. Products: Subject to compliance with requirements, provide Cloud CeramicsInterstate Brick or approved equal (Contact Upchurch Kimbrough Company, Houston, TX):
      a. Blend 1:
         1) Size: Modular .
         2) Texture: Matte.
         3) Color: 33% Ironstone, 33% Park Rose, 34% Mountain Red.

2.07 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
   2. Natural Gray cement for concealed masonry not requiring color pigment.
   3. Colors as selected by the Architect from full range of available colors.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Davis Colors, True Tone Mortar Colors.
    b. Solomon Colors, Inc., SGS Mortar Colors

D. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C404.

F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. ACM Chemistries.
    b. BASF Corp. - Construction Chemicals.
    c. GCP Applied Technologies Inc.

G. Workability Additive (Face Brick only): "A" Marble Dust by Armco Steel Corp., 90/200 Mineral Filler by Limestone Products.

H. Water: Potable.

2.08 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. In event of conflict with reinforcing bar positions required in Structural Drawings, provide type indicated in Structural Drawings.

C. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center or sides of cells as required per the structural drawings. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Hohmann & Barnard, Inc.
    b. Heckmann Building Products, Inc.
    c. Wire-Bond.

2.09 MASONRY HORIZONTAL JOINT REINFORCEMENT

A. Masonry-Joint Reinforcement, General: ASTM A951/A951M.
1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.

5. Wire Size for Veneer Ties: 0.187-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

B. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods, unless otherwise noted in Structural Drawings or Specifications.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Wire-Bond,
      b. Hohmann & Barnard.

C. Masonry-Joint Reinforcement for Multiwythe Masonry:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Hohmann & Marnard; 170-2X Truss Eye-Wire.
      b. Wire-Bond; Series 900 Level Hook and Eye Truss.
   2. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe unless otherwise noted in Structural Drawings or specifications, and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch and maximum vertical adjustment of 1-1/4 inches. Size ties to extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

D. Masonry-Vertical Reinforcement : Coordinate vertical reinforcing in grouted masonry cells with structural drawings and specifications.

2.10 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82, with ASTM 153/A 153M, Class B2 coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

C. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section for Concrete: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.053-inch- thick, steel sheet, galvanized after fabrication.

D. Adjustable Masonry-Veneer Anchors at metal studs
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
      a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.

2. Masonry Anchors for Uncoursed or Random Coarsed Masonry at CMU Back-up: Galvanized ties that are bent in the form of triangular loops designed to be attached to masonry joint reinforcement with vertical wires passing through ties and through eyes projecting from masonry joint reinforcement.
    a. System provides for vertical adjustment for stone pattern indicated in Division 04, Section, Stone Masonry• .
    b. Available Products:
        1) Hohmann & Barnard, Inc,; HVR-295 V.
        2) Wire Bond; Stone Tab Ladder.
3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
    a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, and having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
    b. Fabricate sheet metal anchor sections and other sheet metal parts from 0.067-inch-thick, Stainless Steel, Type 304, ASTM A580/ASTM 580M.
    c. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.188-inch-diameter, Stainless Steel, Type 304, ASTM A580/ASTM 580M.
    d. Available Products: Basis of Design Product[**s**] are:
        1) For Coursed Masonry: Hohmann & Barnard, Inc.; BL-407 Anchor.
            a) Provide with membrane flashing tape at air barrier, provided and installed under Division 07 Air Barrier Section(s), or : Hohmann & Barnard, Inc. X-Seal Tape may be substituted if allowed by air barrier manufacturer.

2.11 EMBEDDED FLASHING MATERIALS

A. Flexible Flashing: Use[one of] the following unless otherwise indicated:
    1. Copper-Laminated Flashing: ASTM B370, CDA Alloy 110, 7-oz./sq. ft. copper core laminated polymer fabric on both sides with non-asphaltic adhesive. Extend flashing past face of brick and trim flush after inspection. Use only where flashing is fully concealed in masonry.
        a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
            1) STS Coatings, Inc.; Wall Guardian Copper TWF
            2) York Manufacturing, Inc.; York Copper Fabric Flashing, Multi-Flash 500.
        b. Copper Laminated Flashing shall not be used for any flashings that will be exposed to view in the completed work. Refer to Division 07 Section Sheet Metal Flashing and Trim for material type(s) for embedded flashings that are exposed to view or partially exposed to view. General Contractor shall coordinate responsibility to provide and install other flashing types.
        c. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
        d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

B. Termination bars: Provide stainless steel termination bars in cavity walls where copper flashing will be installed with termination bars and with waterproof sealant to protect top side of terminations refer to Division 07 "Joint Sealants".
    1. Refer to Drawings for termination bar details at face of exterior sheathing, behind ci insulation. Air barrier system materials (per Division 07 Water and Vapor Barrier Sections) shall lap over and down the face of the through-wall flashings.

2. Termination Bars for Flexible Flashing: #304 Stainless steel sheet 0.090 inch by 3/4 inches with a 3/16 inch minimum sealant flange at top, 8 inch oc pre-punched bolt holes minimum.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. OMG Roofing Products
    b. Wire-Bond.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        1) Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
        2) Heckmann Building Products, Inc., No. 85 Cell Vent.
        3) Hohmann & Barnard, Inc., Quadro-Vent.
        4) Wire-Bond, Cell Vent.

D. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. Advanced Building Products Inc.; Mortar Break II.
    b. Mortar Net Solutions; Mortar Net.
2. Configuration: Provide one of the following:
    a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
    b. Strips, not less than 1-1/2 inches thick and as recommended by the manufacturer for cavity size indicated, and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.13 MASONRY-CELL FILL

A. Where indicated, units shall contain masonry cell insulation designed for installing in cores of masonry units.

B. Loose-Fill Insulation: Perlite complying with ASTM C549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.14 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned. The use of muriatic acid is prohibited.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
      b. EaCo Chem, Inc.
      c. PROSOCO, Inc.
   2. Do not use materials or methods that can damage masonry finishes. Use only manufacturer's approved products and methods.
      a.

2.15 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use only portland cement-and lime in mortar unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type.S
   2. For reinforced masonry, use Type N.
   3. For mortar parge coats, use Type S.
   4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   5. Incorporate color pigment in mortar according to approved color per mock-up review.
   6. Use workability additive for brick masonry.

C. Pigmented Mortar: Use colored cement product.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Mix to match Architect's sample and approved in mock-up.

D. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C143/C143M.

2.16 SOURCE QUALITY CONTROL

A. Owner will engage a qualified independent testing agency to perform source quality-control testing indicated below:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Clay Masonry Unit Test: For each type of unit furnished, per ASTM C 67.

C. Concrete Masonry Unit Test: For each type of unit furnished, per ASTM C 140.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Contractor is responsible to coordinate between trades prior to concrete slab pours to avoid conflicts with CMU wall construction, including but not limited to the following:
1. Positions, sizes, and other requirements for locating all reinforcing coming up through slab. Unless otherwise noted in Structural Drawings, post-installation with epoxy anchors is not an equivalent method of installation. Any request to substitute post-installed anchors in masonry construction should be pre-approved by Contractor via RFI to the Structural Engineer of record, and the Structural Engineer may reject requests for such substitution.
2. Coordinate all conduits and pipes as shown in MEP drawings for concealed installation to greatest extent possible.
3. Reinforced / grouted cells will not be in conflict with electrical conduits, plumbing pipes, or other items built into CMU cells. This includes the quantity, sizes, and locations to comply with all notes, specific location details, and typical details, as indicated in the Structural Drawings.
4. Confirm sill sealer gaskets are installed where studs meet concrete slabs, prior to beginning veneer installation.

3.03 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Do not install any cut units at corner conditions.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying. Do not wet CMU.

3.04 TOLERANCES

A. Comply with construction tolerances in ACI 530.1/ASCE 6/TMS 602

B. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

C. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

D. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.

4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.05 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Clean reinforcement and shanks of anchor bolts by removing mud, oil, or other materials that will adversely affect or reduce bond at the time mortar or grout is placed. Reinforcement with rust, mill scale, or both are acceptable without cleaning or brushing provided that the dimensions and weights, including heights of deformations of a cleaned sample are not less than required by the ASTM specification that governs this reinforcement.

C. Debris: Construct grout spaces free of mortar dropping, debris, loose aggregates, and any material deleterious to masonry grout.

D. Reinforcement: Place reinforcement and ties in grout spaces prior to grouting.

E. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

F. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

G. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

H. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items. Install pipes and conduit as shown on MEP drawings and conceal within masonry cells all locations. Alert Architect to conflicts before installation.

I. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

J. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

K. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

L. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.

2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.06 MORTAR BEDDING AND JOINTING

A. Lay hollow brick CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

F. Cut joints flush where indicated to receive waterproofing, cavity wall insulation and/or air barriers unless otherwise indicated.

3.07 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.
a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.

b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.
   a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
   b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
   c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type reinforcement to allow for differential movement regardless of whether bed joints align.
3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.
   1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.08 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed connector sections and continuous wire in masonry joints.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

B. Provide not less than 2 inches of airspace between back of masonry veneer and face of ci insulation.
   1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

C. Provide self-sealing tape to seal around shaft of screw and legs of anchor at the point of penetration. Unless otherwise indicated in Division 07, Air Barrier sections, tape may be applied at each anchor or in continuous vertical strips, however continuous strips are highly recommended where exterior insulation will visually obscure the tape locations at the air barrier.

3.09 MASONRY-LOOSE FILL CELL INSULATION

A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.

B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.10 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.
      a. Reinforcing above is in addition to continuous reinforcing requirements.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.11 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
   1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed tie sections in masonry joints. Provide not less than 2 inches of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
   6. Provide self-sealing tape to seal around shaft of screw and legs of anchor at the point of penetration. Unless otherwise indicated in Division 07 Air Barrier sections, tape may be applied at each anchor or in continuous vertical strips, however continuous strips are highly recommended where exterior insulation will visually obscure the tape locations at the air barrier.

3.12 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
   1. Build in compressible joint fillers where indicated.
   2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."
   3. Location of expansion joints:
      a. At long walls no greater than 25 feet maximum.
      b. At offsets in walls.
      c. Near corners (10 ft. maximum).
      d. At intersections of walls.
      e. Where short runs of masonry intersect long runs of masonry.
      f. Where materials of different coefficients of thermal expansion are joined.

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch.
   1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.13 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.14 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at 2'-0 inches on center at top of masonry walls shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated. Embed flashing in manufacturer's recommended sealant. Seal lap joints as recommended by manufacturer.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multi-wythe masonry walls, including cavity walls, extend flashing through outer wythe, across air space behind veneer, behind continuous insulation and turned up face of fluid applied weather barrier on masonry inner wythe a minimum of 8 inches (16 inches if cavity mortar netting is installed is cavity). Secure to the inner wythe with continuous termination bar. Seal top of termination bar and install continuous insulation over flashing.
3. At masonry-veneer metal stud exterior walls, extend flashing through veneer, across airspace behind veneer, behind continuous insulation and and up face of sheathing at least 8 inches (16 inches if cavity mortar netting is installed is cavity). Fasten upper edge of flexible flashing to sheathing through termination bar and seal termination bar to weather barrier with compatible sealant.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent product**s** to form weep holes.
2. Form weeps above flashing under brick sills.
3. Space weep holes 24 inches o.c. unless otherwise indicated.

F. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article. At a minimum, place Mortar Net to a height equal to the height of the first course, but not less than 8 inches. Place immediately above the top of flashings embedded in the wall, as masonry construction progresses, to catch mortar droppings and to maintain drainage.

G. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.
1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

H. Install sill sealer at sill plate per manufacturer's written instructions.

3.15 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.16 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level [**B**] [**C**] in TMS 402/ACI 530/ASCE 5.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

H. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

I. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.17 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.18 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
   7. Clean stone trim to comply with stone supplier's written instructions.
   8. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.19 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
   1. Crush masonry waste to less than 4 inches in each dimension.
   2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
   3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

END OF SECTION 04 20 00

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. This specification covers all labor, materials and services incidental to and including the furnishing and setting of all Cast Stone as indicated on the drawings and specified herein.
   1. Trim units.
   2. Mortar materials.
   3. Accessories.

B. Related Requirements:
   1. Division 04 Section - Unit Masonry Assemblies, for miscellaneous masonry accessories.
   2. Division 05 Section - Cold-Formed Metal Framing, for steel stud frames supporting dimension stone cladding.
   3. Division 07 Section - Fluid Applied Membrane Air Barriers, for membranes applied to exterior face of exterior sheathing at exterior masonry cavity walls.
   4. Division 07 Section - Sheet Metal Flashing and Trim, for exposed sheet metal flashing.
   5. Division 07 Section - Firestopping, for firestopping at openings in masonry walls.
   6. Division 07 Section - Joint Sealants, for sealing control and expansion joints in unit masonry.
   7. Division 07 Section - Thermal Insulation, for cavity wall insulation.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces. Tie cast stone locations to building gridlines for verification of dimensions.
   1. Include building elevations showing layout of units and locations of joints and anchors.
   2. Show locations and details of flashing at a scale no less than 3 inches per 12 inches.

D. Samples for Verification:
   1. For each color and texture of cast stone required, 8 inches square minimum in size.
   2. For each trim shape required, 8 inches in length.
   3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

1.04 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364.
   1. Provide test reports based on testing within previous six months.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: The Manufacturer shall have been a recognized and reputable Cast Stone manufacturer for a minimum of five years continuous operation, and shall have adequate experience, facilities and capacity to furnish the quality, sizes and quantity of Cast Stone required without delaying the progress of the work. The Manufacturer's products shall have been previously used and exposed to the weather with satisfactory results.
   1. The Manufacturer shall be responsible for all labor, materials, equipment and services necessary for, and incidental to, providing all Cast Stone covered by this Specification.

B. Standards: Comply with the requirements of the Cast Stone Institute's Technical Manual and the project specifications. Where a conflict may occur, the contract documents shall prevail.

C. All Cast Stone used in this work shall be manufactured by cast stone manufacturer and shall have minimum compressive strength of 6500 lbs. per square inch and absorption of no greater than 6 percent when tested in accordance with the requirements of this Specification.

D. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

F. Furnish cast stone for installation in mockups specified in Section 04 20 00 "Unit Masonry."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.
   1. The Setting Contractor shall unload, receipt for, protect, store and set all Cast Stone covered by this Specification and shall provide and install all anchors for same.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.
   1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
   2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.07 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.02 CAST STONE MATERIALS

A. General: Comply with ASTM C1364.

B. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide natural color or white cement as required to produce cast stone color indicated.

C. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast stone textures and colors.

D. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast stone textures and colors.

E. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

F. Admixtures: Use only admixtures specified or approved in writing by Architect.
1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C260/C260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.

G. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 304 .

2.03 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advanced Architectural Stone Inc. (AAS), 115 Lee Street, Fort Worth, Texas 76140, (817) 572-0012 Fax (817) 293-6378, Email: sales@advancedarchitecturalstone.com, URL: www.advancedarchitecturalstone.com.

2. AHI Supply, LP, 2800 North Gordon, Alvin, Texas 77511, (281) 331-0088 Fax (281) 331-9813, Email: arhoden@ahi-supply.com, URL: www.ahi-supply.com.
3. Continental Cast Stone of Texas Inc., 101 E Shady Grove Rd, Grand Prairie, Texas 75050, (972) 871-7866 Fax (972) 871-1251, Email: info@continentalcaststone.com.
4. Stone Castle Industries Inc., 3615 Almeda Genoa, Houston, Texas 77047, (713) 440-6224 Fax (713) 440-6228, URL: www.stonecastleinc.com.

B. Cast Stone Units: Comply with ASTM C1364.
1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
2. Trim units including window sills wall caps; items as indicated on Drawings.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure Units as Follows:
1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than six days at mean daily temperature of 60 deg F or above.
c. No fewer than seven days at mean daily temperature of 50 deg F or above.
d. No fewer than eight days at mean daily temperature of 45 deg F or above.

F. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

G. Colors and Textures: As selected by Architect from manufacturer's full range.

2.04 MORTAR MATERIALS

A. Provide mortar materials that comply with Section 04 20 00 "Unit Masonry."

2.05 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

2.06 MORTAR MIXES

A. Comply with requirements in Section 04 20 00 "Unit Masonry" for mortar mixes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated in TMS 604.

B. Install cast stone units to comply with requirements in Section 04 20 00 "Unit Masonry."

C. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
   2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

D. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

E. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Set units with joints 1/4 to 3/8 inch wide unless otherwise indicated.
   2. Build anchors and ties into mortar joints as units are set.
   3. Fill dowel holes and anchor slots with mortar.
   4. Fill collar joints solid as units are set.
   5. Build concealed flashing into mortar joints as units are set.
   6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
   7. Keep joints at shelf angles open to receive sealant.

F. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

G. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

H. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

I. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

J. Point joints with sealant to comply with applicable requirements in Section 07 92 00 "Joint Sealants."
   1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

K. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.
   1. Keep joints free of mortar and other rigid materials.

2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.03 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

C. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

D. Fill anchor holes with sealant.
1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

E. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

F. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.
1. Form open joint of width indicated, but not less than 3/8 inch.

G. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

H. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.04 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 ft., [3/8 inch in 20 ft.] [1/4 inch in 20 ft.], or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 ft., [3/8 inch in 20 ft.] [1/4 inch in 20 ft.], or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.05 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears before tooling joints.
   2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
   3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
   5. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
   6. Clean cast stone by methods described in Cast Stone Institute Technical Bulletin #39.
   7. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Standard Form of Construction Agreement, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: This section covers furnishing all labor, materials, equipment, and services in connection with the furnishing, fabrication and erection of all structural steel work complete including:
   1. Steel Columns
   2. Steel Beams
   3. Shelf Angles
   4. Bolts
   5. Angle Frames Around Openings
   6. Laboratory Control
   7. Leveling Plates and anchor plates not cast in concrete or masonry.
   8. Shop Painting

B. Include all supplementary parts and members necessary to complete the structural steel frame, regardless of whether all such parts are definitely shown or specified, and furnish all such bolts, gussets, plates, etc. as may be required for proper assembly of all items.

C. Related Sections:
   1. Division 01 Section “Quality Requirements.”
   2. Division 05 Section “Metal Fabrications.”

1.03 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
   1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
   2. Welded built-up members with plates thicker than 2 inches.
   3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.05 DESIGN

A. Structural Performance: Engineer structural steel connections not specifically detailed by the Contract Documents to withstand design loadings indicated. Beam connections shall be standard AISC double angle unless shown otherwise.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer to prepare calculations, supervise Shop Drawings, and select other structural data for structural steel connections.
   1. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

C. Substitutions: Substitutions of sections or modifications of details, or both, and the reasons therefore, shall be submitted with the shop drawings for approval. Approved substitutions, modifications, and necessary changes in related portions of the work shall be coordinated by the fabricator and shall be accomplished at no additional cost to the Owner.

D. Responsibility for Errors: The fabricator shall be responsible for all errors of detailing, fabrications, and for the correct fitting of the structural members.

E. Templates: Templates shall be furnished by the fabricator with instructions for the setting of anchor bolts.

1.06 CODES

A. American Institute of Steel Construction:
   1. Specification for Structural Steel Buildings with commentary (AISC Manual of Steel Construction).
   2. Code of Standard Practice for Steel Buildings and Bridges.
   3. Specification for Structural Joints using High Strength Bolts.

B. American Welding Society:
   1. Structural Welding Code-Steel. AWS D1.1.

C. Industrial Fasteners Institute:
   1. Handbook on Bolt, Nut and Rivet Standards.

D. Steel Structure Painting Council:
   1. Painting Manual, Volume 1, Good Painting Practice.
   2. Painting Manual, Volume 2, Systems and Specifications.

1.07 SUBMITTALS

A. Comply with pertinent provisions of Division 01 Section “Submittal Procedures”, unless otherwise indicated.

B. Shop Drawings: Submit detailed shop and installation drawings, including design calculations for connections of the structural steel, to the Engineer for review. Steel for which such drawings have not yet been reviewed shall not be fabricated. Such review will cover the general conformance of design. The omissions from the shop and installation drawings of any materials shown on the Specifications shall not relieve the contractor of the responsibility of furnishing and installing such materials, even though such drawings may have been returned and reviewed.

C. Shop Drawings detailing fabrication of structural steel components:
   1. Include and indicate details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
   4. Shop drawings shall be drawn at 1/8" = 1'-0" minimum for plans and ¾" = 1'-0" minimum for sections. Contract drawings shall not be reproduced in whole or in part. Contract drawings modified into shop drawings will be returned without review.
   5. Each sheet of the shop drawings shall bear the review stamp of the Contractor indicating the drawings have been reviewed and is approved. Shop drawings not bearing the Contractor's stamp will be returned without review.

D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

E. Certified mill test reports, evidencing conformity with the requirements of the A.S.T.M. and A.I.S.C. Specifications, shall be submitted to the Architect, Structural Engineer, and Contractor for their respective records. Mill test reports will not be returned or approved.

F. Failure by the contractor to submit the shop drawings and test reports required above shall release the Architect and the Engineer from any liabilities due to the negligence on the part of the Contractor to comply with the construction documents.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.01 MATERIAL GRADES

A. Steel Tubes: ASTM A500, Grade C.

B. Steel Pipe: ASTM A 53 Type E or S Grade B or ASTM A 501

C. W-Shapes: ASTM A 992, Grade 50

D. All other structural steel shapes: ASTM A 36

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. Bolts: Anchor bolts and erection bolts shall have minimum conformance to ASTM F1554 (grade as noted on plans) and to the requirements for heavy hexagon bolts and nuts of ASA Standards B18.2.1 and B18.2.2.

B. High Strength Bolts and Nuts: ASTM A325X with the thread excluded from the shear plane. Bethlehem "Load Indicator Bolts" or LeJeune "Tension Control Fasteners" complete with mating nut and washer and J&M Turner load-indicator washers may be used.

C. Washers: Circular washers shall be flat and smooth, and shall conform to requirements of Type A washers in ASA Standard B27.2. Beveled washers for American standard beams and channels shall be square or rectangular, shall taper in thickness, and shall be smooth. Washers for use with high strength bolts shall be hardened.

D. Adhesive Anchors: Injectable adhesive for the installation of threaded anchors rods into concrete. Rods shall be ASTM A36 U.N.O. Adhesive shall be Hilti- HIT HY 200 or Simpson Acrylic-tie or approved equal.

E. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.

2.03 WELDING ELECTRODES

A. Shall conform to the requirements of the Specifications of the American Institute of Steel Construction. Use E70 electrodes.

2.04 COATINGS

A. Paint: Shall conform to the requirements of Federal Specification TT-P-86 Type I of II, SSPC Paint 4-64T or Federal Specification TT-P-636C primer coating, synthetic, rust inhibiting primer. Tnemic series “1009” gray primer, or approved equal. Tnemec Paint Company, North Kansas City, Missouri.

B. Zinc-Coating: When galvanizing steel is required, the zinc-coating shall conform to ASTM A123 . Zinc-coating for threaded products shall conform to ASTM A153.

C. Cold galvanizing compound shall be “ZRC Cold Galvanizing Compound” as manufactured by ZRC Chemical Products, Quincy, Massachusetts.

PART 3 - EXECUTION

3.01 FABRICATION

A. General: Except as modified herein, fabrication shall be in accordance with the applicable Specifications and Standards of the American Institute of Steel Construction. Workmanship shall be equal to standard commercial practice in modern structural shops. Portions of the work exposed to view shall be finished neatly. Structural material, either plain or fabricated, shall be stored above the ground on platforms, skids, or other supports. Material shall be kept free from dirt, grease, and other foreign matter, and shall be protected as far as practical from

corrosion. All material shall be clean and straight. If straightening or flattening is necessary, it shall be done by a process in a manner that will not damage the material. Finished members shall be free from undue twists, bends, warping distortion, and other irregularities. Holes shall not be made or enlarged by burning. Shearing, flame cutting, and chipping shall be done carefully and accurately. Splicing structural steel members shall not be permitted.

1. Compression joints, depending upon contact bearing, shall have the bearing surfaces machined to a common plane after the members are completed.
2. Protective Painting: One (1) coat of approved primer shall be applied to all exposed surfaces of all structural steel members except those surfaces requiring field welding, to be encased in concrete, to be galvanized, to be spray fireproofed and the top flanges of beams to support metal deck.

   All metal surfaces to be painted shall be cleaned of all loose mill scale, dirt, rust, etc. by the use of steel scrapers, wire brushes, sandblast or other means approved by the Architect. Oil and grease shall be removed with naphtha and the metal surfaces shall be dry when paint is applied.

   Paint shall not be applied during damp weather, or when the temperature is at or below freezing. Any damage to the shop coat of paint and welded areas where shop paint was omitted shall be field painted with shop paint to the satisfaction of the Architect.

   Steel work specified to have no shop paint shall, after fabrication, be cleaned of oil or grease by solvent cleaners and be cleaned of dirt, and other foreign material by thorough sweeping with a fiber brush. Apply shop paint to provide a minimum dry film thickness of 2.0 mils.
3. Bolted Construction: Holes for bolted construction shall be fabricated as specified for bolted construction. Bolt holes shall be at right angles to the member. The slope of bolted parts in contact with the bolt head shall not exceed 1:20 with respect to a plane normal to the bolt axis. Where the surface of a bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for the lack of parallelism. Bolt holes shall have a nominal diameter not greater than one-sixteenth (1/16) inch in excess of the nominal, bolt diameter.
4. Common Bolts: The bolts shall be of such length that they will extend entirely through the nuts, with the beveled end outside the nut. Bolt heads and nuts shall be drawn tight against the work with a suitable wrench not less than fifteen (15) inches long. Threads shall be excluded from shear plane
5. Baseplates: Oversize anchor bolt holes in baseplates to facilitate erection as follows:
   a. Bolts 3/4” to 1” in diameter: 5/16” oversize
   b. Bolts 1” to 2” in diameter: 1/2” oversize

   Use oversize nut or plate washers under nut at all oversized holes in baseplates. Washers must be large enough to cover hole. Washer thickness shall be at least 1/8 of bolt diameter.
6. Camber: Provide camber in members indicated on the drawings. Specified camber applies at the jobsite, just prior to erection, lying flat so that the member weight has no effect. Take necessary precautions to prevent or compensate for camber loss during shipment. Measured camber in members up to 50’-0” long shall be within a tolerance of minus 1/2” to plus zero from the specified camber. Members with field measure camber outside the specified camber shall be returned to the shop.
7. Galvanizing: the following members shall be hot dip galvanized: masonry shelf angles, any steel members exposed to weather, and where noted on drawings.

3.02 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 ERECTION

A. General: Except as modified herein, erection shall be in accordance with the applicable Specifications and Standards of the A.I.S.C. Manual of Steel Construction. Where parts cannot be assembled or fitted properly as a result of errors in fabrication or of deformation due to handling or transportation, such condition shall be reported immediately to the testing laboratory for approval of the method of correction obtained. The straightening of plates and angles or other shapes shall be done by approved methods. Bent or damaged heat-treated parts will be rejected. Steel work shall be drained properly; pockets in structures exposed to the weather shall be filled with an approved waterproof material. The erector will be responsible for shrinkage and distortion of all butt welds. Loose joints will be corrected by cutting with a hand guided torch if necessary.

B. Assembly:
   1. Temporary bracing shall be used wherever necessary to support all loads to which the structure may be subjected, including equipment and operation thereof and piles of materials. Such bracing shall be left in place as long as required for safety. The various members forming parts of a completed frame or structure after being assembled shall be aligned and adjusted accurately before being fastened. Splicing of compression members shall be done after the abutting surfaces have been brought into contact.
   2. Bearing surfaces and surfaces which will be in permanent contact shall be cleaned before the members are assembled. Bearing plates shall be set in exact position and shall have a full and even bearing upon the concrete. As erection progresses, the work shall be bolted or welded sufficiently to take care of all dead load, wind, and erection stresses. Splices will be permitted only where indicated. All erection bolts used in welded construction may be tightened securely and left in place; if removed, the holes shall be filled with plug welds.

C. Field bolting shall be in accordance with the requirements specified for shop fabrication. Unfair holes shall be corrected by reaming. Where the surface of a bolted part has a slope of more than 1:20, a beveled washer shall be used to compensate for the lack of parallelism. Bolt heads and nuts shall be drawn tight against the work with a suitable wrench not less than fifteen (15) inches long. Bolt heads shall be tapped with a hammer while the nut is being tightened.

D. Bolts to be “snug-tight” unless noted otherwise, and shall be tightened a few impacts of an impact wrench or the full effort of a man using a ordinary spud wrench, bringing the plies into contact. Field welding shall be as specified for shop fabrication of welded construction. Any shop paint on surfaces adjacent to joints to be field welded shall be wire brushed to reduce the paint film to a minimum. Slag shall be removed from all completed welds.

E. Field repair of zinc-coatings with cold galvanizing compound per manufacturer's specifications.

F. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

G. Setting baseplates: Set baseplates on shims or other adjustment devices. Tighten anchor bolts after supported members have been positioned and plumbed. Cut off protruding wedges or shims. Grout under baseplates in accordance with Division 3: Section Cast-in-Place Concrete.

3.04 FIELD QUALITY CONTROL

A. An independent testing laboratory shall perform inspection and testing services specified in this section.

B. Shop Inspection
   1. Visual inspection of all shop welding.
   2. Ultrasonic inspection of all full penetration welds.
   3. Examination of galvanizing.
   4. Examination of shop painting.

C. Field Inspection
   1. Proper erection of all pieces.
   2. Proper installation of all bolts, including checking the calibration of impact wrenches used with high strength bolts.
   3. Plumbness of structure and proper bracing.
   4. Ultrasonic inspection of all full penetration welds.
   5. Record and measure camber of beams upon arrival and before erection for compliance with the specified camber. Measure beam lying flat with web in the horizontal position. Members outside the specified camber tolerance shall be returned to the shop and replaced with members meeting the specified camber tolerance.

D. Qualification of Welders: Before assigning any welder to work covered by this section of the Specifications, the fabricator shall provide the Testing Laboratory with certification that each of the welders to be employed on the project has passed qualification tests within the last year using procedures covered in the American Welding Society Standard D1.0-63.

E. The contractor shall be responsible for furnishing fabrication and erection inspection and testing of all welds in accordance with AWS D1.1, Chapter 6. Submit records of inspections and tests to the testing laboratory for their review.

F. Inspection of shop and field welding shall be “verification inspection” in accordance with Section 6 of AWS D1.1 and as follows:
   1. Visually inspect the welding of all shop fabricated members and note the location of all cover plates, connectors, bearing stiffeners, splices, and fillet welds for proper return around ends and check for seams, folds, and delaminations.
   2. Ultrasonically test all full penetration welds in accordance with ASTM E164.
   3. Root passes shall be thoroughly inspected for cracks. All cracks shall be gouged out and rewelded to two inches beyond each end of the crack.
   4. Mark all welds requiring repairs and make reinspections.
   5. The Testing Laboratory inspector shall advise the Owner and Architect of any shop and/or field conditions which, in his opinion, may require further tests and examination. Such further tests shall be performed as authorized by the Owner and Architect.
   6. The Owner reserves the right to use ultrasonic or radiographic inspection to verify the adequacy of all welds. Testing procedures and acceptance criteria shall be as specified in AWS D1.1.

G. Inspection of bolted construction shall be in accordance with AISC "Specification for Structural Steel Buildings" and as follows:
    1. All bolts shall be visually inspected to ensure that the plies have been brought into "snug" contact.
    2. High strength bolts shall be inspected in accordance with Section 9 of the AISC "Specifications for Structural Joints Using ASTM A325X or A490X Thread Excluded Bolts."
    3. For all high strength bolts, unless specifically noted on the Drawings to require only "snug-tight" installation, the inspector shall observe the required jobsite testing and calibration, and shall confirm that the procedure to be used provides the required tension.

END OF SECTION 05 12 00

SECTION 05 22 00 – STRUCTURAL STEEL DECKING

PART 1 - GENERAL

1.01 RELATED WORK

A. Drawings and general provisions of the Standard Form of Construction Agreement, including General and Special Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Roof deck.
   2. Noncomposite floor deck

B. Related Requirements
   1. Division 03 Section “Cast-in-Place Concrete”
   2. Division 03 Section “Lightweight Insulating Concrete”
   3. Division 05 Section “Structural Steel Framing”
   4. Division 05 Section “Long Span Composite Acoustical Roof Deck”
   5. Division 05 Section “Metal Fabrications”

1.03 QUALITY ASSURANCE

A. Steel deck assembly is to meet or exceed the requirements of Class I-90 securement.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.02 MANUFACTURERS

A. Bowman

B. Bac-Fab

C. Merco

D. Roll Form

E. Vulcraft

F. Wheeling

2.03 MATERIALS

A. Steel Deck: Reference plans

B. Fasteners: Reference plans

C. Refer to the Structural Drawings to confirm all steel deck materials and types required for this project.

2.04 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 40 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
      a. Color: Manufacturer’s Standard.
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness; Deck Unit/Bottom Plate: As indicated.
   5. Span Condition: As indicated.
   6. Side Laps: Overlapped or interlocking seam at Contractor’s option

2.05 NONCOMPOSITE FORM DECK

A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated
   1. Span Condition: As indicated.
   2. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.06 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated. Fasteners below pertain to typical roof and noncomposite metal decking. Fasteners shall be provided as specified on the drawings.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile indicated.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

H. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as specified on the drawings. Contractors option to substitute frame fasteners for arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds 9 inches apart in the field of roof and 6 inches apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
   3. Weld Washers: Install weld washers at each weld location

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 24 inches, and as follows:

   1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch.
   3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

D. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds an average of 12 inches apart.
   3. Weld Spacing: Space and locate welds as indicated.
   4. Weld Washers: Install weld washers at each weld location.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 36 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws.
   2. Mechanically clinch or button punch.
   3. Fasten with a minimum of 1-1/2-inch-long welds.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inch, with end joints as follows:
   1. End Joints: Lapped

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.06 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
   2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

END OF SECTION 05 22 00

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Load-bearing cold-formed metal framing.
   2. Exterior non-load-bearing wall framing.
   3. Cold Formed Ceiling Joist Framing.
   4. Cold Formed Roof Rafter Framing.

B. Related Sections include the following:
   1. Division 05 Section - Metal Fabrications.
   2. Division 05 Section - Cold Formed Metal Trusses.
   3. Division 06 Section - Rough Carpentry for subflooring, wall sheathing, or roof sheathing using wood-based structural-use panels, particleboard, fibrous-felted board, and foam-plastic sheathing.
   4. Division 06 Section - Sheathing, for exterior wall sheathings.
   5. Division 07 Section - Thermal Insulation.
   6. Division 07, Air and Weather Barrier Section(s).
   7. Division 09 Section - Gypsum Board Assemblies for interior non-load-bearing metal-stud framing and ceiling-suspension assemblies, and exterior gypsum sheathing.
   8. Division 09 Section - Gypsum Board Shaft-Wall Assemblies for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
   9. Division 09 Section - Metal Support Systems, for ceiling and soffit suspension assemblies.

1.03 DEFINITIONS

A. Minimum Uncoated Steel Thickness: Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.

B. Producer: Entity that produces steel sheet coil fabricated into cold-formed members.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Division 01, Section "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Where stud gauges are noted in Drawings, such gauges are minimum allowed gauges. Provide gauges per delegated design, or noted gauges, whichever is greater.
   2. Design Loads: As indicated on drawings.
   3. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Curtain-Wall Framing:
         1) Metal panel finish: Horizontal deflection of 1/360 of the wall height.
         2) Masonry veneer or plaster/stucco finish: Horizontal deflection of 1/600 of the wall height.

4. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
5. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1/240 of the span.

C. Design exterior non-load-bearing curtain-wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Provide shop drawings prepared by cold-formed metal framing manufacturer or other delegated design engineer.
1. Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
3. For cold-formed metal framing indicated to comply with design loads, include structural analysis data and detailed shop drawings signed and sealed by the qualified professional engineer registered in the state responsible for their preparation, and where project is located.

1.06 INFORMATIONAL SUBMITTALS

A. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.

B. Welding Certificates: Copies of certificates for welding procedures and personnel.

C. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

E. Research/Evaluation Reports: Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
1. Third party evaluation report for products reviewed to local building code or its model code and AISI S100.

1.07 QUALITY ASSURANCE

A. Engineering Responsibility: Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Installer Qualifications: An experienced installer who has completed cold-formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, and galvanized-coating thickness.

E. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

F. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Fire-Test-Response Characteristics: Where metal framing is part of a fire-resistance-rated assembly, provide framing identical to that of assemblies tested for fire resistance per ASTM E 119, and displaying a classification label from, a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

H. AISI Specifications: Comply with AISI's "Specification for the Design of Cold-Formed Steel Structural Members" or "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the following for calculating structural characteristics of cold-formed metal framing.

1. CCFSS Technical Bulletin: "AISI Specification Provisions for Screw Connections."

I. Coordinate with insulation installer, if other than cold formed metal framing installer, to pack stud packs headers and similar construction that will not be accessible after erection, with batt insulation. Should Contractor fail to coordinate installation of batt thermal insulation, Contractor shall be responsible to foam insulate all such cavities at no additional cost to Owner, prior to applying interior sheathing.

J. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section - Project Management and Coordination.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling, and as required in AISI/s "Code of Standard Practice".

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation, and as required in AISI/s "Code of Standard Practice".

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:
   1. Allied Building Products, Inc.
   2. AllSteel Products, Inc.
   3. California Expanded Metal Products Co.
   4. California Metal Systems, Inc.
   5. Clark-Dietrich Building Systems.
   6. Consolidated Fabricators Corp.
   7. MarinoWare; Div. of Ware Industries, Inc.
   8. Scafco Corp.
   9. Steel Construction Systems.
   10. Steel Developers, LLC.
   11. Steeler, Inc.
   12. Super Stud Building Products, Inc.
   13. United Metal Products, Inc.

2.02 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 Galvanized finish.

C. Steel Sheet for Vertical Deflection and Drift Clips: ASTM A 1003/A 1003M, A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90.

2.03 LOAD-BEARING WALL FRAMING

A. General: Provide greater than minimum gauge and dimensions if and where indicated in the Drawings, and where required by Engineer's cold formed metal framing design as indicated in shop drawings.

B. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch. (16 ga.)
   2. Flange Width: 1-5/8 inches, typical minimum or as noted on drawings
   3. Section Properties: As required by design criteria.

C. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch. (16 ga.)
   2. Flange Width: 1-1/4 inches.

D. Z-Shaped and C-Shaped or J-Shaped Furring: With non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation, or insulation and air space, as indicated in Drawings.
   1. Minimum Nominal Thickness: 0.025 inch.
   2. Provide C-Shape or J-Shape furring at perimeter of openings as required to attach window systems and framing, and where indicated in Drawings.

E. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch. (16 ga.)
   2. Flange Width: 2 inches or as noted on drawings
   3. Section Properties: As required by design criteria.

F. Steel Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch. (16 ga.)
   2. Top Flange Width: 2 inches or as noted on drawings
   3. Section Properties: As required by design criteria.

2.04 NONLOAD-BEARING EXTERIOR WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:
   1. Minimum uncoated steel thickness: .0538 inch (16 ga.)
   2. Flange width: 1-5/8 inches.
   3. Provide greater than minimum dimensions where indicated in the Drawings, and where required by Engineer's cold formed metal framing design as indicated in shop drawings.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, complying with ASTM C 955 of manufacturers standard flange width and minimum thickness matching steel stud.
   1. Where curved applications are indicated in Drawings, provide custom pre-curved tracks, or segmented track capable of producing a smooth arc to indicated radiuses.

C. Slotted Deflection Track: Manufacturer's single, deep-leg (Min. 3"), U-shaped steel track; punched with vertical slots in both legs. Studs should be positively attached to deep-leg track using vertical slots while allowing +/- 1" free vertical movement. Legs designed to support horizontal and lateral loads and transfer them to the primary structure.

D. Z-Shaped Furring Channels: With slotted or non-slotted web, face flange of 1-1/4", and wall attachment flange of 7/8". Minimum 20 gauge galvanized steel[, or heavier where required by weight of and deflection limits for attached finish systems]. Size: 2" to fit insulation thicknesses.
   1. Provide J or C shaped track and channels to frame around openings where required and where indicated in Drawings for fire rated construction and / or for screw attachment or support of windows. 16 gauge non-slotted where required to prevent flame spread at cavity wall construction.

E. Z-Shaped Furring: With non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.
   1. Nominal Thickness: 0.025 inch.

F. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating 1" of upward and downward vertical displacement of primary structure, without imposing vertical load on the wall framing.

2.05 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.

4. End clips.
5. Foundation clips.
6. Gusset plates.
7. Stud kickers, knee braces, and girts.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.06 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123.

B. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-threading steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.07 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: 5-12" x 3/8" closed cell foam and adhesive backed peel and stick membrane, equal to Protecto Wrap (800-759-9727) "Triple Guard Energy Sill Sealer." Provide at all exterior metal studs in contact with floor slab.

2.08 SHEATHING

A. Sheathing: Comply with requirements in **Division 09 Section - Gypsum Board Assemblies**.

2.09 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

B. Install sealer gaskets per manufacturer's instructions to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at exterior wall stud locations, with self adhesive legs of T-shaped membrane adhered to face of sheathing and to vertical face of concrete slab or foundation.

3.03 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to ASTM C 1007 and AISI S200 "North American Standard for Cold-Formed Steel Framing - General Provisions", unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

J. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.04 EXTERIOR WALL FRAMING INSTALLATION

A. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable exterior wall-framing system.

B. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

C. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated or required by design.

D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

E. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

F. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

G. At load bearing walls, align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads. Squarely seat studs against top and bottom tracks with gap not exceeding 1/8 inch between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks.

H. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
2. Connect vertical deflection clips to bypassing studs and anchor to primary building structure.

I. Install horizontal bridging in exterior wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.

J. Install Z-shaped furring in exterior insulation plane where indicated and as required to support exterior finish materials. Install C or J shaped furring around perimeter of building openings as required to support edges of finish materials, and where required to provide for attachment of windows, and at other locations as indicated in Drawings.

K. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

L. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

M.

3.05 EXTERIOR FURRING INSTALLATION

A. Installation of furring at continuous insulation
1. Erect furring vertically to hold insulation specified in Division 07, Section "Thermal Insulation" in place. Z-shaped furring members spaced to match stud spacing
2. Erect furring horizontally <at insert locations / description> to hold insulation specified in Division 07, Section "Thermal Insulation" in place. Z-shaped furring members spaced 24 inches maximum o.c.
3. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
4. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
5. At window and door openings, provide C or J shaped perimeter furring or tracks where required for fastening window framing.
6. At jambs and heads of openings in fire rated cavity walls, install 16 gauge C or J shaped perimeter framing or tracks of solid profile without cut-outs, where detailed in Drawings and where required for flame spread prevention into cavity. Framing sized to fill space from face of sheathing to back side of loose lintel, masonry veneer, or other non-combustible finish material.

B. Furring Channels for metal panels: Refer to Division 07 Section **"Metal Wall Panels"**.

3.06 SHEATHING INSTALLATION

A. General: Install sheathing to comply with **Division 09 Section - Gypsum Board**.
1. Coordinate framing installation with sheathing, flashing, waterproofing or air barrier, and sealants installation.

B. Air-Infiltration Barrier Application:
1. Refer to Division 07 Section - **Plastic Film Air Barrier.**

3.07 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field and shop welds will be subject to inspection and testing.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace Work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

3.08 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.

C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.

D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.

E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. General: Furnish all labor, supervision, materials, tools, equipment, appliances and services necessary for the fabrication, delivery and installation of all miscellaneous metal items. All work shall be as shown or indicated on the drawings and as specified in this section.

B. Section Includes:
1. Miscellaneous Framing and Supports
2. Ship Ladders
3. Metal Bollards
4. Pipe Protections
5. Steel Gates
6. Loose Steel Lintels
7. Steel and Iron Finishes
8. Aluminum Finishes

C. Related Requirements:
1. Section 03 30 00 Cast-In-Place Concrete
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 12 00 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
4. Division 06 Section - Rough Carpentry, for concealed blocking for attachment of metal fabrications.
5. Division 09 Section - Painting.
6. Division 11 through 28 and other Sections for equipment requiring miscellaneous steel support structure.
7. Division 32 Sections - Exterior Fence, Gates and railing infill paneling.

1.03 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.04 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Metal ships' ladders.
   2. Metal bollards.
   3. Downspout guards.
   4. Steel Gates
   5. Metal downspout boots.

B. Shop Drawings: Show fabrication and installation details. Provide Shop Drawings for the following:
   1. Metal ships' ladders.
   2. Metal bollards.
   3. Steel Gates
   4. Loose steel lintels, Bearing Plates and Ledge Angles
   5. Shop drawings based on the Contract Documents shall be submitted to the Architect for review prior to ordering of materials.
   6. Failure by the contractor to submit shop drawings, test reports, etc. required above shall release the Architect and the Engineer from any liabilities due to the negligence on the part of the contractor to comply with the construction documents.
   7. Approval will cover size and arrangement of members, character of construction, but not dimensions or quantities.
   8. Contractor shall verify actual dimensions at the construction site.

1.05 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.06 QUALITY ASSURANCE

A. Steel stairs in accordance with latest NAAMM Standards and AISC.

B. Welding shall conform to American Welding Society's Standard Code for Arc and Gas Welding in Building Construction. Welding shall be continuous along entire area of contact, except where tack welding is specifically shown or specified. Grind all exposed welds.

C. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Accessories: Provide all anchors bolts, anchor straps, hangers and other related fittings, fastener and accessories required for proper and secure installation of all miscellaneous metal. Fasteners for exterior use shall be zinc coated. Generally, the sizes, shapes and spacing of items are shown or specified; where not shown or specified, accessories shall be adequate for the required services, subject to approval.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 degree F, ambient; 180 degree F, material surfaces.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Metal Standards: Comply with the following standards, as pertinent:
   1. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
   2. Steel plates to be bent or cold-formed: ASTM A283; grade C;
   3. Steel bars and bar-size shapes: ASTM A306; grade 65, or ASTM A36;
   4. Cold-finished steel bars: ASTM A108l
   5. Cold-rolled carbon steel sheets: ASTM A336;
   6. Galvanized carbon steel sheets: ASTM A526, with G90 zinc coating in accordance with ASTM A525;

C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.

D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.

F. Rolled-Stainless Steel Floor Plate: ASTM A793.

G. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

I. Zinc-Coated Steel Wire Rope: ASTM A741.
   1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

J. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
   1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.

K. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft.zinc coating.
   1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.

L. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

M. Malleable iron castings: ASTM A47;

N. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.

O. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.

P. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.

Q. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.

R. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).

S. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semi red brass).

T. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.

U. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
   1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
   2. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

D. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

E. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F2329/F2329M.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.04 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint Twenty (20) and compatible with paints specified to be used over it.

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.06 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
   1. Fabricate units from slotted channel framing where indicated.
   2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions, fixed hung partitions, low partition bracing supports, suspended equipment, overhead doors, elevator beams etc. from continuous steel beams of sizes [indicated] [recommended by partition manufacturer] [as required by delegated structural design] with attached bearing plates, anchors, and braces as [indicated] [recommended by partition manufacturer] [as required by delegated structural design]. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
   1. Provide bearing plates welded to beams where indicated.
   2. Drill or punch girders and plates for field-bolted connections where indicated.
   3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.
   1. Unless otherwise indicated, fabricate from Schedule forty (40) steel pipe.
   2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with [zinc-rich primer] [primer specified in Section 09 96 00 "High-Performance Coatings"] where indicated.

2.07 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation. Galvanize ships' ladders, including treads, railings, brackets, and fasteners. Construct as

1. Angle: 65-degrees from horizontal.
2. Stringer: C12 x 20.7 steel stringer.
3. Treads shall be not less than 5 inches exclusive of nosing or less than 8-1/2 inches including the nosing, and riser height shall be not more than 9-1/2 inches.
4. Fabricate ships' ladders, including railings from steel.
5. Fabricate treads from Serrated Bar Grate with diamond-pattern front lip. Limit openings in gratings to no more than 1/2 inch in least dimension.
6. Tread Attachment: Weld treads to stringers, and secure with (2) 1/4 inch round-head bolts each side.
7. Slab Attachment: Attach base plates to slab with 3/8 inch x 5 inch expansion anchors. Provide non-shrink grout between slab and base plate.
8. Ladder Handrail: 1-1/4 inch standard steel pipe, welded to stringer at 4 inches - 0 inches O.C.

B. Prime interior steel ships' ladders, including treads, railings, brackets, and fasteners, with zinc-rich primer.

2.08 METAL BOLLARDS

A. Fabricate metal bollards from 6 inches diameter Schedule 40 galvanized steel pipe.
1. Cap bollards with tooled smooth concrete mound at the top of the bollard to shed water.
2. Fill pipe with concrete fill, mound concrete at top of bollard to shed water.
3. Size: 7 feet - 0 inches in length, recessed 3 feet - 0 inches below-grade. 4 feet - 0 inches height above grade, unless otherwise indicated in Drawings.
4. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
5. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
6. Paint: Refer to Division 09, Section "Painting". Colors: safety yellow, or as selected by Architect.

B. Prime steel bollards with zinc-rich primer.

2.09 DOWNSPOUT PROTECTION

A. Downspout Boots:
1. Cast Iron Downspout Boot (for discharge to below grade pipe): Equal to McKinley Iron Works, Type DS4, sized to match downspouts. Top of boots mounted 3 feet - 0• inches above finish floor elevation. Coordinate overall lengths of boots with grading plan for below grade connection to drain pipes.
2. Cast Iron Finish: Rust inhibitive primer.

2.10 STEEL GATES

A. Steel Gate: Tube frame with steel tube horizontals and verticals as detailed on drawings. Provide gate frames with truss rods [and 8"x8"x1/4" triangular welded gusset plates at corners on back side of gate]. Tap drill where required for cladding and hardware installation.
1. Hardware: As shown in Drawings.
2. Gate Hardware: As shown in Drawings, and as follows:
a. Hinges: Heavy Duty gate hinges, structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall be offset and permit gate to swing at least 120 degrees. Provide three hinges for each leaf.

b. Latch: Extra Heavy Duty slide bolt latch with keep, lockable with padlock. (Padlock provided by Owner).
c. Cane Bolts: Provide heavy duty cane bolt and recessed cane bolt sleeve with dust proof cover for each leaf as indicated on Drawings.

B. Composite Pickets: Refer to Division 32 Landscaping Drawings for fencing / picket material.
1. Attachment to Gate Frame: Black zinc coated carriage through-bolts centered in each slat at top of bottom of frame. Nuts and washers on interior side of gate.

C. Finish for gate frame : 1 coat shop primer for field painting.

D. Pre-drill frame as required for attachment of facing material(s) indicated in Drawings.

2.11 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels and bent plates from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels and bent plates located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.12 GENERAL FINISH REQUIREMENTS

2.13 STEEL AND IRON FINISHES

A. All Iron and Steel Work: Unless otherwise specified, power tool clean all surfaces to remove mill scale. Work shall receive a shop coat of paint before leaving the factory or being exposed to the weather.
1. Items Indicated to Receive high-performance coatings: Clean to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning".

B. High Performance Coatings (powder coat and fluoropolymer coatings): Prepare surfaces and apply coatings to comply with Manufacturer's application instructions.
1. Finishes for perforated panels shall be applied after perforation of materials and shall be applied to provide 100 percent coverage of all exposed surfaces including inside of perforations.

C. Shop Paint for field painted items (other than powder coat or fluoropolymer coating): Shop paint shall be Fabricator's standard, fast curing, lead free, "universal" primer, compatible with finish paint system indicated and for capability to provide sound foundation for field applied topcoats.

D. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
2. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

E. Blackened Finish (Black Oxide): Where indicated in the Drawings as "blackened" or blackened steel finish, provide the following shop-applied finish on steel sheet or steel shapes to match the Architect™™s blackened steel finish sample, including color, surface sheen and texture.
   1. Abrasive Pads: general purpose pad equal to Scotch-Brite # 7447 - "Maroon" colored
   2. Blackening Treatment: "Insta-Blak 333 - Gel" by Electrochemical Products Inc. (www.epi.com)
   3. Blackening Finish Wax: Clear, "Metal Wax" by Sculpt Nouveau" (www.sculptnouveau.com)
   4. Surface Preparation: After cutting, forming, welding and other fabrication is complete, and welds have been ground smooth, degrease residual mill oil or grease, cutting compounds and other soluble contaminates with denatured alcohol per SSPC-SP1 "solvent cleaning" requirements. After degreasing, hand sand with pad to remove loose mill scale, loose rust, paint and other detrimental foreign material per SSPC-SP2 "Hand Tool Cleaning" requirements. Repeat until residual rust is completely removed.
   5. Apply blackening treatment with abrasive pad evenly over the surface until a consistent darkened patina is achieved. Rinse with clean water, and re-apply blackening treatment and re-wash with water until required level of blackening color is achieved. Torch surfaces after application and cleaning to remove all residual moisture from the surface.
   6. Wax Finish: Apply two (2) coats minimum of wax, and burnish surfaces when wax is dry (usually 1 0 2 hours).

2.14 ALUMINUM FINISHES

A. As-Fabricated Finish: AA-M12.

B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

C. Aluminum surfaces to be in direct contact with concrete and masonry shall be shop coated with zinc chromate primer.

D. Aluminum work contacting dissimilar metals shall receive a protective coating preventing galvanic action.

PART 3 - EXECUTION

3.01 FABRICATION

A. Contractor shall secure and be responsible for all field measurements required for the proper and accurate fabrication and installation of the items included under this section; field alterations will not be permitted except upon specific authorization of the Architect.

B. All work shall be assembled in the most substantial manner and reinforced where necessary with structural shapes, using concealed screws, bolts or similar fastenings. Make welds of adequate strength and durability, jointing tight, clean and smooth, flush and in true plane with base metals.

C. All screws or rivets shall be countersunk, unless otherwise noted. Provide lock washers for all bolts.

D. All steel to which wood blocking is connected shall be properly punched for anchoring blocking.

E. Exposed steel shapes with marred surfaces shall be ground or draw-filled to a fine grain finish, as approved before applying shop coat of paint.

F. Assembled work shall be completely constructed in the shop, accurately finished and the pieces match-marked for erection. Form exterior joints to exclude water, grind connections in exposed pieces smooth and polish.

G. The Contractor shall do all drilling, cutting, tapping and fitting of work to accommodate other work coming in contact with it, and shall furnish all taps, bolts and other fittings in connection therewith.

H. Except where otherwise noted, fastening to concrete, solid masonry or hollow masonry shall be with expansion bolts or anchors. Fastening to wood plugs will not be permitted. Toggle bolts may be used only when approved by the Architect.

3.02 INSTALLATION, GENERAL

A. All work included in this Contract shall be installed by the Contractor at the proper time and as rapidly as the progress of the adjacent and connecting work will permit.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

D. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
   5. Touch-up shop prime coats.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

G. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

H. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
   1. Cast Aluminum: Heavy coat of bituminous paint.
   2. Extruded Aluminum: Two coats of clear lacquer.

3.03 INSTALLATION OF METAL BOLLARDS

A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

C. Fill bollards solidly with concrete, mounding top surface to shed water.

D. Paint bollards color(s) as approved by architect.

3.04 STEEL GATES

A. Install gates square and plumb. Adjust tension on truss rod as required, after gate cladding is installed.

B. Install with all gate hardware as detailed in Drawings, or where not detailed with same hardware as specified for gates in Division 32, .

3.05 REPAIRS

A. Touchup Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
      a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
   2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking and nailers.
   3. Plywood backing panels.
   4. Wood-Preservative Treated Lumber
   5. Fire-Retardant Treated Materials

1.03 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

F. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. RIS: Redwood Inspection Service.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.05 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Inspect wood materials for conformance to specified grades, species, and treatment at time of delivery to Project site.
   1. Reject and return unsatisfactory wood materials.

C. Provide facilities for handling and storage of materials to prevent damage to edges, ends and surfaces.

D. Keep carpentry materials dry.
   1. Store lumber and plywood in stacks with provision for air circulation within stacks.
   2. Protect bottom of stacks against contact with damp surfaces. Protect exposed materials against weather.
   3. Stack materials minimum 12 inches off ground, or if on concrete slab-on-grade, minimum 1-1/2 inches, fully protected from weather.
   4. Provide for air circulation within and around stacks and under temporary coverings.

E. Place spacers between each bundle of pressure treated materials treated with waterborne chemicals to provide air circulation.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
   3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground. Use an effective preservative treatment that is not corrosive to ferrous metals
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
   2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat all rough carpentry unless otherwise indicated, including the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
   4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
   5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   1. Treatment shall not promote corrosion of metal fasteners.
   2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
   3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
   1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all rough carpentry unless otherwise indicated and the following:
   1. Framing for raised platforms.
   2. Framing for stages.
   3. Concealed blocking.
   4. Framing for non-load-bearing partitions.
   5. Framing for non-load-bearing exterior walls.
   6. Roof construction and blocking.
   7. Plywood backing panels.

2.04 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Cants.
   5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 and the following species:
   1. Mixed southern pine or southern pine; SPIB.
   2. Spruce-pine-fir; NLGA.
   3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
   4. Western woods; WCLIB or WWPA.
   5. Eastern softwoods; NeLMA.

C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine or southern pine; No. Two (2) grade; SPIB.
   2. Spruce-pine-fir (south) or spruce-pine-fir;
   3. Western woods; Construction or No. Two (2) Common

D. For blocking not used for attachment of other construction, Utility, Stud, or No. Three (3) grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For exposed blocking over CMU, No. One (1) grade lumber of any species with sufficient strength that loading of attached items will not crush the surface.

G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.05 PLYWOOD PRODUCTS:

A. All lumber shall be kiln dried to a moisture content of 4-1/2 percent. Kiln dried lumber shall be tempered for not less than four weeks before using.

B. Softwood Plywood for Laminate finish: DOC PS 1, at semi-exposed surfaces unless noted otherwise.

2.06 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.07 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Post-Installed Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group One (1) or Two (2)

2.08 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 5-1/2 inch x 3/8 inch closed cell foam and adhesive backed peel and stick membrane, equal to Protecto Wrap (800-759-9727) Triple Guard Energy Sill Sealer.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD One (1), "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring**,** nailers, blocking, grounds**,** and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Fastenings for Wall Supported Items: Provide and install 2 x 8 (minimum) x 1 stud space wood blocking, unless specified otherwise at all stud wall areas receiving grab bars, toilet partitions, wall bumpers and other wall mounted accessories.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
   3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
   4. ICC-ES evaluation report for fastener.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Comply with approved fastener patterns where applicable.
   2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.02 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 ROUGH HARDWARE

A. Provide bolts, screws, anchors, inserts and fastenings required for proper attachment of carpentry and millwork items. Fastenings to concrete or masonry with expansion bolts or anchors. Toggle bolts may be used for hollow masonry. Fastening to wood plugs not permitted. Fastenings spaced 16 inches o.c. unless otherwise noted.

3.04 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Cabinet Hardware
      a. Hinges
         1) Concealed European Hinges
         2) Specialty Hinges
      b. Cabinet Pulls
         1) Bar Pulls
      c. Shelf Supports
      d. Drawer Slides
      e. Murphy Bed Hardware
      f. Grommets
      g. Coat Rods
      h. Countertop Support Brackets
   3. Fire Retardant Treated Materials
   4. Counter Top Support Brackets
   5. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
   2. Division 09 Section - Resilient Base and Accessories for rubber base installed at cabinet base boards.
   3. Division 10 Section[s] for metal shelving and storage.
   4. Division 11 Section - Residential Appliances for appliances installed in millwork and under countertops.
   5. Division 12 Sections for Counter Tops.
   6. Division 22 Sections for plumbing fixtures and fittings.
   7. Division 26 Sections for electrical devices installed in architectural woodwork.

1.03 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

B. For appliances, equipment, electrical/plumbing fixtures and utilities attached to or adjacent to millwork, coordinate required clearances and rough openings, prior to fabrication and prior to installation of cabinets.
   1. Prior to fabrication of millwork, Contractor to verify that appliance doors, handles, and controls do not conflict with doors and drawers of adjacent millwork, and adjust millwork dimensions or provide filler strips as required to allow full 90° opening of all doors, and full opening of drawers. Coordinate prior to utility rough in where solution involves changing the location of appliances.

1.04 ACTION SUBMITTALS

A. Shop Drawings:
   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   2. Show details at not less than 1-1/2 inches scale. Submittal format shall be 30 inches x 42 inches sheets.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

B. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and installer.

B. Product Certificates: For [each type of product.] [the following:]
   1. Composite wood and agrifiber products.
   2. Thermoset decorative panels.
   3. High-pressure decorative laminate.
   4. Glass.
   5. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.06 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Manufacturer of products.

C. Materials and Fabrication, General:
   1. Provide Custom Grade millwork per AWI standards. Casework and Cabinetry shall be of reveal overlay design, unless otherwise specified or indicated on drawings.
   2. All dimensions, substrates, etc. shall be verified in the field by the Contractor.
   3. Use maximum length material for all trim, base, etc.
   4. Scribe and fit all cabinets and casework tightly to adjoining construction unless otherwise indicated.

a. Where cabinets abut walls or similar construction on the side of the cabinet, provide filler strips or extension of frames or cabinet boxes, as required to allow doors to open a full 90 degrees without door handles hitting walls. Adjust width of cabinet boxes as required based on field measurements.
b. Provide filler and make adjustments at inside corner cabinets as required to allow doors and drawers to open past adjacent handles, appliances installed to millwork, and similar construction that may impede opening of doors and drawers.

D. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
1. Where the Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. AWI Type of Cabinet Construction: Flush overlay.

D. Panel Products for Exposed Surfaces:
1. Doors and Drawer Fronts: Combination Core.
2. Other Surfaces: Medium Density Overlay Plywood, unless otherwise indicated.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Provide products scheduled or equal products approved by the architect. Subject to compliance with requirements, provide products by the following:
    a. Formica Corporation.
    b. Nevermar
    c. Pionite; a Panolam Industries International, Inc. brand.
    d. Wilsonart LLC.

F. Laminate Cladding for Exposed Surfaces:Exposed portions of cabinets include all surfaces, including edges, visible when doors and drawers are closed. Visible surfaces in open cabinets and shelving units are also to be considered exposed surfaces. All exposed surfaces to receive high-pressure decorative laminate complying with laminate grade requirements of the specified cabinet grade.
    1. Horizontal Surfaces: Grade HGS.
    2. Postformed Surfaces: Grade HGP.
    3. Vertical Surfaces: Grade HGS.

G. Materials for Semi-exposed Surfaces: Semi-exposed portions of cabinets include surfaces behind opaque doors and drawer fronts including shelves, dividers, interior faces of cabinet ends, backs, tops and bottoms, and drawer sides, backs and bottoms. Also, included are underside bottoms of cabinets over 2 inch - 0 inch from floor and tops 5 inch - 9 inch or more above floor.
    1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
        a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
        b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
    2. Drawer Sides and Backs: Solid-hardwood lumber.
    3. Drawer Bottoms: Hardwood plywood.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
    1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
    1. As indicated by laminate manufacturer's designations.
    2. Match Architect's sample.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
    1. Wood Species for Opaque Finish: Any closed-grain hardwood.
    2. All lumber shall be kiln dried to a moisture content of 4-1/2 percent. Kiln dried lumber shall be tempered for not less than four weeks before using.

B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
   2. Particleboard: Use of particleboard core material is prohibited in all millwork.
   3. Medium Density Overlay Plywood (MDO): APA PS1-09, Exterior Grade B-B, MDO plywood.
   4. Medium Density Fiberboard Combination Core Plywood: Panels constructed of veneer core plywood inner plies with phenolic-bonded MDF crossbands with PureBond® formaldehyde-free technology; Classic Core as manufactured by Columbia Forest Products, or approved equal.
      a. Panels made of particle board, MDF, Plywood, and combination core with lumber core instead of plywood core are not acceptable substitutions for the combination core panels as specified.
   5. Hardboard: AHA A135.4, Commercial grade tempered hardboard (Masonite) sheet **.**
   6. Thermoset Decorative Panels: MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
   2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
   3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test. Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
   1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
   2. Interior Type A: Low-hygroscopic formulation.
   3. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
   4. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
   5. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.

6. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

2.04 CABINET HARDWARE AND ACCESSORIES

A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 71 00 "Door Hardware."
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Accuride International.
      b. Blum, Julius & Co., Inc.
      c. Grass America Inc.
      d. Knape & Vogt Manufacturing Company.
   2. Provide all screws, fasteners, and miscellaneous hardware and attachments as required for complete installation.

B. Hinges
   1. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, soft-closing.
      a. Provide four (4) hinges per leaf at tall cabinet doors.
      b. Provide hinges designed for thick doors, where thick or hollow core doors are detailed in Drawings.
      c. At combination core plywood, provide hinges with screws of the optimal length to make best advantage of screw pulling strength of the plywood core, regardless of whether the optimal screw length comes standard with the hinges.

C. Cabinet Pulls: Back-Mounted Pulls, ANSI/BHMA A156.9, B02011.
   1. Cabinet Pulls: Back mounted; 6 9/16" inch long, Hardware Resources, Walker 2 Collection Model #727-160MB, in Matte Black finish.

D. Adjustable Shelf Pilasters and Supports for Cabinets: Four (two at each shelf ends) Flush-mounted 23 gauge high strength steel, zinc finish pilaster standards adjustable to 1/2 inches increments, equal to Knape and Vogt Series 255 at each set of shelves.
   1. Provide longest possible standards to fit full height of cabinets, using manufacturer's standard lengths.
   2. Provide and installation hardware, and support brackets equal to Knape and Vogt 237 series, as required for complete installation.
   3. Provide square, self-adhesive felt. pads at glass shelves.
   4. Provide an additional pilaster and shelf support bracket at all shelves wider than 3 feet, at the middle back of shelf, equal to Knape and Vogt Series 255.

E. Drawer Slides: Zinc-plated steel drawer slides with steel ball bearings and as follows:
   1. Box Drawer Slides (for drawers less than 7 inches deep): Side mounted; full-extension type; Medium duty, 100 lb rated.
      a. Typical Box Drawer Slides equal to Knape and Vogt 8400 series.
      b. Kitchen/Breakroom: Soft closing slides equal to Fulterer 5001.ECD series.
   2. File Drawer and Deep Storage Drawer Slides: Side mounted full-extension type; Heavy duty ball bearing, 200 lb rated.
      a. Typical File Drawer Slides equal to Knape and Vogt 8800 series.
      b. Kitchen/Breakroom: Soft closing slides equal to Fulterer FR 5210.ECD series.

3. File Drawer Hangers: Hanging file kit for Wood Drawers, consisting of rail supports and metal cut-to-length rails, equal to Blum "Metafile". Provide one file drawer hanger system per file drawer indicated.
4. Trash Bin Slides: Soft Closing pull-out trash slide system with "platinum" finish trash bin equal to:
    a. Knape and Vogt USC-18-2-50-PT for double trash bin units.

F. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
1. Silencers: 3/8 inch diameter felt self-adhesive pads. Color to match plastic laminate finish color. Install two per cabinet drawer or door.

G. Grommets for Cable Passage: 2-inch OD, color as selected by Architect from manufacturer's full range, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide "TG series" by Doug Mockett & Company, Inc.

H. Murphy Bed Hardware Kit: Fold down murphy bed hardware with tubular steel matress frame and cambered wood slats. Provide Twin Size I-Semble Vertical-Mount Murphy Bed Hardware Kit with Mattress Platform by Rockler, Item #54877 or approved equal.

I. Elbow Catch Latch: Concealed latch for wardrobe locker drawers to be installed in Sleeping Rooms.
1. Product: Provide Ives 2, Model IVE-2A-BLK, Spring Loaded, Surface Mounted, Elbow Catch with 622 Matte Black finish or approved equal.

J. Coat Rod: Heavy Duty 1-1/4 inches round, chrome finish, metal rod with similar finish and material escutcheons at each end with countersunk holes for attachment to inside of cabinet. Installed with U-shape brackets on one or both sides as required to allow rods to be removed and replaced.
1. At handicap accessible wardrobe cabinets, provide a second set of brackets. Install the rod and both sets of brackets with U-shape bracket on one or both sides as required so that the rod may be removed and installed at either height without removing brackets. Provide one such extra set of brackets in one cabinet in each officer bedroom suite, and at 5 percent of all wardrobe lockers in the fire fighter bed rooms.
2. Provide rod below fixed wood shelf where rod and shelf is indicated in closets.

K. Adjustable Wall Storage Shelving on Standards:
1. Double slotted heavy duty standards and brackets with anochrome finish shall be Knape and Vogt No. E85 and E185, or approved equal.
2. Shelves shall be 3/4 inches lumber or hardwood plywood with lumber edging, plastic laminate finish unless otherwise noted.
3. Attach shelves to brackets with screws.

L. Cantilever Countertop support brackets: Provide brackets as manufactured by A & M Hardware, or approved equal:
1. Surface mounted cantilever brackets: Equal to A&M Hardware 1/8 inch steel Workstation Brackets, sized to shelf or countertop depth(s) as indicated in Drawings.
2. Color: As selected by Architect from Manufacturers available colors.

M. Exposed Hardware Finishes: For exposed hardware, unless otherwise specified, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
1. Dark, Oxidized, Satin Bronze, Oil Rubbed: ANSI/BHMA 613 for bronze base; ANSI/BHMA 640 for steel base; match Architect's sample.
2. Bright Brass, Clear Coated: ANSI/BHMA 605 for brass base; ANSI/BHMA 632 for steel base.

3. Bright Brass, Vacuum Coated: ANSI/BHMA 723 for brass base; ANSI/BHMA 729 for zinc-coated-steel base.
4. Satin Brass, Blackened, Bright Relieved, Clear Coated: ANSI/BHMA 610 for brass base; ANSI/BHMA 636 for steel base.
5. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
6. Bright Chromium Plated: ANSI/BHMA 625 for brass or bronze base; ANSI/BHMA 651 for steel base.
7. Satin Stainless Steel: ANSI/BHMA 630.

N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.05 MISCELLANEOUS MATERIALS

A. Provide all screws, fasteners, and miscellaneous hardware and attachments as required for complete installation.

B. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
1. Conceal all anchors, or otherwise locate as indicated in Drawings and approved by Architect.

2.06 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
1. Coordinate with actual appliances and equipment to be mounted to cabinets and under countertops, whether such equipment is provided by Contractor or by Owner, and verify unobstructed operation of equipment and of cabinet doors and drawers.

D. Exposed Ends: Not less than 3/4 inch thick combination core plywood, connected to stile with pressure-glued tongue and plow joint and supplemented by special fasteners.

1. Ends at openings below countertops without adjacent base cabinet: 4 inches wide panel with 3/4 inch combination core MDF/plywood, and 3/4 inches cap at exposed end. Finished to match adjacent millwork. 4 inch dimension is to assist in rubber base wrapping around without puckering.
2. Provide finished backs, sides, and similar surfaces to match other exposed faces wherever exposed in the final work, and whether or not these exposed conditions are specifically indicated in the Drawings. Modify typical details as may be required to provide finished back, side and other panels that are not exposed in the typical conditions for each piece of millwork. Panel construction of such exposed panels shall be not less than that for other exposed panels.

E. Semi-Exposed Panel Ends: Not less than 3/4 inch thick combination core plywood .

F. Unexposed Ends: Not less than 1/2 inch thick plywood attached to front frame in same manner as exposed ends.

G. Back, Top and Bottom Rails: Not less than 3/4 inch x 3 inch solid lumber machined to interlock with end panels, and grooved to receive top and bottom panels with back rails secured under pressure with glue and fastening devices.

H. Shelving: Not less than 3/4 inch thick hardwood plywood with lumber core banded on front with 3/4 inch x 1-1/4 inch hardwood.

I. Bottoms: Not less than 3/4 inch thick plywood fully supported into gains in end panels and grooves in front frame and back bottom rails.

J. Back Panels: Not less than 1/4 inch thick, 5-ply veneer core plywood, glued and fastened to machined rear edge of end panels and to top and bottom rails.
1. At exposed back panels, provide panels equal to those for exposed end panels and exposed surfaces shall match adjacent cabinet body finish.

K. Toe Boards: Not less than 3/8 inch attached between end panels and extended from bottom panel to floor.

L. Corner Blocks: Wood blocks glued and fastened in each of four top corners to maintain cabinet squareness and rigidity.

M. Casework Doors and Drawer Face: 3/4 inch thick hardwood veneer combination core plywood with 1/4 inch hardwood banded edges. At full height cabinet doors (larger than standard base cabinets), use 1 inch thick combination core.

N. Drawer Construction
1. Drawer Body: Not less than 7/16 inch Solid-hardwood lumber sub-front, back and sides, fully dovetailed and glued at all four corners with fronts fastened to sub-front with mounting screws from interior of body.
2. Drawer Bottoms: Not less than 1/4 inch thick 5-ply veneer core plywood glued into and fully supported by grooves in all four sides of drawer body.

O. Wall cabinets:
1. Valances: Provide continuous valance across each run of cabinets, with minimum number of joints required in each run. Locate joints to be hidden with doors in closed position.
a. Set valance back slightly from face of cabinet frame to avoid contact with doors.
b. Unless otherwise indicated, provide nominal 2 inch valance measured from top side of the bottom shelf to bottom of valance at typical cabinets and nominal 3• valance where below cabinet lighting is indicated.

2. Doors: Fabricate doors to extend to 1/8 inch below bottom of valances, to allow for adjustment and hide the sight line of valances with doors in closed position.
3. Exposed side panels: Extend down to match bottom of valance.

4. Finishes at Tops and Bottoms:
   a. Exposed Finishes: Bottoms of cabinets 5 feet - 9 inches and higher, and tops of cabinets 5 feet - 9 inches and lower, above floor level are considered exposed surfaces to receive finish matching other exposed surfaces.
   b. Semi-Exposed Surfaces: Bottoms of cabinets 2 feet - 0 inch to 5 feet - 9 inches above floor level and tops of cabinets 5 feet - 9 inches or higher above floor level are considered semi-exposed surfaces to receive matching finish to other semi-exposed surfaces. Color may vary from finish used at cabinet interiors, confirm with Architect.
   c. Exposed finishes are also acceptable as long as consistently applied within any room or space.

P. Ventilation and Louvers: Provide ventilation for Audio Visual (A/V) equipment cabinets in Dayroom, Fitness Room, and any other locations as indicated in Drawings. Coordinate with A/V and other equipment installers as applicable for open area required for ventilation and any other requirements.
   1. Provide intake air through the bottom panel of the cabinet, outside of the base at the toe kick. Provide slots in the base panel 1-1/2 inches to 2 inches wide, with edge banded interior faces of the cut-outs. Do not make any one slot long enough to compromise the strength of the base panel to the extent that the panel may crush in the middle.
   2. Where A/V or other equipment installer will provide an exhaust fan with trim kit, coordinate cutout size with A/V installer, located high on the side panel of the cabinet.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate fully with work of related trades for piping, conduit, outlets, switches, plumbing fixtures, equipment, appliances, and other items installed into or adjacent to millwork cabinets, as required to avoid conflicts. Contractor shall make adjustments to millwork or other construction, at no additional cost to Owner, that may be required due to Contractor's failure to coordinate between trades or existing conditions.

B. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.02 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Where exposed fastening is unavoidable, use fine finishing nails, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

E. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   3. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips .
   5. Countertops: Coordinate countertop installation with other specification sections. Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertops.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 41 16

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Provide all building insulation as indicated, on the drawings and as specified herein:
   1. Glass-fiber blanket insulation.
      a. Unfaced Glass-fiber blanket
   2. Mineral-wool board insulation.
      a. Exterior Cavity Walls
   3. Applications
      a. Cavity Walls
      b. Framed Walls
   4. Product Safety Data Sheets

B. Related Requirements:
   1. Section 04 20 00 "Unit Masonry" for insulation installed in masonry cells and for coordination in marking centerlines of studs on the face of exterior continuous insulation for subsequent installation of ties and anchors.
   2. Division 05 Section - Cold Formed Metal Framing, for coordination with framing for packing cavities with Batt insulation and for installation of thermal envelope continuous insulation.
   3. Section 06 16 00 "Sheathing" for board sheathing installed directly over wood or steel framing and composite insulation sheathing board for sloped roofs.
   4. Division 07 Sections for Roofing Systems
   5. Division 07 Sections for Air Barriers
   6. Division 09 Sections for Non-Structural Metal Framing
   7. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.
   8. Division 21 and 23 Sections, for piping and mechanical ductwork insulation.

1.03 ACTION SUBMITTALS

A. Samples of materials and complete product literature (with documented R-Values) submitted for approval to the Architect prior to ordering materials.

B. Mock-up: Build pre-construction mockup detailed on the drawings to verify selections made under Submittals, to verify details and tie-ins, and to demonstrate typical construction and waterproofing details, and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
   1. Prior to product installation a field-constructed mock-up shall be provided under the provisions of Division 1 Section - Submittals, Product Data, Samples and Mock-ups.

2. Construct a typical exterior wall section, incorporating back-up wall, cladding, window and sill, insulation, flashing and any other critical junctions (roof, foundation, etc.) as detailed in Drawings.
3. Locate mockups as directed by Architect.
4. Build mockups as indicated in Drawings.
    a. Show typical components, attachments to building structure, and methods of installation.
5. Obtain Architect's approval of mockups before starting installation.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
9. Demolish and remove mockups when directed.

1.04 QUALITY ASSURANCE

A. Design Criteria:
    1. Thermal Resistance: R-Value designations indicated in accordance with ASTM C-518 is the thermal resistance of the insulation only.
    2. Fire Resistance: Material shall have a Class B fire rating less than 75 as tested by ASTM E-84.

B. Paper faced batt insulation shall not be used. Foil-faced insulation shall not be used except as specifically prescribed herein.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original packages, clearly marked with brand name, type and R-Value.

B. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.01 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
    1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
        a. CertainTeed Corporation.
        b. Johns Manville; a Berkshire Hathaway company.
        c. Knauf Insulation.
        d. Owens Corning.
    2. Flame-Spread Index: Not more than twenty-five (25) when tested in accordance with ASTM E84.

3. Smoke-Developed Index: Not more than fifty (50) when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.02 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation: Continuous Insulation "ci" at exterior wall Construction,: Semi-rigid mineral wool insulation board that is water repellent and meets ASTM C612, IVA. Thermafiber RainBarrier 45 Insulation, or approved equal.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Johns Manville; a Berkshire Hathaway company.
      b. Rockwool International.
      c. Thermafiber, Inc.; an Owens Corning company.
   2. Applications - ci insulation for exterior walls.
   3. R-Value: 4.3 per inch of thickness. Thickness(es) as noted on Drawings.
   4. Facing: Unfaced.
   5. Density: 4.5 pounds per cubic foot.
   6. Surface Burning Characteristics: Flame Spread 0, Smoke Developed 0.
   7. Moisture Resistance: Absorbs less than 0.03 percent by volume, ASTM C 1104.
   8. Non-Corrosive, ASTM C 665.
   9. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.03 INSULATION FASTENERS

A. Provide insulation fasteners as recommended by manufacturer for substrates and conditions indicated.

2.04 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates. Adhesive shall be compatible with air barrier membrane.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine areas receiving insulation work to insure work of preceding trades is completed. Check surfaces to see that they are uniform in place, free from mortar droppings, grease, oil or other debris which would affect proper insulation. Application constitutes acceptance of substrate conditions.

B. Coordinate marking centerline of studs on exterior face of continuous insulation as required for insulation installation and for subsequent fastener installation by other trades.

C. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

C. Prepare surfaces using methods recommended by manufacturer for achieving the best result for the substrate under the project conditions.

D. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

E. Install insulation with manufacturer's R-value label exposed after insulation is installed.

F. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

G. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Fit insulation tight within spaces and tight to and behind mechanical and electrical wiring Remove projections that interfere with placement.

H. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

I. Install batt insulation without visible voids, gaps or separations. Place insulation in Cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members. Cut and trim insulation neatly to fit spaces without laps, bulges or folds. Use batts free of rips and tears.
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
   2. Coordinate with light gauge metal stud installer to pack batt insulation in light gauge metal construction as it is being constructed, that will be inaccessible to install batts when completed (headers, stud packs, etc).
   3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
   4. Fill roof expansion joints with batt insulation to equal or greater R-value of insulation at roof surface.

J. Mineral Fiber Semi-Rigid Board Continuous Insulation:
   1. Continuous insulation at exterior walls shall be adhered or attached in place per manufacturer's recommendations for the substrates and conditions indicated. Use of friction fit only between furring channels is not an acceptable installation.
      a. Construction adhesive must be recommended by its manufacturer for use with the continuous insulation board and compatible with air barrier membrane or dampproofing mastic with which it will come in contact.
      b. Mechanical fasteners installation shall be coordinated with air barrier manufacturer's requirements for fastener penetrations through the air barrier, as applicable.

2. Fit courses of insulation with edges butted tightly in both directions. Press units firmly against substrates indicated.
3. Press units firmly against sheathing, or other substrates. Stagger joints. Make insulation continuous. Fill all voids.
4. Coordinate placement of insulation with location of masonry veneer anchors, metal Zee furring, and similar construction.
5. Cut and fit insulation tight to protrusions or interruptions to insulation plane.

3.03 INSTALLATION OF CAVITY-WALL INSULATION

A. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.
   1. Fit courses of insulation between masonry wall ties and other obstructions, with edges butted tightly in both directions, and with faces flush.
   2. Press units firmly against inside substrates.

3.04 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

3.05 FIELD QUALITY CONTROL

A. Comply with requirements of Authorities having jurisdiction for inspection of installation of insulation, and with requirements of commissioning agent. Notify respective parties and schedule required inspections prior to closing walls or cavities containing thermal insulation.

B. Comply with requirements of Division 01, Section "Construction Waste Management".

3.06 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 26 00 - VAPOR RETARDERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Vapor Retarder Products
      a. Polyolefin Resins vapor retarders.
   2. Vapor barrier film beneath slabs on grade.
   3. Installation over Void Boxes

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for under-slab vapor retarders.
   2. Division 31 Section - Earthwork.

1.03 COORDINATION

A. Coordinate installation with scheduled concrete pours to avoid delays. Make provision for installation of work by other trades.

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM E 1745-17 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.
   2. ASTM E 154- 08 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
   3. ASTM F 1249-06 (2011) Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.
   4. ASTM D 882-10 Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   5. ASTM D 1709-09 Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
   6. ASTM E 1643-18a Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   7. ASTM D 4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications

B. American Concrete Institute (ACI):
   1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturer's literature.
2. Manufacturer's installation instructions for placement, seaming and penetration repair.

B. Samples: Provide 12 inch x 12 inch samples of vapor barrier material and samples of tape for joints.

PART 2 - PRODUCTS

2.01 POLYOLEFIN RESINS VAPOR RETARDERS

A. Membrane Film:
   1. Qualities:
      a. Maintain a permeance of less than 0.01 Perms , as tested in accordance ASTM E-154, with mandatory conditioning tests, per ASTM E1745 Section 7.1 (7.1.1-7.1.5).
      b. Strength: ASTM E 1745 Class A.
      c. Thickness: 15mils minimum, in accordance with ACI 302.2R-06.
      d. Provide third party documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1.
   2. Available products:
      a. Basis of Design: Stego Wrap Vapor Barrier (15 mil) by Stego Industries.
      b. Vapor Block (15 mil) by Raven Industries.
      c. VaporGuard (15 mil) by Reef Industries.
      d. No Substitutions.

B. Accessories:
   1. Seams Tape: Stego Tape by Stego Industries LLC, or membrane manufacturer's standard tape for applications indicated.
   2. Penetration Repair: Stego Mastic and Stego Tape by Stego Industries LLC, or membrane manufacturer's standard product for applications indicated.
   3. Perimeter / Edge Seal: Crete Claw, Stego Tack Tape and Stego Term Bar by Stego Industries LLC, or membrane manufacturer's standard product for applications indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to vapor retarders, including removing projections capable of puncturing vapor retarders.

B. Do not proceed until fill is level and without voids, and plumbing and electrical rough-ins are complete.

3.02 INSTALLATION OF VAPOR RETARDERS GENERAL

A. Install Vapor Barrier in accordance with ASTM E 1643-11:

B. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

C. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives, vapor retarder fasteners, or other anchorage system as recommended by manufacturer.

D. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.

E. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.

F. Alternate: Seal vapor barrier to footing/grade beam with double sided tape, termination bar, or both.

G. Overlap joints 6 inches and seal with manufacturer's tape.

H. Apply tape/Crete Claw to a clean and dry vapor barrier.

I. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

J. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

3.03 INSTALLATION OF VAPOR BARRIER OVER VOID BOXES

A. Cartons for slabs shall have protective cover board with Stego 15 mil and Stego Crete-Claw Tape.

B. Stego Crete-Claw Tape Instructions: Overlap seams a minimum of 6 inches. Seal all seams in Stego Wrap using Crete-Claw Tape.

C. Install Crete-Claw Tape on the entire perimeter of the Stego Wrap Installation.

D. Install additional Crete-Claw Tape if required.

3.04 PROTECTION

A. Protect vapor retarders from damage until concealed by permanent construction. Prior to pouring concrete, inspect membrane for punctures or damage and repair as required.
   1. At crawl space applications, inspect membrane for damage prior to substantial completion. Repair damaged areas per membrane manufacturer's instructions.

END OF SECTION 07 26 00

SECTION 07 27 26 - FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Medium Build Vapor-Permeable, fluid-applied air barriers.
   2. PreInstallation Meeting

B. Related Requirements:
   1. Section 01 40 00 - Quality Requirements; coordination with Owner's independent testing and inspection agency.
   2. Section 01 43 39 - Mock-Ups; exterior wall mock-ups.
   3. Division 04 and 07 Sections cladding system(s) installed in front of fluid applied weather barrier.
   4. Section 06 16 00 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.
   5. Division 07 Section - Sheet Metal Flashing and Trim.

1.03 DEFINITIONS

A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 REFERENCES

A. ASTM C 1250 - Standard Test Method for Nonvolatile Content of Cold Liquid-Applied Elastomeric Waterproofing Membranes.

B. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

C. ASTM D 2240 - Standard Test Method for Rubber Property - Durometer Hardness.

D. ASTM D 4541 - Standard Test Method for Pull-off Strength of Coatings Using Portable Adhesion Testers.

E. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

F. ASTM E 96 - Test Method for Water Vapor Transmission of Materials

G. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen.

H. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylight, Doors and Curtain Walls by Uniform Static Air Pressure Differences.

I. ASTM E 779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.

J. ASTM E 783 - Standard Test Method for Field Measurement of Air Leakage through Installed Exterior Windows and Doors.

K. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference.

L. ASTM E 1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

M. ASTM E1677 Specification for Air Retarder (AR) Material or System for Low-Rise Framed Building Walls

N. ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

O. ASTM E2178: Standard Test Method for Air Permeance of Building Materials.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.
   1. Convene a minimum of two weeks prior to commencing Work of this Section.
   2. Review air-barrier requirements and installation. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, air barrier materials approved for use, compatibility of materials, details of construction, coordination with installation of adjacent and covering materials, air-leakage and bond testing, air-barrier protection and chemical/fire safety plans.
   3. Attendance is required by :
      a. General Contractor
      b. Architect
      c. Owner's representative
      d. Certified Installing Contractor Superintendent
      e. Weather barrier manufacturer's designated field representative
      f. Representatives of related trades including covering materials, substrate materials and adjacent materials.
   4. General Contractor to prepare and distribute meeting minutes.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
   2. Submit Manufacturer's Product Safety Data Sheets for each product.

B. Quality Assurance Submittals:
   1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.
   2. Manufacturer Instructions: Provide manufacturer's written installation instructions.
   3. Manufacturer's Field Service Reports: Provide site reports from authorized field service representative, indicating observation of weather barrier system installation.

C. Closeout Submittals:
   1. Weather Barrier Warranty: Manufacturers executed warranty form with authorized signatures and endorsements indicating date of Substantial Completion.

1.07 INFORMATIONAL SUBMITTALS

A. Installer Qualifications

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer shall have experience with installation of commercial fluid-applied weather barrier assemblies under similar conditions.

B. Single Source Responsibility: Components used shall be sourced from one manufacturer, including sheet membrane, air barrier sealants, primers, mastics, and adhesives. Obtain air barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Mockups: Coordinate with the General Contractor to build a free standing pre-construction mockup [s] to verify selections made under Sample submittals, demonstrate understanding of the complete wall construction, demonstrate typical construction and waterproofing details, demonstrate aesthetic effects, and to set quality standards for materials and execution..
   1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   2. Demolish and remove mockups when directed.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer.
   1. Handle materials in accordance with material manufacturers recommendations.
   2. Protect stored materials from direct sunlight and other sources of ultra-violet light.
   3. Keep solvent away from open flame or excessive heat.

C. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.

2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Review requirements for sequencing of installation of weather barrier system with installation of windows, doors, louvers and flashings to provide a weather-tight barrier system. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

C. Schedule installation of exterior cladding within nine months of weather barrier system installation, or within Manufacturer's recommended duration for exposure to the elements and UV radiation, whichever is less.

1.11 WARRANTY

A. Material Warranty: Provide material manufacturer's standard product warranty, for a minimum ten (10) years from date of Substantial Completion. See additional specific warranty requirements under Part Two (2) Products.

B. Subcontractor Installation Warranty: Provide a two (2) year installation warranty from date of Substantial Completion, including all accessories and materials of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
   1. The air barrier assembly shall be capable of withstanding combined design wind, fan and stack pressures, both positive and negative on the envelope without damage or displacement, and shall transfer the load to the structure.
   2. Fluid applied air barriers shall not displace adjacent materials in the air barrier assembly under full load.
   3. The air barrier assembly shall be joined in an airtight and flexible manner to the air barrier materials of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations, creep, and anticipated seismic movement.

B. Junctions of weather barrier shall be coordinated with other adjacent weatherization systems for complete weather tight building envelope.

C. Connections to Adjacent Materials: Provide connections to prevent air leakage at the following locations:
   1. Foundation and walls, including penetrations, ties and anchors.
   2. Walls, windows, curtain walls, storefronts, louvers and doors.
   3. Different assemblies and fixed openings within those assemblies.

4. Wall and roof connections.
5. Floors over unconditioned space.
6. Walls, floors and roof to utility, pipe and duct penetrations.
7. All other potential air leakage pathways in the building envelope.

D. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested according to ASTM E 2357.

E. Air-Barrier Assembly Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft.when tested according to ASTM E 2357.

2.03 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
   1. Products: (Basis of Design Product: Tyvec Fluid Applied WB by Dupont Sprayed or Trowel applied to 25 mils thickness.) Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
      c. Ultimate Elongation: Minimum 250 percent; ASTM D 412, Die C.
      d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
      e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      f. UV Resistance: Can be exposed to sunlight for 180 days according to manufacturer's written instructions.
   2. Application: Brick Veneer Cavity Wall Systems, Metal Wall Panel Systems, & Cementitious Siding Systems.
   3. Air Barrier Accessories:
      a. Solvent Based Primer for Flashing, Transition Strip and Detail Membranes: 3M High Strength 90; Denso Butyl (used with self-adhered membranes only)
      b. Through-Wall Flashings or Shelf Angle Flashings: DuPont recommended through-wall flashing, coordinate with Division 7 Section Sheet Metal Flashing and Trim
      c. Sealants, Mastics, Adhesives and Tapes: DuPont Sealant for Tyvek, Coordinate with Division 07 Section Joint Sealants
      d. Fluid Applied System; DuPont Tyvek Flashing and Joint Compound; fiberglass mesh tape
      e. Transition, Termination, and Detailing Membrane: DuPont StraightFlash, or DuPont Tyvek Flashing and Joint Compound (60mil)
      f. Penetrations & Termination Sealant: DuPont Sealant for Tyvek Fluid Applied System
      g. Window Flashing Membrane: DuPont Tyvek Fluid Applied Flashing and Joint Compound, or DuPont.
      h. Tyvek Fluid Applied Flashing Brush Formulation, or DuPont StraightFlash with DuPont FlexWrap.
      i. Joint Treatment:
         1) No joint treatment required for joints up to 1/16 inch.

2) Joints 1/16 to 1/4 inch: Joint compound applied to form a 1 inch width on each side of sheathing joint; smooth joint compound across sheathing joint. Thickness shall be 15 to 25 mils.
3) Joints 1/16 to 1/2 inch: Apply joint tape to bridge both sides of joint equally. Apply joint compound and trowel smooth embedding joint compound uniformly into joint tape to form a 1 inch width on each side of sheathing joint at a consistent thickness of 15 to 25 mils.
4) Joints 1/2 to 1 inch: Apply sheet flashing primer above and below sheathing joint. Center sheet flashing over sheathing joint and press firmly in place per manufacturer™™s recommendations.

4. Warranty
   a. Limited Warranty
      1) Manufacturer's warranty for weather barrier for a period of ten (10) years from date of Purchase.
      2) Pre-installation meeting and jobsite observations by weather barrier manufacturer for warranty are required.
      3) Warranty Areas: Entire area of fluid applied weather barrier.

2.04 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Joint Tape: Self-adhered fiberglass mesh tape as recommended by weather barrier manufacturer.

C. Flashing:
   1. Vapor permeable elastomeric flashing:
      a. Product: DuPont, Tyvek Fluid Applied Flashing and Joint Compound+, and /or:
      b. Product: DuPont, FlexWrap, NF.
   2. Sheet flashing with butyl adhesive layer, for use at transitions between wall material, building corners, and over gaps in sheathing up to 1 inch wide:
      a. Product: DuPont, StraightFlash.
   3. Thru-wall flashing:
      a. Refer to Division 4 "Unit Masonry" and Division 7 Section "Sheet Metal Flashing and Trim".
      b. Flexible membrane flashing with butyl adhesive layer: Product: DuPont, Thru-Wall Flashing. Use only if and where not otherwise specified or detailed for metal flashings.

D. Joint Compound: Fluid-applied, vapor permeable, elastomeric flashing material; trowel applied.
   1. Product: DuPont, Tyvek Fluid Applied Flashing and Joint Compound+.

E. Sealant: Elastomeric; non-vapor permeable sealant; compatible with weather barrier.
   1. Product: DuPont Sealant for Tyvek Fluid Applied Systems.

F. Primers for flexible flashing and sheet flashing:
   1. Provide flashing manufacturer's recommended primers for substrates indicated to assist in adhesion between substrate and flashing.

2. Products may include but are not necessarily limited to:
    a. 3M High Strength 90
    b. Denso Butyl Spray
    c. SIA 655
    d. Permagrip 105
    e. ITW TACC Sta Put SPH

G. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
1. Products: Subject to compliance with requirements, provide one of the following:
    a. Dow Corning Corporation; 123 Silicone Seal.
    b. Pecora Corporation; Sil-Span.
    c. Tremco Incorporated; Spectrem Simple Seal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate and schedule installation with other trades to install weather barrier prior to windows, doors, louvers and other openings, and to ensure maximum duration for exposure of the weather barrier to the elements is not exceeded.

B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify substrate and surface conditions are in accordance with weather barrier manufacturer recommended tolerances prior to installation of weather barrier and accessories.
2. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
3. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
4. Verify that substrates are visibly dry and free of moisture.
5. Verify that masonry joints are flush and completely filled with mortar.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Prime substrate for installation of sheet membrane transition strips if recommended by material manufacturer and as follows:
1. Ensure that penetrating work by other trades is in place and complete.
2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
3. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.

C. Prime substrate for installation of fluid-applied air barrier if recommended by material manufacturer based on project conditions.

D. Protection from spray-applied materials:
   1. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
   2. Ensure any required foam stop or back up materials are in place to prevent over-spray and achieve complete seal.

E. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

F. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

G. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

H. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

I. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

J. Bridge discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.03 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
   3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
   a. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

C. Joint treatment:
   1. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

2. Sheathing:
    a. Joints shall be prepared per manufacturer's approved joint treatment details.
    b. Apply joint tape as recommended by fluid-applied weather barrier manufacturer.
        1) No joint treatment required for joints up to 1/16 inch.
        2) Joints 1/16 to 1/4 inch: Joint compound applied to form a 1 inch width on each side of sheathing joint; smooth joint compound across sheathing joint. Thickness shall be 15 to 25 mils.
        3) Joints 1/16 to 1/2 inch: Apply joint tape to bridge both sides of joint equally. Apply joint compound and trowel smooth embedding joint compound uniformly into joint tape to form a 1 inch width on each side of sheathing joint at a consistent thickness of 15 to 25 mils.
        4) Joints 1/2 to 1 inch: Apply sheet flashing primer above and below sheathing joint. Center sheet flashing over sheathing joint and press firmly in place per manufacturers recommendations.
3. Non-movement joints in masonry and transitions to columns and beams:
    a. Joints 1/4 inch wide or less: Apply joint compound a minimum of 2 inches wide by 60 mils thick to each side of joint or crack.
    b. Joints 1/4 to 1/2 inch: Apply primer 2 inches on each side of joint. Center sheet flashing over joint and press firmly in place per manufacturer's recommendations.
4. Apply joint compound to cladding anchors prior to installation of weather barrier membrane per manufacturer's instructions.
5. Apply joint compound around penetrations in exterior walls forming a fillet bead minimum 1/2 inch onto each surface.

D. Installation - Flexible flashing at wall openings:
1. Prime substrates as recommended by self-adhered sheet membrane flashing manufacturer. Cut sheet membrane flashing a minimum of 12 inches longer than length of sill rough opening.
2. Cover horizontal sill by aligning sheet membrane edge with inside edge of sill. Adhere to rough opening across sill and up jambs a minimum of 6 inches. Secure sheet membrane tightly into corners by working in along the sill before adhering up the jambs.
3. Fan sheet membrane at bottom corners onto face of wall. Firmly press in place.
4. Apply 9-inch wide strips of sheet membrane at jambs. Align sheet membrane with interior edge of jamb framing. Start sheet membrane at head of opening and lap sheet membrane at sill.
5. Install sheet membrane at opening head using same installation procedures used at sill. Overlap jamb flashing a minimum of 2 inches.
6. Apply preformed silicone extrusion so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
    a. Preformed Silicone Extrusion: Set in full bed of silicone sealant applied to walls, frame, and air-barrier material.
7. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
8. Coordinate flashing with fluid-applied weather barrier and window installation.
9. Allow Flashing, Joint Compound and Sealant to cure for minimum 24 hours before coating with Fluid-applied Weather Barrier.

10. Primary Seal Jamb Flashing at continuous insulation: After installation of metal channel at continuous insulation layer, apply 9-inch wide strip of sheet membrane flashing from the front face of the C-channel back onto the framing. Lap a minimum of 2 inches over the previously installed jamb membrane, and with minimum of 2 inches lap at the head and sill. Apply liquid membrane over joint between exterior sheathing and metal C-channel.

E. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

F. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, transition strip.

G. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

H. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.04 INSTALLATION, GENERAL

A. Install fluid-applied weather barrier prior to installation of windows, doors, and louvers.

B. Mask and protect any adjacent finished surfaces from fluid-applied weather barrier material.

C. Install fluid-applied weather barrier over exterior face of required exterior wall substrates in accordance with weather barrier manufacturer recommendations and instructions.

D. Corners: Apply joint compound, 25 mil thick, to outside and inside corners. Joint compound shall extend 2 inches from corner for full height of corner; or: Apply primer to outside and inside corners, extend 2 inches on each side of corner. Center sheet flashing over corner and press firmly in place per manufacturers recommendations. Apply 1/2 inch fillet bead of joint compound applied to full-height of inside corners.

3.05 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.

B. Install fluid-applied weather barrier by pressure rolling or spray and backroll method as approved by manufacturer

C. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness of 25 mils and/or as recommended by manufacturer to comply with performance requirements, providing a consistent and uniform thickness. Apply in one or more equal coats.

D. Do not cover air barrier until it has been tested and inspected by testing agency.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.06 FIELD QUALITY CONTROL

A. Notify weather barrier manufacturers designated representative to obtain required periodic observations of weather barrier system installation.

B. Inspections: Weather barrier materials, accessories, and installation are subject to inspection by Manufacturer and Owner for compliance with performance requirements.

C. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

D. Cooperate with testing agency. Allow access to work areas and staging. Notify testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Do not cover Work of this Section until testing and inspection is accepted.

E. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.
   4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   5. Site conditions for application temperature and dryness of substrates have been maintained.
   6. Maximum exposure time of materials to UV deterioration has not been exceeded.
   7. Surfaces have been primed, if applicable.
   8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   9. Termination mastic has been applied on cut edges.
   10. Strips and transition strips have been firmly adhered to substrate.
   11. Compatible materials have been used.
   12. Transitions at changes in direction and structural support at gaps have been provided.
   13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   14. All penetrations have been sealed.

F. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness voids, skips, pinholes or other defects as recommended by weather barrier manufacturer. .
   2. Remove and replace deficient air-barrier components for retesting as specified above. Contractor shall be responsible to pay for re-testing of assemblies failing the initial tests.

G. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

H. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Coordinate with installation of materials which cover the air barrier assemblies, to ensure exposure period does not exceed that recommended by the air barrier manufacturer.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

D. Remove masking materials and adjacent protection after weather barrier installation.

END OF SECTION 07 27 26

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Standing-seam metal roof panels. Work includes all labor, materials, equipment and services necessary for fabrication and installation and/or replacement of metal wall panels, aluminum battens and metal patches as shown on drawings and as herein specified.
      a. Basis of Design Standing Seam Roofing

B. Related Sections:
   1. Division 07 Section - Sheet Metal Flashing and Trim.
   2. Division 07 Section - Roof Specialties.
   3. Division 07 Section - Roof Accessories.
   4. Division 07 Section - Joint Sealers.

1.03 REFERENCE STANDARDS

A. References in these specifications to standards, test methods and codes, are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies which may be used as references throughout these specifications.
   1. ASTM - American Society for Testing and Materials, Philadelphia, PA.
   2. FM - Factory Mutual Engineering and Research, Norwood, MA.
   3. NRCA - National Roofing Contractors Association, Rosemont, IL.
   4. OSHA - Occupational Safety and Health Administration, Washington, DC.
   5. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Chantilly, VA
   6. UL - Underwriters Laboratories, Northbook. IL

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.

4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:
   1. Shop drawings based on the Contract Documents and field conditions of each metal panel type, profile and trim configuration to be replaced and/or installed.
   2. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
   3. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Letter from Manufacturer stating acceptance of proposed underlayment for use with their products and for specified special warranty.

C. Product Test Reports: For each product, for tests performed by a qualified testing agency. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer. Fabricator and erector shall demonstrate experience of a minimum of five years of related industry experience.

B. Design Criteria: Engineering panels for structural properties in accordance with the latest edition of the American Iron and Steel Institute "Cold Formed Steel Design Manual", using "effective width" concepts.

C. Metal Shapes Design Criteria: Conform to latest edition of Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Storage:
   1. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
   2. Panels should be stored on edge in a clean dry place. One end should be slightly elevated to allow moisture to run off rather than accumulate on the faces.
   3. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
   4. Panels with strippable plastic film must not be stored in the open, exposed to the sun. Retain strippable protective covering on metal panels during installation.

C. Handling:
   1. Prevent contact with materials during storage which may cause discoloration or staining.
   2. In handling prefinished panels, lift up panels and do not slide panels when un-stacking.
   3. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

B. Jobsite Safety: Execute all operations and provide a safe work environment in accordance with OSHA standards and regulations.
   1. Follow all industry, code, fire prevention guidelines and requirements for storage of materials, staging areas, roof access, and application means and methods.

1.11 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.
   1. Warranty Period: 20 years from date of Substantial Completion.
   2. Type: Single Source, No Dollar Limit.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

B. Testing Requirements: The roof system shall be tested in compliance with local code requirements and as follows:
   1. Wind Resistance: Through-fastened roof panel systems tested in compliance with UL 580 or UL 1897. Standing seam attached systems tested in compliance with UL 580 or ASTM E 1592.
   2. Physical Weathering Properties: The system shall be tested to demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G152, ASTM G154, or ASTM G155.
      a. Corrosion Resistance: Metal panels shall have corrosion resistance in accordance with local code requirements for the materials indicated.
   3. Impact Resistance: The system shall be tested to resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272, CGSB 37-GP-52M, or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470.
   4. Fire Classification: The system shall be identified and listed for the fire class as required by local code by an approved testing agency, tested in compliance with ASTM E 108 or UL 790.

C. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As required by code and indicated on Drawings, whichever is greater.
   2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.02 STANDING-SEAM METAL ROOF PANELS

A. Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.
   2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1637.

B. Basis of Design Standing Seam Metal Roof Panel System: MBCI "BattenLok HS", with Signature 300 (Kynar 500) "Cool Roof" 70% PVDF fluoropolymer resin coating in color as selected by Architect from Manufacturer's standard range, or approved equal
   1. 24 Gauge, 16" x 2" smooth face, interlocking, Galvalume steel panel with concealed fastening system and high grade hot melt elastomeric sealant to seal adjoining panel legs.
   2. Minimum .25 Solar Reflectance (SR) on steep-slope roofs. Minimum .65 SRI for low-slope roof (2:12 or less).
   3. Fascia and gutter shall be pre-formed, custom design as shown on drawings, fabricated of same material as panel.
   4. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Berridge
      b. Centurion Industries
      c. PAC-CLAD

C. Insulation
   1. Polyisocyanurate Board Insulation: A closed cell flat, rigid polyisocyanurate foam core material, integrally laminated between glass fiber facers, in full compliance with ASTM C1289, , Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
   2. Flat insulationpPanels shall have a nominal thickness of two staggered layers of 2.2 inches to achieve a minimum Long Term aged Thermal Resistance LTR30 value per ASTM C1289-13e1. Provide tappered panels as required for slopes indicated.
   3. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. ACFoam II by Atlas Energy Products; Atlanta, GA
      b. ENRGY 3 by Johns Manville, Inc.; Denver, CO.
      c. EnergyGuard by GAF, Gainesville, TX
      d. H-Shield by Hunter Panels, LLC; Portland, ME.
      e. Multi-Max FA by RMAX, Inc.; Dallas, TX.
      f. Paratherm by Siplast/Icopal; Irving, TX.
   4. Cover Board: ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch (13 mm) thick.
      a. A high density panel composed of interlocking wood fibers and waterproofing binders, having a top surface that is pre-treated with an asphalt based coating (water absorption - 7 percent volume maximum).

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at [240 deg F; ASTM D1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D1970.
   3. Products: Subject to compliance with requirements and approval of roofing panel Manufacturer. Product provided must be acceptable to roofing panel Manufacturer for use with their products and specified warranty. Coordinate details for interface of underlayment provided with other air barrier and dampproofing systems as indicated in other Division 07 Sections. Acceptable products may include the following::
      a. Carlisle Residential; a division of Carlisle Construction Materials; WIP 300HT.
      b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.

2.04 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Roof Curbs: Fabricated from same material as roof panels, [0.048-inch] <**Insert dimension**> nominal thickness; with bottom of skirt profiled to match roof panel profiles and with welded top box and integral full-length cricket. Fabricate curb subframing of 0.060-inch- nominal thickness, angle-, C-, or Z-shaped steel sheet. Fabricate curb and subframing to withstand indicated loads of size and height indicated. Finish roof curbs to match metal roof panels.
   1. Insulate roof curb with 1-inch- thick, rigid insulation.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.05 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
   3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
   5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.06 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:
   1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions[**for seacoast and severe environments**].
   2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

D. Stainless Steel Panels and Accessories:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
    a. Run grain of directional finishes with long dimension of each piece.
    b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 COORDINATION AND EXAMINATION

A. Coordinate with other trades, prior to rough-in and penetrations, exact locations for roughing-in of components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels. Pipe and other small penetrations shall not be located in roof panel seams. Large equipment shall be located to avoid valleys and damming conditions to the maximum extent possible. Examine and confirm these locations again before installation to avoid conflicts.
    1. Provide metal roof panel crickets at roof curbs that do not fit entirely between the seams of a single roof panel with at least 2" to the seam on both sides. Coordinate size of crickets with actual equipment and curbs to be provided. Coordinate height of curbs as required for crickets prior to ordering curbs.
    2. Contractor is responsible to relocate pipe and similar penetrations as required to avoid seams, and to relocate curbs and larger equipment as required to avoid dams or other ponding conditions. Contractor shall not be due additional compensation to relocate items and make other corrections as required due to failure of Contractor to coordinate between trades.

B. Fabricator and erector are responsible for inspecting existing conditions to verify general conditions, panel profiles and panel attachments and examine all parts of existing building affecting the installation of his work.

C. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
    1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
    2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
        a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

D. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.
   1. Apply over the entire roof surface.
   2. Where underlayment meets other weatherization barriers behind materials other than roofing, coordinate with installers of adjacent materials to provide continuous weatherization of the envelope, including accommodation for any chemically incompatible materials.

B. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

3.04 INSTALLATION OF STANDING SEAM METAL ROOF PANELS

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Install flashing and trim as metal panel work proceeds.
   6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
   7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
   8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
   1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
   2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
   3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
   4. Stainless Steel Panels: Use stainless steel fasteners.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
   1. Install clips to supports with self-tapping fasteners.

2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Watertight Installation:
    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
2.
3.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Connect downspouts to underground drainage system indicated.

J. Roof Curbs: Install flashing around bases where they meet metal roof panels.

K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.07 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. Do not allow protective coatings to melt onto roof panel surfaces. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. For metal surfaces intended to weather or patina, wear gloves and take precautions to avoid spills, oil from hands and skin, etc. that can leave marks or cause uneven weathering of panel surfaces. Require the same of other trades working on or near panel surfaces after installation.

C. Protect panels from damage during remainder of construction period. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and / or Owner.

END OF SECTION 07 41 13.16

SECTION 07 42 13.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Work includes all labor, materials, equipment and services necessary for fabrication and installation of metal wall and soffit panels as shown on drawings and as herein specified for the following:
   1. Pre-Installation Meeting.
   2. Mock-Ups.
      a. Free Standing Mock-Up
   3. Concealed-fastener, lap-seam metal wall panels.
      a. Flush Profile
      b. Creased Rib Profile
   4. Metal Soffit System
   5. Miscellaneous Materials

B. Related Sections:
   1. Division 05 Section - Cold Formed Metal Framing, for sub-girts and support framing.
   2. **[Division 06 Section - Sheathing]**.
   3. Division 07 Section - "Roofing" Sections, and "Sheet Metal Flashing and Trim", for coordination of air barrier and terminations between metal wall panels, and roofing and parapet copings.
   4. Division 07 Section "Air Barriers"
   5. Division 07 Section - Joint Sealers.

1.03 ACTION SUBMITTALS

A. Product data and shop drawings based on the Contract Documents and field conditions of each metal panel type, profile and trim configuration to be installed.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Indicate field or factory applied sealant.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
2. Submit samples of each type and color of sealant.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Certification Letter from Manufacturer stating acceptance of proposed underlayment for use with their products, including anticipated service temperatures.

D. Field quality-control reports.

E. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer with a minimum of five years of related industry l experience.

B. Design Criteria: Engineering panels for structural properties in accordance with the latest edition of the American Iron and Steel Institute "Cold Formed Steel Design Manual", using "effective width" concepts.

C. Metal Shapes Design Criteria: Conform to latest edition of Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

D. Mockups: Build free standing mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
   1. Locate mockups facing South where exposed to direct sunlight, or as directed by Architect.
   2. Build mockup of typical wall area as shown on Drawings.
      a. Show typical components, attachments to building structure, and methods of installation.
   3. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   4. Obtain Architect's approval of mockups before starting installation.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
   6. Demolish and remove mockups when directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage. In handling prefinished panels, lift up panels and do not slide panels when un-stacking.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
   1. Panels with strippable plastic film must not be stored in the open, exposed to the sun.
   2. One end should be slightly elevated to allow moisture to run off rather than accumulate on the faces.
   3. Prevent contact with materials during storage which may cause discoloration or staining.
   4. In handling prefinished panels, lift up panels and do not slide panels when un-stacking.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.08 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers written instructions and warranty requirements.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of canopies and soffit supports, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.09 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. Furnish written warranty signed by applicator for two year period from date of substantial completion of building covering repairs at back side of parapets as required to maintain parapets, roof and flashings in watertight conditions.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Testing Requirements: The roof system shall be tested in compliance with local code requirements and as follows:
   1. Wind Resistance: The system shall be tested to comply wind resistance forces per local code requirements.

B. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
   1. Wind Loads: As required by code and as indicated on Drawings, whichever is greater.
   2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degree F, ambient; 180 degree F, material surfaces.

2.02 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

A. Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.

B. Flush-Profile, Concealed-Fastener Metal Wall Panels (to be installed at back of parapet conditions): Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
   1. Basis of Design Metal Wall Panels: 24 Gauge, 12" W x 1" flush face, interlocking, galvanized steel panel with concealed fastening system and high grade hot melt elastomeric sealant to seat the adjoining panel legs, anchored to solid substrate or framing system as indicated Panel shall be MBCI F-120 Flat Profile Panels• • , Berridge "FW Metal Panels", or Centurion Industries "AL Flat Panels" shall be acceptable products.
      a. Finish at parapet walls: For use exposed to direct sunlight (such as vertical applications), panel shall have Signature 300 (Kynar 500) "Cool Roof" 70 percentage PVDF fluoropolymer resin coating in color as selected by Architect. Minimum .25 Solar Reflectance Index (SRI).

C. Rib-Profile, Concealed-Fastener Metal Wall Panels (installed in vertical orientation at exterior walls were indicated in Drawings): Formed with raised, center-creased, trapezoidal major ribs; with reveal joint between panels.
   1. Basis of Design Metal Wall Panels: 24 Gauge, 16" W x 1" face, interlocking, galvanized steel panel with concealed fastening system and high grade hot melt elastomeric sealant to seat the adjoining panel legs, anchored to galvanized steel furring sub-girts as indicated on Drawings. Panel shall be MBCI Masterline 16 Panels• • , Berridge HR-16 Panels, or PAC-CLAD HWP shall be acceptable products.

2.03 METAL SOFFIT SYSTEM

A. Basis of Design Metal Soffit Panel System: Beridge Vee-Panel, Kynar 500 finish (soffit use only) and installed with Print Pattern Finish - Honey Walnut.

1. 24 Gauge, 12 inches W x 1 inch flush face, interlocking, galvanized steel panel with concealed fastening system and high grade hot melt elastomeric sealant to seat the adjoining panel legs, anchored to galvanized steel furring sub-girt at 12 inch o.c.

2.04 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system. [Coordinate supports with section 07 48 00 Rainscreen Support System.]

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated. Provide prefinished metal vent screeds at perimeter of soffit panels as indicated in Drawings.
   1. Closures: Provide pre-molded neoprene and/or sheet metal closures shaped to fit panel profile at eaves and rakes, fabricated of same metal as metal panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Exposed Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

2.05 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

2.06 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 COORDINATION AND EXAMINATION

A. Coordinate with other trades, prior to rough-in and penetrations, exact locations for roughing-in of components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels. Conduit, pipe and other small penetrations shall not be located in panel seams. Examine and confirm these locations again before installation to avoid conflicts.
   1. Contractor is responsible to relocate pipe and similar penetrations as required to avoid seams. Contractor shall not be due additional compensation to relocate items and make other corrections as required due to failure of Contractor to coordinate between trades.

B. Fabricator and erector are responsible for inspecting substrates, areas, and conditions, with the General Contractor present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
   1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
   2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
      a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

C. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.03 INSTALLATION

A. Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
   1. Shim or otherwise plumb substrates receiving metal panels.
   2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
   3. Install screw fasteners in predrilled holes.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:
1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
3. Copper Panels: Use copper, stainless steel, or hardware-bronze fasteners.
4. Stainless Steel Panels: Use stainless steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:
1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

B. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.05 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
   1. For metal surfaces intended to weather or patina, wear gloves and take precautions to avoid spills, oil from hands and skin, etc. that can leave marks or cause uneven weathering of panel surfaces. Require the same of other trades working on or near panel surfaces after installation.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Protect panels from damage during remainder of construction period.

D. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.13

SECTION 07 46 46 - FIBER-CEMENT SIDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. This Section includes Pre-Stained & Paint-Grade for the following:
   1. Fiber-cement siding and accessories.
      a. Basis of Design products
   2. Free Standing Mock-Up

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
   2. Division 07 Section - Sheathing.
   3. Division 07 Section - Sheet Metal Flashing and Trim for flashing, gutters, and other sheet metal work.
   4. Division 07 Section - Joint Sealers.
   5. Division 07 Section - Weather Resistant Barrier for building wrap application.
   6. Division 07 Section - Flexible Flashing for door and window flashing.
   7. Division 09 Section - Painting.

1.03 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type, color, texture, and pattern required.
   1. 12-inch- long-by-actual-width Sample of siding.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain each type, color, texture, and pattern of siding and soffit, including related accessories, through one source from a single manufacturer.

B. Mockups: Build free standing pre-construction mockup [s] to verify selections made under Sample submittals, demonstrate understanding of the complete wall construction, demonstrate typical construction and waterproofing details, demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Build mockup [s] as shown on drawings, including face and backup wythes, fenestrations, flashings and accessories.. Comply with requirements in Section 01 43 39 "Mockups".
      a. Prior to product installation a field-constructed mock-up shall be provided under the provisions of Division 1 Section - Submittals, Product Data, Samples and Mock-ups, to verify details and tie-ins, and to demonstrate the required quality of materials and installation.
      b. Construct a typical exterior wall section, incorporating back-up wall, cladding, window and sill, insulation, flashing and any other critical junctions (roof, foundation, etc.) as detailed in Drawings at typical wall locations as located by Architect.
      c. Locate mockups as directed by Architect.
      d. Build mockups as indicated in Drawings.
         1) Show typical components, attachments to building structure, and methods of installation.
         2) Include a sealant-filled joint at least 16 inches
      e. Obtain Architect's approval of mockups before starting installation.
      f. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
      g. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      h. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
      i. Demolish and remove mockups when directed.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.09 SEQUENCING

A. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.

PART 2 - PRODUCTS

2.01 BASIS OF DESIGN FIBER-CEMENT SIDING

A. General: ASTM C 1186, Type A, Grade II, fiber-cement board, noncombustible when tested according to ASTM E 136; with a flame-spread index of 25 or less when tested according to ASTM E 84.
   1. Paint-Grade Fiber-Cement Lap Siding
   2. Noncombustible when tested according to ASTM E 136.
   3. Flame-spread index of 25 or less when tested according to ASTM E 84.

B. Basis-of-Design Product: The design for siding and accessories is based on Hardie HZ10, Artisan Siding, V-Groove Profile by James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: request info (info@jameshardie.com); Web: https://www.jameshardie.com/?loc=refresh
   1. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified:
      a. CertainTeed Corporation.
      b. GAF Materials Corporation.
      c. Nichiha Fiber Cement.

2.02 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
   1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Fasteners:
   1. For fastening to metal, use ribbed bugle-head screws of sufficient length to penetrate a minimum of 1/4 inch, or three screw-threads, into substrate.
   2. For fastening fiber cement, use hot-dip galvanized fasteners.
   3. Siding shall be attached by Manufacturer's recommended "Blind Nailing" method.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement siding and related accessories.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
   1. Siding shall be attached by Manufacturer's recommended "Blind Nailing" method.
   2. Do not install damaged components.
   3. Install fasteners no more than 24 inches o.c.

B. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.04 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace with new materials complying with specified requirements.

B. Clean finished surfaces according to manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 52 16 - (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Substrates
      a. Metal Decks
   2. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
   3. Roof insulation.
   4. Cover board.
   5. Walkways.

B. Section includes the installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 31 00 "Steel Decking."

C. Products installed but not furnished under this section
   1. Sheet Metal Flashing and Trim.
   2. Sheet Metal Roofing Specialties.

D. Related Requirements:
   1. Division 05 Section - Steel Decks.
   2. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking, and for wood-based, structural-use roof deck panels.
   3. Section 07 21 00 "Thermal Insulation" for insulation beneath the roof deck.
   4. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
   5. Division 07 Section - Roof Accessories.
   6. Division 07 Section"Roof Specialties"
   7. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.03 REFERENCE STANDARDS

A. References in these specifications to standards, test methods and codes, are implied to mean the latest edition of each such standard adopted. The following is an abbreviated list of associations, institutions, and societies which may be used as references throughout these specifications.
   1. ASTM - American Society for Testing and Materials, Philadelphia, PA.
   2. FM - Factory Mutual Engineering and Research, Norwood, MA.
   3. NRCA - National Roofing Contractors Association, Rosemont, IL.
   4. OSHA - Occupational Safety and Health Administration, Washington, DC.
   5. SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Chantilly, VA

6. UL - Underwriters Laboratories, Northbook. IL

1.04 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.05 DESCRIPTION OF WORK

A. The basic work description required in this specification are referenced below:
   1. Roofing Type: Two ply SBS modified bitumen roof system. Johns Manville Specification 2FID or equal by approved manufacturer.
   2. Deck: As indicated on drawings and herein.
   3. Slope: 1/4 inch.
   4. Substrate board: Rigid Gypsum or Perlite Board as specified.
   5. Vapor Retarder: As indicated.
   6. Insulation - Bottom Layer: Polyisocyanurate or Polystyrene as specified, at thickness as indicated on drawings and herein, mechanically attached with tapered insulation system as indicated on the drawings.
   7. Cover Board - Top Layer: High density fiberboard, perlite board or other rigid board as specified, having a minimum thickness of 3/4 inches, applied in hot asphalt. Provide tappered system as indicated.
   8. Roof System Membranes:
      a. Base Sheet: ASTM D-6163, Type I, Grade S., applied in ASTM D-312 Type IV asphalt. Johns Manville Dynabase or comparable product by other approved manufacturer.
      b. Highly Reflective Cap Sheet: ASTM D-6163, Type I, Grade G, applied in D-312 Type IV asphalt. Johns Manville DynaGlas FR CR, or comparable product by other approved manufacturer.
   9. Flashing System Membrane:
      a. Hot mop applied, ASTM D-6163, Type I, Grade G. Highly reflective SBS cap sheet to match the field membrane. Mechanically fastened base sheet per Manufacturers recommendations where required. Johns Manville DynaWeld Cap FR CR, or comparable product by other approved manufacturer.
      b. Where required for roof warranty, use liquid applied membrane flashing at roof penetrations and any existing openings with less than 8 inch vertical rise above the new roofing surface.
      c. Roofing manufacturers approved, non-reflective, base flashing system at repair to existing locations as required for roof warranty.

1.06 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Tour, inspect, and discuss existing conditions.
      a. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
      b. Review structural loading limitations of roof deck during and after roofing.
   3. Review project specifications and their requirements.

4. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
5. Review special flashing and installation details.
6. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
7. Review manufacturer's inspection requirements and forms.
8. Review required submittals, both completed and yet to be completed.
9. Review coordination of roof penetrations.
10. Review required inspections, testing, certifying, and material usage accounting procedures.
11. Review base flashings, special roofing details, roof drainage, equipment curbs, and condition of other construction that affects roofing system.
12. Review governing regulations and requirements for insurance and certificates if applicable.
13. Review temporary protection requirements for roofing system during and after installation.
14. Review roof observation and repair procedures after roofing installation.

B. Review checklist items, including but not limited to:
1. Base flashings shall extend a minimum 8 inch height from finished membrane. Verify curb heights for all new equipment have been coordinated.
2. Counter flashings on A/C, ventilators, and other roof top equipment shall have soldered corners, and curb size shall be coordinated with equipment submittals.
3. Thru-wall scuppers and escutcheon plates shall be soldered and sealed entirely at face of building. Discuss leader box overflow requirements.
4. Pipe support requirements.
5. All equipment and supports resting on roof membrane require roof pads.
6. All trades to provide protection board at their work areas, and storage on roof when works occurring after roofing operations are complete cannot be avoided. All trades required to keep their work area clean and roof surface clear of their screws and other potentially damaging hardware, equipment, and debris.
7. Metal workers and base flashings shall not damage completed roof membranes.
8. No penetrations through base flashings. No penetrations through top side of roof curb flashing caps.
9. Sealant filled hooded pans required at all small pipe penetrations.
10. Refrigerant line penetrations (peel back insulation first, then seal, then replace insulation).
11. Cutting oils, refrigerant oils, soldering, etc. above roof will cause concern. Discuss plans to address concerns and protect roofing.
12. Keep through-wall flashings below weep vents where roofing abuts brick veneer walls.
13. Where roofing extends to bottom of windows in walls above adjacent roofing, solder and seal any flashing joints. No exposed fasteners or penetrations in sill flashings or counter flashings.
14. Overflow drains shall be 2 inches above primary roof drain elevation, unless noted otherwise.
15. Ponding water 48-hrs after rain event shall be evidence of improper slope. Contractor shall provide tapered insulation and install membrane laps in manner to prevent ponding.
16. Dirt legs at gas lines shall have 1" minimum clearance from finished roof membrane.
17. Plumbing stack lead flashings shall turn inside a minimum 1" distance.
18. Provide splash blocks or pans where one roof drains to another roof surface.
19. Exposed wood blocks shall not be permitted on top of roofing membrane unless specifically indicated in Drawings.

20. All roof penetrations shall be a minimum 2-0 inches (or other distance as required by Contract Documents, or as required by roofing Manufacturer) away from other roof penetrations, from roof edges, or from parapet walls, whichever distance is greatest in each case.
21. Supports for roof ladders must not penetrate base flashings or copings. For back side of parapet walls not otherwise detailed in Drawings, install metal roof panel with treated blocking behind panel (to prevent crushing of wall panel); lag bolt ladder through metal panel to blocking inside of wall. Seal & gasket fastener penetrations.
22. Clamping rings at drains shall be tightened after installation.
23. Adhere to Manufacturers' recommendations for fastener spacing.
24. Avoid stepping of through-wall flashings and base flashings to maximum extent possible.
25. Provide lining at pipe support clamps to prevent corrosion between dissimilar metals.
26. All exposed gas piping to be painted per painting specifications.
27. Rise wall flashings must not cover weeps at any exterior finish materials.
28. Screws through decking shall not be visible at exposed deck at either the interior of the building or at exterior canopies.
29. Electrical wiring shall be installed within equipment curbs and other construction to maximum extent possible. Where penetrations are unavoidable, provide liquid scrim flashing system on 12 inches vertical hard pipe with gooseneck, for threaded UV resistant flex conduit attachment.
30. Condensate shall be installed within equipment curbs where possible, unless otherwise indicated. Where copper condensate is shown to be used above roof, paint it to match gas piping.
31. Coordination of lightning protection penetrations and attachment details with roof warranty requirements.
32. Final roof inspections will include acceptance from the manufacturer, the General Contractor, the roofing contractor / installer, the Architect, and Owner, prior to final payment.

C. Roofing Conferences: Allow for two additional roofing conferences to be called for as deemed necessary by the Architect; one being a conference for final inspection & project wrap-up.

1.07 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For products from other than the basis of design manufacturer, submit complete comparison of properties to the basis of design products.
   2. Submit Manufacturer's Product Safety Data Sheets for each product.

B. Shop Drawings: Include plans, sections, details, and attachments to other work, including but not necessarily limited to the following:
   1. Layout and thickness of insulation and cover boards.
   2. Base flashings and membrane terminations.
   3. Flashing details at penetrations.
   4. Tapered insulation, including slopes. Tapered insulation shown in Drawings is diagrammatic. All tapered insulation required to prevent ponding as defined by the roofing Manufacturer's warranty requirements is a part of the base scope of this contract. Include crickets at all mechanical curbs and similar obstructions to water flow, whether or not such crickets are specifically indicated in the Drawings.
   5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
   6. Crickets, saddles, and tapered edge strips, including slopes.

7. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
8. Tie-in with adjoining air barrier.

C. Samples for Verification: For the following products:
1. Selection Samples of manufacturer's standard colors for Cap Sheet and Flashing color selection by Architect.
2. Manufacturer's standard sample size roofing membranes and cap sheet
3. Manufacturer's standard sample size cover board
4. Manufacturer's standard sample size of roof insulation
5. Manufacturer's standard substrate board sample
6. Manufacturer's standard vapor retarder sample
7. Walkway Pads or Rolls: Samples of manufacturer's standard colors for selection by Architect.

D. Wind Uplift Resistance Submittal: For roofing system indicating compliance with wind uplift performance requirements.

1.08 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates:
1. Submit certification that materials meet ASTM, federal, local code, and performance specifications, and that materials furnished are compatible for deck indicated each one to the other and to adjacent related work. Certificates shall be from the material manufacturer. Certificates from suppliers or wholesalers will not be acceptable.
2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

C. Submit Test Reports indicating that roof materials comply with minimum solar reflectance index requirements noted in performance requirements.

D. Evaluation Reports: For components of membrane roofing system, from ICC-ES.

E. Field Test Reports:
1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's special warranties.

1.09 CLOSEOUT SUBMITTALS

A. Manufacturer's printed recommendations for proper maintenance of the specified roof system including inspection frequencies, penetration addition policies, temporary repairs and leak call procedures.

B. Signed and fully actuated warranties.

C. Installer's Guarantee contact information and leak call procedures.

D. Submit site visit reports from Manufacturer's representative.

E. Include all changes to plans, details, and specifications, as well as all RFI's, ASI's, and Change Orders related to roofing in project Record Documents (Record Drawings and O & M's).

F. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

1.10 QUALITY ASSURANCE

A. Manufacturer Qualifications: Primary roofing products, including each type of sheet, all manufactured in the United States, shall be supplied by a single manufacturer which has been successfully producing the specified types of primary products for not less than 10 years. The primary roofing products shall have maintained a consistent composition for a minimum of five years.
   1. Ensure that the primary roofing materials manufacturer provides direct trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conducts a final inspection upon successful completion of the project.
   2. The roofing system product supplier shall furnish the Roofing Contractor with Material Safety Data Sheet/Sheets (MSDS), incorporating OHSA approved form, current edition. Said sheets shall be available at the site at all times until project completion. A copy shall be included in the project closeout documentation.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.
   1. Contractor shall have a minimum of 5 years experience in successfully installing the same or similar roofing materials and be certified in writing by the roofing materials manufacturer to install the primary roofing products.

C. Product Quality Assurance Program: Primary roofing materials shall be manufactured under a quality management system that is monitored regularly by a third party auditor under the ISO 9001:2000 or equivalent audit process.

D. Agency Approvals: The proposed roof system shall conform to the following requirements. No other testing agency approvals will be accepted.
   1. Underwriter Laboratories Class A acceptance of the proposed roofing system (including mopping asphalt or cold adhesive) without additional requirements for gravel or coatings.

E. Scope of Work: The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full time supervision, experienced roof mechanics, all materials, tools and equipment necessary to complete, in an acceptable manner, the roof installation in accordance with this specification. Comply with the latest written application instructions of the manufacturer of the primary roofing products. In addition, application practice shall comply with requirements and recommendations contained in the latest edition of the Handbook of Accepted Roofing Knowledge (HARK) as published by the National Roofing Contractors Association, amended to include the acceptance of a phased roof system installation.

F. Local Regulations: Conform to regulations of public agencies, including any specific requirements of the city and/or state of jurisdiction.

G. Testing and Verification:
   1. Owner retains the right, at Owner's option, to sample all roofing products on site for testing by an accredited laboratory without advance notice or additional cost to Owner to patch test samples.
   2. Owner may, at Owner's option, select and employ at Owner's expense:

a. A roofing systems Consultant to review the Construction Documents and/or perform surveillance during any installation of substrate, roofing, flashing and any other part of the total roofing system.
b. An independent roofing inspection service specializing in performing Non Destructive Evaluation (NDE), for moisture detection purposes, before the final acceptance of the roofing or before the end of the roofing Guarantee Period.

3. Prior to final acceptance, Contractor shall water test all roof drains. Architect and Program Manager shall be notified prior to conducting water tests.
4. A representative of Owner, the Program Manager, the General Contractor, the Roofing Contractor and Roofing Manufacturer's technical representative shall review the roofing system toward the end of the warranty period and toward the end of the Roofing Contractor's guarantee period. The Roofing System Manufacturer's authorized technical representative shall inspect the roofing system near the close of the Manufacturer's warranty. The Roof System Manufacturer's representative within seven days of each site visit shall submit a written report to Owner.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
1. Deliver materials in quantities required to allow continuity of application before beginning roofing operations.
2. Deliver in packaging, or with certificate or bill of materials, bearing approved testing agency labels as required by code and authorities having jurisdiction.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.
1. Protect stored liquid material from direct sunlight.
2. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.
1. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
2. Store in a clean, flat and dry location.
3. All material stored on the roof overnight shall be stored on pallets. Rolls of roofing must be stored on ends.
4. Store materials on the roof in a manner so as to preclude overloading of deck and building structure.
5. Store materials such as solvents, adhesives, and asphalt cutback products away from open flames, spark, or excessive heat.
6. Cover all material using a breathable cover such as a canvas. Polyethylene or other non-breathable plastic coverings are not acceptable.

D. Handling: Handle all materials in such a manner as to preclude damage and contamination with moisture or foreign matter. Handle rolled goods to prevent damage to edges or ends. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

E. Damaged Material: Any materials that are found to be damaged or stored in any manner other than stated above will be automatically rejected, removed and replaced at the Contractors expense.

1.12 FIELD CONDITIONS

A. Requirements Prior to Job Start
   1. Notification: Give a minimum of five (5) days notice to the Testing Lab and Manufacturer prior to commencing any work, and notify both parties on a daily basis of any change in work schedule.
   2. Permits: Obtain all permits required by local agencies and pay all fees which may be required for the performance of the work.
   3. Coordinate with other trades for all roofing preparation requirements, including but not limited to items listed in pre-installation meeting requirements and agenda.
   4. Coordinate all requirements for Manufacturer's full warranty of the roofing system, without exclusions. Should conflicts be discovered between Manufacturer's requirements and requirements of the Drawings and Specifications, generally the most restrictive requirement shall prevail. Notify Architect immediately upon discovery of conflicts. Contractor shall not be due additional compensation for correction of conditions required for roof warranty due to his failure to coordinate Manufacturer's requirements.

B. Environmental Requirements
   1. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
   2. Precipitation: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.
   3. Temperature Restrictions - asphalt: At ambient temperatures of 40° F and below, special precautions must be taken to ensure that the specified Type IV asphalt maintains a minimum acceptable 400°F at the point of sheet application. The asphalt must not be overheated to compensate for cold conditions. The use of insulated handling equipment is strongly recommended. Hot luggers, mop carts, and kettle-to-roof supply lines should be insulated. Hand mops should be constructed with a smaller yarn head to facilitate short moppings. Luggers and mop carts should never be more than half filled at all times.

C. Protection Requirements
   1. Membrane Protection: Provide protection against staining and mechanical damage for newly applied roofing and adjacent surfaces throughout this project.
   2. Torch and Hot Work Safety (for work over Owner-occupied facilities): Designate one person on each crew to perform a daily fire watch. The designated crew member shall watch for fires or smoldering materials on all areas of roof construction. Continue the fire watch after roofing material application has been suspended for the day.
   3. Limited Access (for Partially-Occupied Sites): Erect temporary fencing or other barriers as required to prevent access by the public or Owner's personnel to areas where potentially hazardous materials, tools and equipment are located during the course of the project.
   4. Debris Removal: Remove all debris daily from the project site and take to a legal dumping area authorized to receive such materials.

5. Site Condition: Complete, to the owners satisfaction, all job site clean-up including building interior, exterior, and landscaping where affected by the construction.

1.13 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, non-pro-rated and without monetary limitation, in which manufacturer agrees to 100 percent repair or replacement of components of membrane roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, substrate board, roofing accessories, roof penetrations flashed with liquid flashing system, and any other components of membrane roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Installer's Guarantee: Submit roofing Installer's Guarantee, on Guarantee form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system as required to maintain roof in water tight condition for the duration of the warranty period. Guarantee shall cover roofer's complete scope of work including metal flashings and copings for the following Guarantee period:
   1. Guarantee Period: Two years from date of Substantial Completion.

C. A fully executed Warranty and Guarantee, delivered to the Owner or included in project record documents in triplicate, and accepted by Owner, is a prerequisite for final Acceptance of the project by Owner.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
   1. Accelerated Weathering: Roof membrane shall be tested to demonstrate physical integrity over the working life of the roof based upon it withstanding 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
   2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746/D3746M, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470. Hail resistance rating - VSH.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: The roof system, including attachment to deck and all components above deck (ie the roof assembly) shall be tested in compliance to FM Approvals 4474, UL 580, or UL 1897, and shall be Class 1-90.
   1. Wind pressures as indicated on Drawings.

D. Fire Classification: The system shall be identified and listed for the fire class as required by local code by an approved testing agency, tested in compliance with ASTM E 108 or UL 790.

E. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency.
   1. Identify products with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated.
   1. Identify products with appropriate markings of applicable testing agency.

G. Jobsite Safety: Execute all operations and provide a safe work environment in accordance with OSHA standards and regulations.
   1. Follow all industry, code, fire prevention guidelines and requirements for storage of materials, staging areas, roof access, and application means and methods.

2.02 MANUFACTURERS

A. Source Limitations: Obtain all components for roofing system from roof membrane manufacturer.

2.03 Description of system

A. Roofing Membrane Assembly: A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogenous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, hot mop applied over a prepared substrate. Both reinforcement mats shall be impregnated/saturated and coated each side with an SBS modified bitumen blend. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°° F. Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.

B. Basis-of-Design Product: The design for modified bitumen roofing is based on Johns Manville 2FID system with class A Fire Rating. Subject to compliance with requirements, provide the named products or comparable products by one of the following:
   1. Derbigum.
   2. GAF Materials Corporation.
   3. Siplast, Inc.
   4. Soprema.
   5. Other approved equal. Substitutions must be approved by Architect. See Division 1 specifications for requirements for proposed substitutions. Substitutions for convenience will only be considered within first 30 days after notice to proceed.

2.04 BASE SHEET MATERIALS

A. SBS-Modified Bitumen Fiberglass Mat Base Sheet: ASTM D6163/D6163M, Type I, Grade S, SBS-modified asphalt sheet, reinforced with fiberglass fabric, smooth surfaced, suitable for cold adhesive or hot asphalt application method.
   1. Basis of Design product - Johns Manville DynaBase.
      a. ASTM D-6163, Type I, Grade S.
      b. Thickness (avg.): 90 mils (ASTM D 5147).
      c. Weight (min per 100 sq. ft of coverage): 60 lb.
      d. Low temperature flexibility @ -10°° F: PASS (ASTM D 5147).
      e. Dimensional Stability (max): 0.2 percent (ASTM D 5147).
      f. Approvals: UL Class listed, FM Approved (products shall bear seals of approval).
      g. Reinforcement: Fiberglass scrim/fiberglass mat or other meeting the performance and dimensional stability criteria.

2. Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
    a. Derbigum
    b. Other approved equal. Substitutions must be approved by Architect. See Division 1 specifications for requirements for proposed substitutions. Substitutions for convenience will only be considered within first 30 days after notice to proceed.

2.05 STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS CAP SHEET

A. Granule-Surfaced Roofing Cap Sheet: ASTM D6163/D6163M, Type I, Grade G, SBS-modified asphalt sheet, reinforced with fiberglass fabric, high SRI granular surfaced; suitable for cold adhesive or hot asphalt application method.
    1. Basis of Design product - Johns Manville DynaGlas 30 FR CR
        a. ASTM D-6163, Type I, Grade G.
        b. Thickness (avg.): Minimum of 130 mils (ASTM D 5147).
        c. Weight (min per 100 ft square of coverage). 90 lb.
        d. Dimensional Stability (max): 0.2 percent (ASTM D 5147).
        e. Approvals: UL Class listed, FM Approved (products shall bear seals of approval).
        f. Reinforcement: Fiberglass mat or other meeting the performance and dimensional stability criteria.
        g. Surfacing: Ceramic or synthetic granules meeting minimum solar reflectance index requirements [of 83 initial, 65 3-year aged] [as noted in Performance Requirements article of these specifications] <insert solar reflectance requirements>.
    2. Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
        a. Derbigum
        b. GAF
        c. Johns Manville
        d. Sipast
        e. Soprema, Inc.
        f. Other approved equal. Substitutions must be approved by Architect. See Division 1 specifications for requirements for proposed substitutions. Substitutions for convenience will only be considered within first 30 days after notice to proceed.

2.06 BASE FLASHING SHEET MATERIALS

A. Granule-Surfaced Flashing Sheet: , granule surfaced, suitable for application method specified.
    1. Basis of Design product - Johns Manville Dyna Weld Cap FR CR
        a. ASTM D-6163, Type I, Grade G.
        b. Approvals: UL Approved, FM Approved (products shall bear seals of approval).
        c. Reinforcement: Fiberglass scrim mat or other meeting the performance and dimensional stability criteria.
        d. Surfacing: Ceramic or synthetic granules meeting minimum solar reflectance index requirement [of 83 initial, 65 3-year aged] [as noted in Performance Requirements article of these specifications] <insert solar reflectance requirements>.

B. Liquid-Applied Membrane Flashing: A flashing membrane assembly approved by the Roofing Manufacturer for the conditions indicated to achieve warranty as specified, consisting of a reinforcing scrim or fabric, encapsulated in resinous or elastomeric liquid applied flashing material. UV resistant and suitable for intended substrate(s).

1. Johns Manville Permaflash Flashing System, or Roofing Manufacturer's approved equal product.
2. Where used: Roof Penetrations, and other locations as required by Manufacturer for specified warranty on the full roof system.

2.07 AUXILIARY ROOFING MATERIALS

A. General: Roofing accessories and miscellaneous materials shall be approved in writing by roofing Manufacturer for use as part of the roofing assembly for this project, prior to installation.

B. Adhesives and Sealants:
   1. Mopping Asphalt: Type IV asphalt certified for full compliance with the requirements listed in Table I, ASTM D 312. Each container of bulk shipping ticket shall indicate the equiviscous temperature, EVT, the finished blowing temperature, FBT, and the flash point, FP. Mopping asphalt shall be approved in writing by the roof membrane manufacturer.
      a. Trumbull ASTM D-312, Type IV, or as approved by the primary roofing manufacturer.
   2. Bituminous Cutback Materials
      a. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D 41 requirements, as provided by the primary roofing manufacturer.
      b. Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges conforming to ASTM D 4586 Type II requirements, as provided by the primary roofing manufacturer.
   3. Sealant: A moisture curing, non-slump elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials.
   4. Comply with VOC limits of authorities having jurisdiction.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than 4-inch diameter.

E. Sheathing Paper: Red-rosin type, minimum 3 lb/100 sq. ft..

F. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

G. Asphalt Bleed-out Masking:
   1. Roofing Granules: Ceramic or synthetic granules of color scheme matching the granule surfacing of the finish ply, meeting minimum SRI index specified.
   2. Use of coating as provided by primary roofing manufacturer, meeting minimum SRI index specified, requires specific approval by Architect. Coating is not an acceptable solution to repair roof membrane soiled by construction activities, unless specifically approved by Architect. Architect reserves right to reject a coating as equal installation to granules in any and all cases.

H. Perlite Cant Strips: A cant strip composed of expanded volcanic minerals combined with waterproofing binders. The top surface shall be pre-treated with an asphalt base coating. The face of the cant shall have a nominal 4 inch dimension.

I. Expansion Joints: Provide factory fabricated weatherproof exterior covers for expansion joint openings as detailed in the Drawings and as required by roofing Manufacturer for complete installation.

2.08 ROOF INSULATION

A. General: Rigid Roof Insulation shall be UL and FM approved. Insulation shall be approved in writing by the insulation manufacturer for intended use and for use with the specified roof assembly. Maintain a minimum panel size of 4 feet by 4 feet where insulation is specified to be installed in hot asphalt.

B. Polyisocyanurate Board Insulation: A closed cell , rigid polyisocyanurate foam core material, integrally laminated between glass fiber facers, in full compliance with ASTM C1289, , Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
   1. Flat insulationpPanels shall have a nominal thickness of two staggered layers of 2.2 inches to achieve a minimum Long Term aged Thermal Resistance LTR30 value per ASTM C1289-13e1. Provide tappered panels as required for slopes indicated.
   2. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. ACFoam II by Atlas Energy Products; Atlanta, GA
      b. ENRGY 3 by Johns Manville, Inc.; Denver, CO.
      c. EnergyGuard by GAF, Gainesville, TX
      d. H-Shield by Hunter Panels, LLC; Portland, ME.
      e. Multi-Max FA by RMAX, Inc.; Dallas, TX.
      f. Paratherm by Siplast/Icopal; Irving, TX.

C. Tapered Insulation: Provide factory-tapered insulation boards.
   1. Material: Match roof insulation.
   2. Minimum Thickness: 1/4 inch.
   3. Slope:
      a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
      b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.09 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[and cover boards] to substrate, and acceptable to roofing system manufacturer.
   1. The insulation fasteners shall provide attachment required to meet the specified uplift performance and to restrain the insulation panels against the potential for ridging.
   2. The fastening pattern for each insulation panel to be used shall be as recommended by the insulation manufacturer and approved by the manufacturer of the primary roofing products.
   3. Acceptable insulation fastener manufacturers for specific deck types are listed below.
      a. Metal Decks: Insulation mechanical fasteners for metal decks shall be factory coated for corrosion resistance. The fasteners shall meet or exceed Factory Mutual Standard FMG 4470, and when subjected to 30 Kesternich cycles, show less than 15 percent red rust. Designed for fastening roof insulation to substrate, and provided or approved by primary roofing system Manufacturer.

1) A fluorocarbon coated screw type roofing fastener having a minimum 0.220 inch thread diameter. Plates used in conjunction with the fastener shall be a metal type having a minimum 3 inch diameter as supplied by the fastener manufacturer.
2) As provided or approved by the primary roofing Manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer to achieve required uplift resistance and for adhering insulation to substrate and conditions uncovered by roof tear-off.

D. Cover Board: ASTM C208, Type II, Grade 2, cellulosic-fiber insulation board, 1/2 inch thick.
1. A high density panel composed of interlocking wood fibers and waterproofing binders, having a top surface that is pre-treated with an asphalt based coating (water absorption - 7 percent volume maximum).
2. Acceptable types are as follows:
a. Johns Manville 3/4 inches Fesco Board.
b. Siplast Wood Fiberboard by Siplast/Icopal; Irving, TX.
c. High Density Fiberboard by the Celotex Corp.; Tampa, FL.
d. Structodeck by Wood Fiber Industries; Chicago, IL.
e. Fiber Base by Temple-Inland Forest Products Corporation; Diboli, TX.
f. High Density Roof Insulation by Huebert Fiberboard, Inc.; Boonville, MO.
3. Cover Board - Perlite: As an alternate and when required by the primary roofing manufacturer for a single source warranty, perlite board meeting ASTM D-728. 3/4 inch thickness.

2.10 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D312/D312M, .

2.11 WALKWAYS

A. Walktread: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated or synthetic granule wearing surface as provided by the primary roofing Manufacturer. Johns Manville DynaTred Plus or comparable product by other approved manufacturer.
1. Where available from roofing Manufacturer, use product matching cap sheet finish or with SRI 83 or greater.
2. Provide around each rooftop mounted equipment for maintenance.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.
   1. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
   1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Perform fastener-pullout tests according to roof system manufacturer's recommendations.
   1. Submit test result within 24 hours of performing tests.
      a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

D. Install sound absorbing insulation strips in ribs of acoustical roof decks according to acoustical roof deck manufacturer's written instructions.

3.03 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
   1. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing roofing system.

D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified in Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

E. Asphalt Heating:
   1. Heat asphalt to its equiviscous temperature, measured at the mop cart or mechanical spreader immediately before application.
      a. For cap sheets, heat asphalt according to cap sheet manufacturer's recommendations.
   2. Circulate asphalt during heating.
   3. Do not raise asphalt temperature above equiviscous temperature range more than one hour before time of application.
      a. For cap sheets, comply with cap sheet manufacturer's recommendations.
   4. Do not exceed asphalt manufacturer's recommended temperature limits during asphalt heating. Contractor shall monitor and maintain a record available for review if required by Owner or Manufacturer's representative.
   5. If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525° F. Minimum application temperature shall be 450° F.
   6. Do not heat asphalt within 25 degree F of flash point.
   7. Discard asphalt maintained at a temperature exceeding finished blowing temperature for more than four hours.
   8. Asphalt Moppings: Ensure that all moppings do not exceed a maximum of 25 lb/sq. Mopping shall be total in coverage, leaving no breaks or voids.
   9. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

10. Apply hot roofing asphalt within plus or minus 25 degree F of equiviscous temperature.
    a. For cap sheets, comply with cap sheet manufacturer's recommendations.

F. Asphalt Heating: Heat and apply SEBS-modified roofing asphalt according to roofing system manufacturer's written instructions. Kettles and tankers shall be equipped with accurate, fully readable thermometers

G. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.04 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:
    1. Install base layer of insulation with [joints staggered not less than 24 inches in adjacent rows] [end joints staggered not less than 12 inches in adjacent rows] [and with long joints continuous at right angle to flutes of decking].
        a. Locate end joints over crests of decking.
        b. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
        c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
        d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
        e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
            1) Trim insulation, so that water flow is unrestricted.
        f. Fill gaps exceeding 1/4 inch with insulation.
        g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
        h. Mechanically attach base layer of insulation[and substrate board] using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
            1) Fasten insulation according to requirements in [FM Approvals' RoofNav for specified Windstorm Resistance Classification] [SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity].
            2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
    2. Install upper layers of insulation [and tapered insulation], with joints of each layer offset not less than 12 inches from previous layer of insulation.
        a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
        b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
        c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
        d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
        e. At internal roof drains, slope insulation to create a square drain sump, with each side equal to the diameter of the drain bowl plus 24 inches.
        f. Trim insulation, so that water flow is unrestricted.

g. Fill gaps exceeding 1/4 inch with insulation.
h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
i. Adhere each layer of insulation to substrate using adhesive according to [FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification] [SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity] and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
    1) Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 degree F of equiviscous temperature.
    2) Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
    3) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.05 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
    1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    2. At internal roof drains, conform to slope of drain sump.
        a. Trim cover board, so that water flow is unrestricted.
    3. Cut and fit cover board tight to nailers, projections, and penetrations.
    4. Adhere cover board to substrate using adhesive according to [FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification] [SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity] and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
        a. Set cover board in a solid mopping of hot roofing asphalt, applied within plus or minus 25 degree F of equiviscous temperature.
        b. Set cover board in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
        c. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. Install sheathing paper over cover board and immediately beneath roof membrane.

3.06 INSTALLATION OF ROOFING MEMBRANE, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing" and the following requirements.
    1. Base sheet shall be inspected by roofing Manufacturers representative , prior to application of cap sheet.
    2. Schedule required inspections prior to beginning roofing Work.
    3. Take precautions to prevent materials from entering or clogging roof drains, scuppers, pipes, or other similar devices. Remove roof drain and scupper plugs or covers when no work is taking place or when rain is forecast.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

1. Backnail roofing sheets to nailer strips according to roofing system manufacturer's written instructions.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.
   1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
   2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

E. Aesthetic Considerations and Patching: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this project. Make necessary preparations, utilize recommended application techniques, apply the specified materials including granules and exercise care in ensuring that the finished application is acceptable to the Owner.
   1. Finished application should contain no wrinkles, creases, fishmouths, sagging of base flashings, or other visible imperfections.
   2. Bleed-out of asphalt fully masked to consistent appearance and conforming with SRI requirements.
   3. Excessive patching in new roof areas will require removal and replacement if, in the opinion of the Architect, aesthetic quality is compromised.
   4. Excessive patching in new roof areas will require removal and replacement if, in the opinion of the Manufacturer's representative, the amount of patching is to the extent that it is no longer qualified as a new roof or would affect roof warranty.

F. Priming: Prime metal and concrete and masonry surfaces with a uniform coating of the specified asphalt primer.

3.07 INSTALLATION OF BASE SHEET

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.

B. Loosely lay one course of sheathing paper, lapping edges and ends a minimum of 2 inches and 6 inches, respectively.

C. Roofing Application: Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets.
   1. Apply all layers of roofing perpendicular to the slope of the deck.
   2. Fully bond the base ply to the prepared substrate, utilizing minimum 3 inch side laps and minimum 12 inch end laps. Apply each sheet directly behind the asphalt applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3 feet.
   3. Fully bond the finish ply to the base ply, utilizing minimum 3 inch side and end laps. Apply each sheet directly behind the asphalt or torch applicator. Stagger end laps of the finish ply a minimum 3 feet. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply top pressure to top seal T-laps immediately following sheet application. Stagger side laps of the finish ply a minimum 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum 3 feet from end laps on the underlying base ply.

4. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes.

D. Installation of SBS-Modified Bitumen Polyester-Mat Base Sheet:
   1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
   2. Extend roofing sheets over and terminate above cants.
   3. Install base sheet in a shingle fashion.
   4. Adhere to substrate in a uniform coating of cold-applied adhesive.
   5. Torch apply to substrate.
      a. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
   6. Install base sheet without wrinkles, rears, and free from air pockets.
   7. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
      a. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches.
      b. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
      c. Stagger end laps not less than 18 inches.
      d. Heat weld end laps, Completely bond and seal laps, leaving no voids.
      e. Roll laps with a 20-pound roller.
   8. Repair tears and voids in laps and lapped seams not completely sealed.
   9. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.08 INSTALLATION OF SBS-MODIFIED BITUMINOUS CAP SHEET

A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.

B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
   1. Extend cap sheet over and terminate above cants.
   2. Install cap sheet in a shingle fashion.
   3. Install cap sheet as follows:
      a. Adhere to substrate in a solid mopping of hot roofing asphalt applied at asphalt temperature recommended by cap sheet manufacturer.
      b. Adhere to substrate in cold-applied adhesive.
      c. Torch apply to substrate.
         1) Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.
   4. Install cap sheet without wrinkles or tears, and free from air pockets.
   5. Install cap sheet, so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
   1. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches.

2. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
3. Stagger end laps not less than 18 inches.
4. Heat weld laps Completely bond and seal laps, leaving no voids.
5. Roll laps with a 20-pound roller.
6. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

E. Apply roofing granules of same color as roof membrane to cover exuded bead at laps while bead is hot, to provide a continuous color appearance.

F. Granule Embedment: Broadcast granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot or the adhesive is soft, to ensure a monolithic surface color, compliant with SRI index requirements.

3.09 INSTALLATION OF FLASHING AND STRIPPING

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer Sheet Application:
a. Mechanically fasten backer sheet to walls or parapets.
b. Adhere backer sheet over roofing membrane at cants in a solid mopping of hot roofing asphalt.
c. Seal all laps.

B. Backer Sheet Application:
1. Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt.
2. Seal all laps.

C. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot roofing asphalt applied at asphalt temperature recommended by flashing sheet manufacturer. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

D. Flashing Sheet Application: Adhere flashing sheet to substrate in cold-applied adhesive at rate required by roofing system manufacturer.

E. Flashing Sheet Application: Adhere flashing sheet to substrate in asphalt roofing cement at rate required by roofing system manufacturer.

F. Flashing Sheet Application: Torch apply flashing sheet to substrate.
1. Perform torch application according to NFPA 241, including two-hour fire watch after torches have been extinguished.

G. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

H. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

I. Install liquid flashing system according to manufacturer's recommendations.

1. Extend liquid flashing not less than 3 inches in all directions from edges of item being flashed.
2. Embed granules, matching color of roof membrane, into wet compound.

J. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

K. Roof Drains: Set 30-by-30-inch- 4-pound lead flashing in bed of asphaltic adhesive on completed roofing membrane.
1. Cover lead flashing with roofing cap-sheet stripping, and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane.
2. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.
3. Install stripping according to roofing system manufacturer's written instructions.

L. Parapet Wall Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using the reinforcing sheet and the flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum 3 inch side laps and extend a minimum of 3 inches onto the base ply surface and 3 inches up the parapet wall above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by by application of asphalt primer; allowing primer to dry thoroughly. Hot mop apply the flashing membrane into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of 4 inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets. Check and seal all lose laps and edges. Nail the top edge of the flashing on 9 inch centers. Mechanically fasten membranes at parapets walls as recommended by roofing Manufacturer.

M. Parapet Wall Flashing Application - Wood Surfaces: Flash wood or plywood parapet walls and curbs using the reinforcing sheet and the flashing membrane. The reinforcing sheet shall have minimum 3 inch side laps and extend a minimum of 3 inches onto the base ply surface and to the top of the parapet wall or curb. Nail the reinforcing sheet through the field of the sheet to the vertical wood surface on 12 inch centers from the top of the cant to top of the wall or curb. Fully adhere the remainder of the flashing reinforcing sheet that extends over the cant and roof level. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by application of asphalt primer; allowing primer to dry thoroughly. Hot mop apply the flashing into place using three foot widths (cut off the end of roll) always lapping the factory selvage edge. Extend the flashing sheet a minimum of 4 inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall/roof surfaces, preventing air pockets. Check and seal all loose laps and edges. Nail the top edge of the flashing on 9 inch centers. Mechanically fasten membranes at parapets walls as recommended by roofing Manufacturer.

N. Water Cut-Off: At end of days work, or when precipitation is imminent, construct a water cutoff at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to the resumption of roofing.

3.10 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

A. Edge Metal: Completely prime metal flanges and allow to dry prior to installation. Turn the base ply down 2 inches past the roof edge and over the nailer. After the base ply and continuous cleat (if applicable) have been installed, set the flange in mastic and stagger nail every 3 inches on center. Strip-in the flange using the stripping-ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the gravel-stop rise of the edge metal. See item: Sealant, for finish of this detail.

B. Lead Pipe Flashings: Completely prime the lead flanges and allow to dry prior to installation. After the base ply has been applied, set the flange in mastic and strip-in the flange using the stripping-ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the flange-sleeve juncture of the pipe flashing. See item: Sealant, for finish of this detail.

C. Lead Drain Flashings: Completely prime the lead drain flashing and allow to dry prior to installation. After the base ply has been applied, set the lead flashing sheet in mastic and form to turn down inside of the drain bowl. Ply-in the perimeter of the lead flashing using an additional layer of the base ply material, overlapping the perimeter of the lead a minimum of 4 inches. Terminate the finish ply to extend beneath the clamping ring seal. Install the clamping ring with all bolts in place.

D. Light Air Unit Supports: Where existing light air handing units or other equipment that are supported by wood sleepers (not supported by a roof curb) are to be removed and reinstalled, separate wood sleepers from the new roof assembly using the manufacturers walktread-roof protection material. Cut each walktread pad to a size which extends a minimum of 2 inches beyond the perimeter of each sleeper block. Set the walktread pad dry over the new assembly. Set each sleeper block dry over the walktread pad.

E. Metal Pipe Flashings: Completely prime the metal pipe flanges and allow to dry prior to installation. After the base ply has been applied, set the flanges in mastic and strip-in the flange using the stripping-ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the flange-sleeve juncture of the pipe flashing. Install a watertight umbrella to the penetration, completely covering the opening of the pipe flashing. See Item: Sealant, for finish of this detail.

F. Sealant: Apply a smooth continuous bead of the specified sealant at the exposed finish ply edge transition to metal flashings incorporated into the roof system.

3.11 INSTALLATION OF WALKWAYS

A. Walkway Pads: Install walkway pads using units of size indicated or, if not indicated, of manufacturer's standard size, according to walkway pad manufacturer's written instructions.
   1. When not precut, cut the walktread material into maximum 5 foot lengths and allow to relax until flat.
   2. Adhere the sheet in a full bed of Manufacturers approved plastic cement.
   3. Walk-in each sheet after application to ensure proper adhesion. Use a minimum spacing of 2 inches between sheets to allow for proper drainage.
   4. Install walkways at the following locations:
      a. Perimeter of each rooftop unit.
      b. Between each rooftop unit location, and at service sides of other rooftop mechanical equipment, creating a continuous path connecting rooftop equipment locations.
      c. Install walktread material as sacrificial pads under pipe supports and other equipment supports that do not penetrate the roof as required by Manufacturer.

d. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
e. Top and bottom of each roof access ladder.
f. Locations indicated on Drawings.
g. Install all walktreads and pads so as not to cause water to pond.
h. As required by roof membrane manufacturer's warranty requirements.

5. Provide 3-inch clearance between adjoining pads.
6. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.12 PROTECTING AND CLEANING

A. Site Conditions: Remove all screws, fasteners, and miscellaneous debris from completed roof. Leave all areas around job site free of debris, roofing materials, equipment, and related items after completion of job. Clean or repair any soiled roofing areas as required by Manufacturer for warranty requirements and to restore solar reflectance.

B. Protect roofing system from damage and wear during remainder of construction period.
1. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

C. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 52 16

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Provide all metal flashing and sheet metal work, as shown on the drawings and as herein specified.
   1. Sheet Metals
      a. Copper-Laminated Flashing
      b. Galvanized Steel
   2. Underlayments
      a. Self-Adhered HT Underlayment
   3. Roof Drainage Fabrications
      a. Hanging Gutters
      b. Downspouts
      c. Scuppers
         1) BOD Shop Fabricated Scuppers
      d. Conductor Heads
   4. Low-Slope Roof Fabrications
      a. Copings
         1) BOD Coping System
      b. Base Flashing
      c. Counter Flashing
      d. Penetration Flashings
      e. Hooded Pans with Pourable Sealant:
   5. Steep Roof Slope Fabrications
      a. Roof Penetration Flashings
   6. Wall Sheet Metal Flashing
      a. Through Wall Flashing
      b. Opening Flashing
   7. Miscellaneous Fabrications
      a. Equipment Support Flashings

B. Related Requirements:
   1. Division 04 Section - Unit Masonry for through-wall flashing.
   2. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
   3. Section 07 71 00 "Roof Specialties" for manufactured copings, roof-edge specialties, roof-edge drainage systems, reglets, and counterflashings.
   4. Division 07 Section - Joint Sealers.
   5. Division 07 Section - Painting.

1.03 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.04 ACTION SUBMITTALS

A. Product Data: For each of the following
   1. Underlayment materials.
   2. Elastomeric sealant.
   3. Butyl sealant.
   4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.
   1. Include plans, elevations, sections, and attachment details.
   2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
   3. Include identification of material, thickness, weight, and finish for each item and location in Project.
   4. Include details for forming, including profiles, shapes, seams, and dimensions.
   5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
   6. Include details of termination points and assemblies.
   7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
   8. Include details of roof-penetration flashing.
   9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
   10. Include details of special conditions.
   11. Include details of connections to adjoining work.
   12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
   13. Failure by the contractor to submit shop drawings required above shall release the Architect from any liabilities due to the negligence on the part of the Contractor to comply with the construction documents.

C. Samples: For each exposed product and for each profile, color and texture specified, 12 inches long by actual width.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

B. Special warranty.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
   1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested , shop shall be listed as able to fabricate required details as tested and approved.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Build mockup of typical roof edge eave, including fascia fascia trim, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
   1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
   2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.09 WARRANTY

A. Sheet metal applicator and General Contractor shall personally guarantee sheet metal work for a period of Two-Years after acceptance of the building by the Owner against any defects or water leaks. Guarantee shall include all labor and materials necessary to correct any defects or water leaks upon notice from the Owner.

B. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with latest edition of NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
   1. Design Pressure: As indicated on Drawings.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change: 120 degree F, ambient; 180 degree F, material surfaces.

2.02 SHEET METALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Copper-Laminated Flashing: ASTM B370, CDA Alloy 110, 7-oz./sq. ft. copper core laminated polymer fabric on both sides with non-asphaltic adhesive. Extend flashing past face of brick and trim flush after inspection. Use only where flashing is fully concealed in masonry. Coordinate with Division 04 Unit Masonry.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hohmann & Barnard; Copper SA
      b. STS Coatings, Inc.; Wall Guardian Copper TWF
      c. Wire-Bond, Inc.; Copper Seal
      d. York Manufacturing, Inc.; York Copper Fabric Flashing, Multi-Flash 500.
   2. Copper Laminated Flashing shall not be used for any flashings that will be exposed to view in the completed work. Refer to Division 07 Section Sheet Metal Flashing and Trim for material type(s) for embedded flashings that are exposed to view or partially exposed to view. General Contractor shall coordinate responsibility to provide and install other flashing types.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

D. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A755/A755M.
   1. Surface: Smooth, flat.

2. Exposed Coil-Coated Finish:
    a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
3. Color: As selected by Architect from manufacturer's full range.
4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

E. Lead Sheet: ASTM B749 lead sheet.

2.03 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive integrally bonded to cross-laminated, high-density polyethylene film, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
    1. Subject to compliance with requirements, provide one of the following:
        a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
        b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
        c. Henry Company; Blueskin PE200 HT.
        d. Owens Corning; WeatherLock Metal High Temperature Underlayment.
        e. Polyglass, Polystick MTS.
        f. Soprema, Lastobond Shield HT.
        g. Tamko, TW Metal and Tile Underlayment.
    2. Performance Requirements: Provide in accordance with material manufacturer's recommendations for anticipated in-service temperatures, but not less than 240 degree rating as specified. Provide primer when recommended by flashing membrane manufacturer.
        a. Thermal Stability:
            1) Stable after testing at 240 degree F ASTM D 1970, or to higher temperature resistance where indicated by panel manufacturer.
            2) Low-Temperature Flexibility: Passes after testing at minus 20 degree F per ASTM D 1970.
        b. Widths: To suit conditions, generally provide 3 inch minimum width adhered to each face or different material being sealed.

2.04 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, solder, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
    1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
        a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.

b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for [Zinc-Coated (Galvanized)] [Aluminum-Zinc Alloy-Coated] Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

C. Solder:
1. For Zinc-Coated (Galvanized) Steel: ASTM B32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.

I. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.

J. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions and with interlocking counterflashing on exterior face, of same metal as reglet. BOD Product: Equal to Fry CO, original metal reglet.with . "Springlock Flashing" by Fry Reglet.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Cheney Flashing Company.
b. Fry Reglet Corporation.
c. Heckmann Building Products, Inc.
d. Hickman Edge Systems LLC
e. Keystone Flashing Company, Inc.
f. National Sheet Metal Systems, Inc.
2. Source Limitations: Obtain reglets from single source from single manufacturer.
3. Material: Galvanized steel, 26 gauge**.**
4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
5. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

6. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
7. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
8. Accessories:
    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing's lower edge.
9. Finish: With manufacturer's standard color coating.

2.05 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
    1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
    2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
    3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
    4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
    5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:
    1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
    2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
    1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
    2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.

G. Seams:
    1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.06 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters:
1. Fabricate to cross section required, complete with end pieces, outlet tubes, and other accessories as required.
2. Fabricate in minimum 96-inch- long sections.
3. Provide 1 inch straps at 30 inch o.c. max. and bracket hangers at 30 inch o.c, max.
4. Furnish flat-stock gutter brackets and gutter spacers and straps fabricated from same metal as gutters, of size recommended by cited sheet metal standard, but with thickness not less than twice the gutter thickness.
5. Fabricate expansion joints, expansion-joint covers,[gutter bead reinforcing bars,] and gutter accessories from same metal as gutters. Shop fabricate interior and exterior corners.
6. Gutter Profile: Style F in accordance with cited sheet metal standard.
7. Expansion Joints: Lap type.
8. Accessories: [Continuous, removable leaf screen with sheet metal frame and hardware cloth screen] [Wire-ball downspout strainer] [Valley baffles].

B. Downspouts: Fabricate rectangular downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
1. Fabricate from the following materials:
a. Galvanized Steel: 0.022 inch thick.
b. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

C. Shop-Fabricated Scupper: Fabricate from 24 Gauge galvanized steel with Kynar 500 finish. Formed one-piece through wall scupper flashing with flange extending at least 4 inch in all directions from scupper and at least 4 inch onto roof surface (4 inch beyond roof cants at overflow scuppers). Basis of Design construction shall be patterned on a scupper as manufactured by Hickman Edge Systems or approved equal. Provide with prefinished Kynar snap-on face trim in color as selected by the Architect.

D. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim and built-in overflows. Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.07 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Shop-Fabricated Coping System: Minimum of 24 Gauge galvanized steel pre-formed, prefinished cap installed over drainable 20 gauge galvanized steel perforated cleat, 12 inch wide at 60 inch centers. Increase minimum gauges of cap and cleats, and decrease cleat spacing as required to meet specified standards and performance criteria. Cleat secured with nails into P.T. wood blocking. Internal supports and concealed splice plates. Basis of Design construction shall be patterned on the Hickman Edge Systems "Permasnap Premier" Coping System. Cap shall receive Kynar coating in color to be selected by the Architect. Provide continuous welded pre-formed corners and intersections.
   1. Coping: Fabricated from minimum 24 gauge galvanized, prefinished steel unless otherwise noted.
   2. Coping Corners and Intersections: Mitered, preformed and continuously welded.
   3. Cleats: Fabricated from same material as coping.
   4. Splice Plates: Concealed, of the same material and finish as coping.
   5. Finish for Galvanized Steel: Kynar coating in colors as selected by Architect.

B. Base Flashing: [Shop fabricate interior and exterior corners.]Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

C. Counterflashing: [Shop fabricate interior and exterior corners.]Fabricate from the following materials:
   1. Galvanized Steel: 0.022 inch thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

E. Hooded Pans with Pourable Sealant: As detailed in drawings, constructed of 20 gauge galvanized sheet steel, riveted and soldered watertight. Provide hooded pans at all new pipe, conduit, refrigerant line and other similar through-roof penetrations as necessary where power / condensate do not penetrate within RTU roof curbs. Bed flanges with plastic cement (Fed. Spec. SS-C-153, Type II) on top of roofing. Caulk around penetrations. Fill pans with roofing granules to 1 inch from top, and fill to the top with pourable sealant. Mold sealant to cone shape sloping to outside.
   1. Provide pans of adequate sizes for penetrations as indicated in Drawings, including space between penetrations within the same hooded pan.

2.08 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Penetration Flashing: Fabricate from the following materials:
   1. Galvanized Steel: 0.028 inch thick.
   2. Aluminum-Zinc Alloy-Coated Steel: 0.028 inch thick.

2.09 WALL FLASHING FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch- high, end dams. Fabricate from the following materials:

1. Copper-Laminated Flashing: Where not covered by section 04 20 00 Unit Masonry use[one of] ASTM B370, CDA Alloy 110, 7oz./sq. ft. copper core laminated polymer fabric on both sides with non-asphaltic adhesive. Extend flashing past face of brick and trim flush after inspection. Use only where flashing is fully concealed in masonry.
    a. Basis of Design: York Copper Fabric Flashing, Multi-Flash 500 by York Manufacturing, Inc. or approved equal.
    b. Copper Laminated Flashing shall not be used for any flashings that will be exposed to view in the completed work. Refer to Division 07 Section Sheet Metal Flashing and Trim for material type(s) for embedded flashings that are exposed to view or partially exposed to view. General Contractor shall coordinate responsibility to provide and install other flashing types.
    c. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
    d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.
    e. Coordinate with section 04 20 00 Unit Masonry
2. Copper-Laminated Fabric: 7oz./sq. ft.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- high, end dams. Provide with drip edges hemmed 1/2" on underside. Fabricate from the following materials:
1. Copper-Laminated Fabric
2. Galvanized Steel: 0.022 inch thick with PVDF coating in color (s) as selected by the architect.
3. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

2.10 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:
1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prepare substrate if recommended by underlayment manufacturer.

3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

3.03 INSTALLATION, GENERAL

A. General: unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
   1. All complete work shall be water and weathertight. Joints, cuts, miters, splices or other installation means made as neat as possible. Fastenings as inconspicuous as possible.
   2. Details shown are design details, fabrication techniques, and methods as per SMACNA recommendations.

B. Proper and adequate provisions shall be made in fabrication, installing and fastening sheet metal work for expansion and contraction of metal and other materials entering into the work so that pulling, splitting, opening of joints, warpage or other failure of the work shall be prevented. Expansion joints in sheet metal placed not farther than 30 feet apart unless stricter requirements are indicated.

C. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
   1. Install fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   2. Seam through wall flashing fabric per manufacturer's recommendations.
   3. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   4. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder.
   5. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
   6. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
   7. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
   8. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
   9. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
   10. Do not field cut sheet metal flashing and trim by torch.
   11. Do not use graphite pencils to mark metal surfaces.

D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
   1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
   3. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

E. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
   1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
   2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
   3. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less that 1 inch deep, filled with mastic sealant (concealed within joints).

F. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws .

G. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

H. Seal joints as required for watertight construction.
   1. Use sealant-filled joints unless otherwise indicated. Form expansion joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
      a. Embed hooked flanges of joint members not less than 1 inch into sealant.
      b. Form joints to completely conceal sealant.
      c. Adjust setting proportionately for installation at higher ambient temperatures.
         1) Do not install sealant-type joints at temperatures below 40 degree F.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."
   3. Use joint adhesive for nonmoving joints specified not to be soldered.

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter.
   1. Do not solder metallic-coated steel and aluminum sheet.
   2. Do not pretin zinc-tin alloy-coated copper.
   3. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
   4. Heat surfaces to receive solder, and flow solder into joint.
      a. Fill joint completely.
      b. Completely remove flux and spatter from exposed surfaces.

J. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3.04 INSTALLATION OF ROOF-DRAINAGE SYSTEM

A. Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNAS Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.

B. Hanging Gutters:
   1. Join sections with joints sealed with sealant.
   2. Provide for thermal expansion.
   3. Attach gutters at eave or fascia to firmly anchor them in position.
   4. Provide end closures and seal watertight with sealant.
   5. Slope to downspouts.
   6. Fasten gutter spacers to front and back of gutter.
   7. Anchor and loosely lock back edge of gutter to continuous cleat.
   8. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
   9. Anchor gutter with gutter brackets spaced not more than 30 inches apart to roof deck unless otherwise indicated, and loosely lock to front gutter bead.
   10. Install gutter with expansion joints at locations indicated on Drawings, but not exceeding, 50 feet apart. Install expansion-joint caps.

C. Downspouts:
   1. Join sections with 1-1/2-inch telescoping joints.
   2. Provide hangers with fasteners designed to hold downspouts securely to walls.
   3. Locate hangers at top and bottom and at approximately 60 inches o.c.
   4. Provide elbows at base of downspout to direct water away from building.
   5. Connect downspouts to underground drainage system.

D. Parapet Scuppers:
   1. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   2. Anchor scupper closure trim flange to exterior wall and solder to scupper.
   3. Loosely lock front edge of scupper with conductor head.
   4. Solder exterior wall scupper flanges into back of conductor head.

E. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.

F. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.05 INSTALLATION OF ROOF FLASHINGS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
   1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
   2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Copings:
   1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.

2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
    a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
    b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
3. Install copings with concealed splice plates, preformed corners, and positive drainage (inward slope) on top surface. No exposed fasteners through copings allowed.
4. Coping constructed in lengths not exceeding 10 feet. Joints between sections shall be tight and lay flat over splice plates. Coping shall be fastened with continuous clips both sides over 45 mil neoprene sheet. Bent, crimped or warped sections are not permitted. Metal at corners shall be soldered.

C. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of [snap-in installation and sealant or lead wedges and sealant] [interlocking folded seam or blind rivets and sealant] [anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas] <Insert requirement> unless otherwise indicated.
5. Counter flashing constructed in lengths not exceeding 10 feet and installed in receiver so that flashing lays tightly against base flashing and overlaps base flashings a minimum of 4 inches. Joints between sections shall be tight and lay flat. Metal at corners continuous. Bent, crimped or warped sections are not permitted.
    a. Coordinate counterflashings with roofing installation of termination bars at top edge of roofing base flashings.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.
1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.

F. Install hooded sealant filled pans at equipment supports, pipes, conduits and other items penetrating roof or at items resting on roof without integral curbs and base flashing. Bed flanges with plastic cement (Fed. Spec. SS-C-153, Type II) on top of roofing. Caulk around penetrations. Fill pans to 1 inch from top with roofing granules. Fill top inch of pans with pourable sealant and mold to cone shape sloping to outside.

G. Termination bars: Provide stainless steel termination bars in cavity walls where copper flashing will be installed with termination bars and with waterproof sealant to protect top side of terminations, refer to Division 07 "Joint Sealants".
1. Refer to Drawings for termination bar details at face of exterior sheathing, behind ci insulation. Air barrier system materials (per Division 07 Water and Vapor Barrier Sections) shall lap over and down the face of the through-wall flashings.
2. Termination Bars for Flexible Flashing: #304 Stainless steel sheet 0.090 inch by 3/4 inches with a 3/16 inch minimum sealant flange at top, 8 inch oc pre-punched bolt holes minimum.

3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    a. OMG Roofing Products
    b. Wire-Bond.

3.06 INSTALLATION OF WALL FLASHINGS

A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.
    1. Joints in thru-wall flashings and counterflashings shall be lapped 4 inch minimum with laps bedded in sealant.
    2. Head and sill flashings shall not have joints and shall have sides turned up (edge dams) with all corners folded, not cut and shall extend 9 inch minimum beyond both sides of opening.
    3. Head, sill and thru-wall flashings shall be set in a bead of sealant applied under the exterior edge of the flashing and on top of the masonry or lintel angle on which the flashing rests.
    4. Penetrations in thru-wall flashing are not permitted. Vents in thru-wall flashing shall be completely flashed and water tight.
    5. Metal reglets shall have a bead of sealant installed to complete system with counterflashing.

B. Install metal jamb flashing, in material as noted, over adjacent air barrier system at jambs of curtainwall and other locations as shown on the drawings, as required to close openings to cavity wall. Mechanically attach with stainless steel fasteners and seal metal flashing to wall / air barrier with self adhering membrane flashing as specified in Division 07 Section - Modified Bituminous Sheet Air Barriers.

3.07 INSTALLATION OF MISCELLANEOUS FLASHING

A. Equipment Support Flashing:
    1. Weld or seal flashing with elastomeric sealant to equipment support member.

3.08 INSTALLATION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.09 CLEANING

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

3.10 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Provide roof accessories listed below and other items as indicated on the drawings.
   1. Roof curbs.
   2. Equipment supports.
   3. Pipe and duct supports.
      a. Fixed Height Roller Type Pipe Supports
   4. Pipe portals.
   5. Preformed flashing sleeves.

B. Related Requirements:
   1. Division 06 Section - Rough Carpentry, for wood blocking.
   2. Division 07 Section - Roofing Section(s).
   3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
   4. Division 07 Section - Sealants.
   5. Division 22 Sections for Plumbing.
   6. Division 23 Sections for Mechanical.
   7. Division 26 Sections Electrical.

1.03 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, rough-in diagrams, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.06 PRODUCT DELIVERY

A. Deliver products in manufacturers original unopened packages, clearly marked with brand name and model number.

B. Store materials on clean, raised platforms with weather protective covering when stored outdoors.

1.07 PROJECT CONDITIONS

A. Any equipment curb heights indicated in Drawings are minimum curb heights required in general. Taller curbs may be required for minimum height above adjacent roofing for roof warranty, including tapered insulation and crickets. All curbs shall be tall enough to accommodate minimum curb height, or minimum heights above roof as indicated in Drawings, or minimum 8 inches above highest adjacent roof surface, whichever is greatest. Coordinate with roofing installer to confirm total curb heights required.

B. Do not install materials during inclement weather or when air temperature may fall below 40° F, including wind chill.

C. Do not install materials over damp, frozen or otherwise unsuitable surface.

1.08 WARRANTY

A. Manufacturer for each item shall guarantee products against defects in material and workmanship for a period of five years.

B. Roofer's Warranty: Roofer's water tightness warranty shall not have exclusions for items installed by the roofing installer. Refer to Division 07 roofing sections..

C. Metal roof pipe boot warranty: Manufacturer's standard 20 year warranty.

D. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Comply with "NRCA Roofing and Waterproofing Manual" for installation of units.

2.02 ROOF CURBS

A. BOD Pre-fabricated Roof Curbs: Welded 18 gauge welded galvanized steel and integral base plate with factory installed 2 x 4 pressure treated wood nailer, and heavy gauge galvanized steel counterflashing. Reinforcing on sides greater than 36 inches. Supports to be provided at all HVAC roof top condensers and as shown on drawings. Unit shall be tapered to provide level rooftop equipment, as manufactured by the Pate Co., Model #PC-2, or approved equal.
   1. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
   2. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
   3. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.

2.03 EQUIPMENT SUPPORTS

A. BOD Prefabricated Roof Equipment Support: Welded 18 gauge welded galvanized steel and integral base plate with factory installed 2 x 6 pressure treated wood nailer, insulation board and heavy gauge galvanized steel counterflashing. Reinforcing on sides greater than 36 inches. Curbs to be provided at all mechanical roof top units and as shown on drawings. Unit shall be tapered to provide level rooftop units, as manufactured by the Pate Co., Model #ES-2b approved equal.
   1. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
   2. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
   3. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.

2.04 PIPE SUPPORTS

A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 3 3/4-inch- diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes. Unit shall be Miro Industries "Pillow Block Pipestands", Model 3-R, or approved equal.

2.05 PIPE PORTALS

A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints,[straight sides,] [integral metal cant,] [stepped integral metal cant raised the thickness of roof insulation,] and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless steel snaplock swivel clamps.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

2.06 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and metal collar. Unit shall be Thaler Metal Industries, "Dryer B-1 for flat/lowslope roofs" "Dryer B-2 for slope roofs", as required for pipe sizes, or approved equal.

B. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
      d. Thaler Metal Industries Ltd.
   2. Metal: Aluminum sheet, 0.063 inch thick.
   3. Height: 7 inches.
   4. Diameter: As indicated on Drawings.
   5. Finish: Manufacturer's standard.

C. Curbed Portal Systems: Provide pre-manufactured, insulated curbs, tall enough to provide 12 inch vertical height measured from top of curb to roof surface, equal to Pate pc-2 series curbs. Provide with the following waterproofing:
   1. For use at weatherhead, gas, refrigerant, and similar pipe penetrations , and at steel pipes penetrations for mechanical rooftop screen framing: Pipe flashing portal system provided with formed cap flashing with ring, graduated elastomeric seal that fits over the ring, and stainless steel clamps. Pipe Portal System equal to Pate pcc-4 or ppc-6, as applicable to penetration size. Multiple penetration portal caps may be used where multiple pipe penetrations are in close proximity.

D. Flat Roof Pipe Seal: One piece spun aluminum base with full five inch sloped-roof surface flange, graduated step PVC boot and adjustable stainless steel clamps equal to Pate "Pipe Seal", size as required by pipe, or approved equal.
   1. Color: As selected from manufacturer's standard color selection.
   2. Hardware: Provide with adjustable metal clamp for clamping top of graduated boot to pipe, and Manufacturer's recommended base fasteners for the conditions and substrates as indicated.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Aztek Washer Company
      b. Marco Industries
      c. The Pate Company

E. Sloped Roof Pipe Seal: One piece flexible aluminum base with pleated EPDM cone adjustable to any roof slope and rated for high temperature resistance (tested to: minimum 225 Degrees F continuous exposure), equal to Pate "Dektites", size as required by pipe, or approved equal.
   1. Type and configuration to suit roof pitch.
   2. Sizes: Sized to pipe penetrations.
   3. Color: As selected from manufacturer's standard color selection.
   4. Hardware: Provide with adjustable metal clamp for clamping top of graduated boot to pipe, and Manufacturer's recommended base fasteners for the conditions and substrates as indicated.

5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Aztek Washer Company "Master Flash"
    b. Marco Industries "Roof Boots",
    c. The Pate Company, "Dektites"

F. Pipe Hood Assemblies: Heavy gauge aluminum construction with removable top cover, face plate and 3 sided body for easy access. Separate fully welded and insulated aluminum mounting base furnished to isolate hood from galvanized curb. Pate "PHA" system or approved equal.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Aztek Washer Company
    b. Marco Industries
    c. The Pate Company, "Dektites"

2.07 METAL MATERIALS

A. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

B. Steel Tube: ASTM A500/A500M, round tube.

C. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

2.08 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Pipe Umbrellas: Provide one piece pipe umbrellas where indicated in Drawings. Sizes to match penetrations indicated.

C. Polycarbonate Glazing: Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated according to UL 972 with an average impact strength of 12 to 16 ft-lbf/in. of width when tested according to ASTM D256, Method A (Izod).

D. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.09 FABRICATION

A. Curb Cap Flashings: All curb cap flashings without exception shall be one piece galvanized steel construction with no rivets or sealant joints, and with pre-punched holes on vertical surface for mechanical fastener attachment to curbs. Except for equipment support curbs required to be a level mounting surface, top side of curb cap flashings shall have slight slope to drain away from penetrations on all sides. Penetration openings shall be fabricated to dimensions of penetrating items and shall turn up integral with flashing cap at least one inch, with a turned out lip for applying sealant, unless otherwise approved by Architect.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate between trades as required to ensure waterproof installation acceptable to roofing installer and Manufacturer.
   1. Ensure roof curbs meet minimum height requirements above adjacent roofing, including insulation thickness, tapered insulation, and crickets.
   2. Coordinate with roofing Installer’s tapered insulation shop drawings to ensure curbs, pipes, vent caps, and other potential obstructions to flow of water will not occur within one foot horizontal of roofing valleys.
   3. Verify and coordinate actual roof slopes as required for level top of curbs.
   4. Coordinate installation of roofing membrane pads under all support pedestals.

B. Coordinate between roofing, mechanical, plumbing and other trades as required to ensure that duct and pipe penetrations occur in the middle of roof panels and not at standing seams between panels. Locate ducts and offset pipes below roof deck penetrations as required to avoid roofing seams.

3.02 EXAMINATION

A. Examine areas to receive roof accessories to insure work of preceding trades is completed. Verify substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, uniform, free of grease, oil or other debris which would affect proper installation, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Application constitutes acceptance of substrate conditions.

3.03 INSTALLATION

A. Install roof accessories according to manufacturer's current printed written instructions and recommendations.

1. Coordinate installation of accessories with roof and flashing installations. Provide weathertight installation.
2. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
3. Anchor roof accessories securely in place so they are capable of resisting indicated wind loads in accordance with the local building codes..
4. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
5. Fasteners, General: All fasteners shall be installed straight and to make proper seal at gaskets. No fasteners of any sort are allowed through top side of curb cap flashings. All fasteners in flashing caps shall be through vertical sides only. No fasteners of any sort are allowed through roofing membranes or materials unless specifically approved in writing by roofing installer and manufacturer, and approved by Architect.
6. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface lines are level, see Part 2 article "Fabrication".

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

F. Preformed Flashing-Sleeve[and Flashing Pipe Portal] Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

G. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.04 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 91 13 "Exterior Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Furnish all labor, materials, tools, equipment and related items required for the complete installation of firestopping at penetrations through rated partitions and floors, including the following applications:
   1. Penetrations in fire-resistance-rated walls.

B. Related Requirements:
   1. Division 04 Section - .Masonry
   2. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.
   3. Division 09 Section - Drywall Partitions.
   4. Division 21 - Fire Suppression
   5. Division 22 - Plumbing
   6. Division 23 - Heating, Ventilating, and Air Conditioning
   7. Division 26 - Electrical

1.03 STANDARDS

A. All work under this section shall conform to the requirements of the Underwriters' Laboratories, Inc., the National Board of Fire Underwriters and the local building code. Where requirements specified differ from the requirements of any authorities having jurisdiction, the more stringent requirements shall apply.

B. Underwriters Laboratories (UL) of Northbrook, IL publishes tested systems in their "FIRE RESISTANCE DIRECTORY" that is updated annually.
   1. UL Fire Resistance Directory:
      a. Firestop Devices (XHJI)
      b. Fire Resistance Ratings (BXRH)
      c. Through-Penetration Firestop Systems (XHEZ)
      d. Fill, Voids, or Cavity Material (XHHW)
      e. Forming Materials (XHKU)
   2. Test Requirements: UL 1479, Fire Tests of Through-Penetration Firestops

C. ASTM Standards
   1. Test Requirements: ASTM E 814, "Standard Method of Fire Tests of Through Penetration Fire Stops"
   2. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E 2174, Standard Practice for On-site Inspection of Installed Fire Stops.

4. Firestopping system shall be a complete system of materials supplied by one manufacturer.

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of qualified firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

1.05 INFORMATIONAL SUBMITTALS

A. Manufacturer's Instruction: Furnish manufacturer's printed material specifications and installation instruction for each type of fireproofing.

1.06 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.07 QUALITY ASSURANCE

A. Source Limitations: The Contractor shall engage a single entity to assume full responsibility for installation of all fire penetration firestopping, fire resistive joints, and fire penetration assemblies throughout project, both for items specified herein, and items as specified in other referenced specification Sections. Coordinate with all work of section 07 84 43 Joint Firestopping

B. Installer Qualifications:
   1. Five years experience in performing installation of materials with similar quantities of fireproofing materials.
   2. A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include;
      a. Employs the necessary experience, staff, and training to install manufacturer's products per specified requirements.
      b. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
   3. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in project to a single sole source firestop specialty contractor.

C. Requirements of regulatory agencies:
   1. Building code requirements of the municipality for fire resistance ratings of areas to receive fireproofing materials.

D. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Penetration firestopping is identical to those tested per testing standard referenced.
   3. Testing:
      a. Fire resistant rating of assemblies - ASTM E-814.
      b. Compound shall meet all requirements of UL 1479.

E. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened and undamaged packages clearly labeled, identified with brand, type and UL label where applicable.bearing name of manufacturer and product identification.

B. Reject damaged packages found unsuitable for use and remove from job site.

C. Store materials off ground, under cover, away from damp surfaces, protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

E. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

F. Do not use damaged or expired materials.

G. Keep materials dry at all times.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.10 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.01 PENETRATION FIRESTOPPING SYSTEMS

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. 3M Fire Protection Products.
   2. Hilti, Inc.
   3. Tremco, Inc.

D. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.

F. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. ProVent Systems, Inc.
   2. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
   4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
   5. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
   6. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
   7. Special Coating: Corrosion resistant on interior of fittings.

G. Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of zero (0) as determined by ASTM G21.

H. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
   1. Permanent forming/damming/backing materials.
   2. Substrate primers.
   3. Collars.
   4. Steel sleeves.

2.02 FILL MATERIALS

A. Safing Insulation: Forming material, minimum 3 inches unfaced safing insulation with a nominal density of 4 pcf, and bearing the UL Classification Marking shall be "Thermafiber" as manufactured by Owens Corning.

B. Compound: Pliable, non-toxic, non-combustible, non-asbestos, low density, lightweight compound shall be "Firecode" as manufactured by USG Corp., "Flame Stop V" as manufactured by Flame Stop Inc. or "Metacaulk" as manufactured by Rectorseal.

2.03 MIXING

A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Verify penetrations are properly sized and in suitable condition for application of materials.
   2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
   3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
   4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
   5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

C. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

D. Do not cover up through-penetration fire stop and joint system installations that will become concealed behind other construction until each installation has been examined by the building inspector, per requirements of Section 109, International Building Code 2000, ed.

3.03 PREPARATION

A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.04 INSTALLATION

A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.

B. Safing Insulation: Cut safing insulation slightly wider than the opening. Compress and tightly fit min. 2 1/2 inches or 3 inches thickness of insulation with nominal density of 4 pcf completely around penetrant.

C. Firestopping Compound: Trowel apply the compound from its container and work into the penetration opening. Apply compound to minimum 1/2 inch to 1 inch thickness on top of safing insulation. Ensure that compound is in contact with all surfaces and that entire opening is filled with safing and compound. Utilize appropriately rated product for specific rated partition application.

D. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

E. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.05 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Date of installation.
3. Tested System or Engineered Judgment Number
4. Type of Assembly Penetrated
5. Through-penetration firestop system manufacturer's name.
6. Hourly Rating to be Achieved

3.06 FIELD QUALITY CONTROL

A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.

B. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas

C. Keep areas of work accessible until inspection by applicable code authorities.

D. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops or other recognized standard.

E. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.

F. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.07 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
1. Wall to Wall Joints in or between fire-resistance-rated constructions.
2. Head of Wall Joints - Gaps between the top of walls and ceilings or roof assemblies.
3. Bottom of Wall Joints
4. Wall to Wall Corner Guard Joints

B. Related Requirements:
1. Section 04 20 00 - Unit Masonry
2. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers[and for wall identification].
3. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.
4. Section 09 29 00 - Gypsum Board

1.03 REFERENCES

A. Underwriters Laboratories, Inc. (UL) Fire Resistance Directory, Volume II, updated annually:
1. Joint Systems (XHBN)
2. Perimeter Fire Containment Systems (XHDG)
3. Fire Resistance Ratings (BXRH)
4. Fill, Voids, or Cavity Material (XHHW)
5. Forming Materials (XHKU)

B. ASTM Standards:
1. ASTM E 1966, Standard Test Method for Fire-Resistive Joint Systems
2. ASTM E 1399, Test Method for Cyclic Movement and Measuring the Minimum and Maximum Joint Width of Architectural Joint Systems
3. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials
4. ASTM E 2174, Standard Practice for On-Site Inspection of Installed Fire Stops
5. ASTM E 2307, Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using Intermediate-Scale, Multi-story Test Apparatus
6. ANSI/UL 2079, Tests for Fire Resistance of Building Joint Systems
7. ASTM D6904, Standard Practice for Resistance to Wind-Driven Rain
8. ASTM C679, Standard Test Method for Tack-Free Time of Elastomeric Sealants

C. International Firestop Council Recommended (IFC) Guidelines for Evaluating Firestop Systems Engineering Judgments

D. International Building Code (IBC 2009)

E. NFPA 101 - Life Safety Code

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of tested firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.06 CLOSEOUT SUBMITTALS

A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.07 QUALITY ASSURANCE

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

B. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL or OPL label, where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature restrictions.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.09 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

E. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

F. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

G. Comply with ASTM D 6905 (modified) for resistance to wind driven rain and water.

1.10 COORDINATION

A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.

B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Provide firestopping composed of components that are compatible with each other and substrates forming joints under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each fire-resistive joint system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Fire-Test-Response Characteristics:
   1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
   2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
      a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
         1) UL in its "Fire Resistance Directory."

2.02 MANUFACTURERS

A. To the greatest extent possible provide products and systems from one manufacturer with needed ancillary products as recommended by the same manufacturer.

B. Subject to compliance with joint systems (XHBN) listed in Volume II of the UL Fire Resistance Directory; provide products of the following manufacturer:
   1. 3M Fire Protection Products.
   2. A/D Fire Protection Systems Inc.
   3. Grabber Construction Products.
   4. Hilti, Inc.
   5. Nelson Firestop; a brand of Emerson Industrial Automation.
   6. Passive Fire Protection Partners.
   7. Specified Technologies, Inc.
   8. Tremco, Inc.

2.03 JOINT FIRESTOPPING SYSTEMS

A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
   1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
   2. Firestop Top Track Seal: For metal stud partitions installed on flat concrete slab use one-piece, pre-formed, polyurethane foam based, firestop seal for use with standard head-joint top tracks, and slip-type head joints in fire-rated construction at top of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track.
      a. Basis of Design: Hilti CFS-TTS firestop top track seal or approved equal.
   3. Firestop Top Track Seal for metal deck: For metal stud partitions installed to underside of metal deck, use one-piece, pre-formed, polyurethane foam based, firestop seal for use with standard head-joint top tracks and slip-type head joints in fire-rated construction at top of partition to maintain continuity of the fire-resistance-rated assembly indicated. Provide in width and configuration required to accommodate depth and installation of studs and designed to saddle-over the top track. Refer to manufacturers installation instructions for plug and cover usage to completely seal off voids formed by metal deck flutes.
      a. Basis of Design: Hilti CFS-TTS firestop top track seal or approved equal.

C. Joints at Intersection between Rated Wall Assemblies and Nonrated Horizontal Assemblies: Provide joint firestopping systems with ratings determined by ASTM E 2837.

D. Mold Resistance: Provide joint firestopping system sealant with mold and mildew resistance rating of one (1) or less as determined by ASTM G21.

E. Rain and water resistance: provide perimeter joint sealant tested in accordance with ASTM D 6904 with less than 1 hour tack free time as tested in accordance with ASTM C 679.

F. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

G. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
   2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

C. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

D. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.03 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

C. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

D. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
   1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
   2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
   3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.

3. Tested System or Engineered Judgment Number
4. Type of Construction Joint
5. The Width of the Joint
6. Hourly rating to be achieved
7. Designation of applicable testing agency.
8. Date of installation.
9. Manufacturer's name.
10. Installer's name.

3.05 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.

B. Examine sealed joints to ensure proper installation before concealing or enclosing areas.

C. Keep areas of work accessible until inspection by applicable code authorities and/or independent inspection agency.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

E. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.

F. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.06 CLEANING AND PROTECTION

A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.

B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Provide sealant required to close joints that would allow moisture or air to enter structure between fixed materials, as shown on the drawings and as herein specified, including but not limited to:
   1. Sealing of interior perimeter joints of window framing, door frames, and other openings in walls.
   2. Sealing interior and exterior walls to floor or roof decking/construction for fire resistive or thermal, moisture or acoustical barrier.
   3. Setting of thresholds in sealant.
   4. Sealing of joints between countertops and wall surfaces for a sanitary joint.
   5. Sealing of joints of every nature and description that would allow moisture or air penetration.
   6. Sealing of joints indicated to be caulked or sealed whether specifically mentioned herein or not.
   7. Sealing around all pipe, duct and vent penetrations.
   8. Sealing at paving joints.
   9. Acoustical Sealant and Backer Rod

B. Sealant application:
   1. Interior and exterior masonry joints
   2. Interior drywall partitions, doors and window joints
   3. Counter Top Caulking
   4. Sealing partitions to structure above
   5. Interior wet zone applications
   6. Interior/Exterior Water Tight Traffic-Bearing Horizontal Joints
   7. Exterior paving applications

C. Sealants Include:
   1. Silicone joint sealants.
   2. Nonstaining silicone joint sealants.
   3. Urethane joint sealants.
   4. Latex joint sealants.
   5. Polyurethane Sealants

D. Installation of Joint Sealants

E. Sealant Schedule
   1. BOD Sealant Schedule

F. Related Requirements:
   1. Division 04 Section - Unit Masonry Assemblies.
   2. Division 06 Section - Sheathing
   3. Division 06 Section - Interior Architectural Woodworking and Counter Tops
   4. Division 07 Sections Thermal and Moisture Resistant Barriers
   5. Division 07 Section - Sheet Metal Flashing and Trim.
   6. Division 07 Section - Metal Panels.
   7. Division 07 Section Roofing Systems
   8. Division 07 Section "Exterior Expansion Joints"
   9. Division 08 Sections Door Frame and Window systems
   10. Division 08 Section - Aluminum Entrances and Storefront.
   11. Division 09 Section - Ceramic Tiling.
   12. Division 09 Section - Gypsum Board Assemblies.
   13. Division 09 Section - Painting.
   14. Division 21 Section - Fire Suppression.
   15. Division 22 Section - Plumbing.
   16. Division 23 Section - Mechanical.
   17. Division 26 Section - Electrical.
   18. Section 32 13 73 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

1.03 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's product specifications, color range, handling/installation/curing instructions, and performance tested data sheets for each elastomeric product or joint backing material.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.05 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 degree F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.06 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
   1. Where new sealants will adjoin existing sealants to remain, confirm chemical compatibility of sealant type prior to preparing submittals. In the event of chemical incompatbility, suggest alternate compatible sealant products for those applications.

B. Primers: Non-staining type as recommended by sealant manufacturer for each working surface. Material shall not leave residue or stain on adjacent surfaces. Each joint must be primed prior to sealing.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 JOINT-SEALANT BACKING

A. Foam Backer Rod for Acoustic Construction: ASTM C1330, Closed cell polyethylene,. Acceptable Manufacturers: ITP, Nomeco, or approved equal. (Available through Tom Brown, Inc. 800-446-2298)

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.03 MISCELLANEOUS MATERIALS

A. Primer: Non-staining type as recommended by sealant manufacturer for each working surface. Material shall not leave residue or stain on adjacent surfaces. Each joint must be primed prior to sealing.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Precompressed Self-Expanding Breathable Foam Seal: Shall be "Willseal 600" as manufactured by "Tremco", Beachwood, Ohio or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
      c. Unglazed surfaces of ceramic tile.
      d. Exterior insulation and finish systems.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Porcelain enamel.
      d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
   4. Provide flush joint profile at [locations indicated on Drawings] <Insert locations> according to Figure 8B in ASTM C1193.
   5. Provide recessed joint configuration of recess depth and at [locations indicated on Drawings] <Insert locations> according to Figure 8C in ASTM C1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL

A. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 BASIS-OF-DESIGN JOINT SEALANT SCHEDULE

A. Sealant for Interior and Exterior Masonry Control Joints: 1 part ultra low modulus silicone sealant equivalent to "Spectrum One (1)" by Tremco, or "890 NST" by Pecora. Color to match adjacent surfaces.

B. Caulking for Interior Joints: One part acrylic latex sealant equivalent to "AC-20" by Pecora, "Tremflex 834" by Tremco, "Acrylic Latex" caulk by DAP, or "Sonolac" by Sonneborn.

C. Caulking for Countertop Joints: One-part clear silicone sealant, 860 by Pecora, or equal.

D. Materials for sealing top of wall to bottom of decking:
   1. For use at non-fire-rated (thermal and/or acoustical) construction: [The following products are acceptable for thermal and air seal between top of wall and bottom of deck. At contractor's option, use one of the following products:] [Refer to Division 07, "Spray Foam Insulation" for closed cell foam insulation for this use.] <insert other option.>
      a. Closed cell 2-component spray applied polyurethane foam insulation and air barrier, Icynene ProSeal, or comparable product by another Manufacturer.
      b. Single component, gun applied, closed cell polyurethane insulating foam sealant for gaps up to 3 inches: Great Stuff Pro, Gaps and Cracks Insulating Foam by Dow Chemical Company, or comparable product by another Manufacturer.
      c. Firmly pack gaps and voids above the stud track with Mineral Fiber Batt insulation (Refer to Division 07 or 09 for Thermal or Acoustical Insulation). Caulk gun or trowel apply, and trowel coat to form a continuous seal between top of sheathing and bottom of deck with USG "Acoustical Sealant", or comparable product by Tremco or Pecora. For thermal-only (non-acoustical) applications, apply sealant to exterior or unconditioned side of partition. For acoustical applications, apply sealant to both sides of the partition.
      d. Contractor shall confirm chemical compatibility of sealant used with adjacent air barrier system(s).
      e. Where top of wall sealant is used at perimeter wall construction, apply in manner to achieve a continuous air seal from top of air barrier system to bottom of deck, without gaps or voids. Confirm acceptable detail(s) with air barrier system Manufacturer. Refer to Division 07 Air Barrier Section(s) for air barrier materials.
      f. Where top of wall sealant will be exposed in finished interior space <or, insert other criteria>, apply in a manner to produce an aesthetic finished result, flush with the face of wall. [Cut spray foam flush with face of wall] [and] [neatly trowel acoustical sealant to a semi-smooth finish], and remove excess material.
   2. For use at fire-rated construction: Refer to Division 07, Section Joint Firestopping.

E. Sealant for Gypsum Board joints for Acoustic Construction: USG "Acoustical Sealant" or equal by Tremco or Pecora.

F. Interior Wet Zones: One component, mildew resistant, Silicone, Tremsil 200 by Tremco, or approved equal.

G. Interior/Exterior Water Tight Traffic-Bearing Horizontal Joints: Preformed closed-cell ethylene vinyl acetate (EVA) copolymer foam with a pre-cured, traffic-rated factory-applied sealant. Basis of Design product - Willseal Color Coreseal H by Willseal a Tremco Affilliate Brand, 34 Executive Drive, Hudson NH 03051, 603-273-0707, www.willseal,com, or approved equal.

1.	Tensile Strength:	74 psi +/- 21	ASTM D 3575 T
2.	Tear Resistance:	13.5 lbf/in +/- 20 percent	ASTM D 3575 G
3.	Density	2.3 +/- 20%	ASTM D 3575 W
4.	Elongation at break:	275% +/- 25%	ASTM D 3575 T
5.	Water Absorption:	1% volumn max	DIN 53428
6.	Location:	Connection Bridge expansion joints.	

H. Sealant for Exterior Concrete Paving and Sidewalk Joints: Two part urethane (self leveling) sealant equal acid curing to "MasterSeal SL-2" by Sonneborne / BASF Chemical Co., "Urexpan NR-200" by Pecora, or "THC-900" Tremco. Provide non-sag product at joints in vertical curbs, equal to "MasterSeal NP-2" by Sonneborne / BASF.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes:
   1. Interior standard steel doors and frames.
      a. Factory Primed
      b. Fire Rated
   2. Exterior standard steel doors and frames.
      a. Factory Primed
   3. Borrow Lites
   4. Lite Openings
   5. Frame Anchors
   6. Steel Finishes
      a. Factory Primed

B. Related Requirements:
   1. Division 04 Section - Masonry.
   2. Division 05 Section - Cold-Formed Metal Framing
   3. Division 06 Section - Rough Carpentry.
   4. Division 07 Section - Flashing, Sheet Metal.
   5. Division 08 Section - Wood Doors.
   6. Division 08 Section - Finish Hardware.
   7. Division 08 Section - Glazing.
   8. Division 09 Section - Non-Load Bearing Metal Framing
   9. Division 09 Section - Painting Section

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

B. SDI - Steel Door Institute

C. HMMA - Hollow Metal Manufacturers Association

1.04 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of framing and glazing including manufacturer recommended installation instructions.
   1. Include construction details, material descriptions, core descriptions, STC ratings, hardware reinforcements, profiles, anchors, insulation values, fire-resistance ratings, and finishes.

B. Concurrent Review: Submit submittals under this Section together with all other door and door hardware submittals for concurrent review of door openings.

C. Manufacturer Verification of SDI Certification

D. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. STC ratings where appropriate
   3. Insulation values for exterior Doors and Frames.
   4. Hardware mounting heights.
   5. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   6. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   7. Locations of reinforcement and preparations for hardware.
   8. Details of each different wall opening condition.
   9. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   10. Details of anchorages, joints, field splices, and connections.
   11. Details of accessories.
   12. Details of moldings, removable stops, and glazing.
   13. Details of conduit and preparations for power and control systems.

E. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.06 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.07 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified furnish SDI Certified manufacturer products that comply with ANSI/SDI A250.8 "Recommended Specifications for Standard Steel Doors and Frames", latest edition.

C. Design Criteria: Doors and frames noted to have a specified hourly label shall be Underwriter's Laboratories Inc. labeled construction shall bear the required UL label.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

C. Warranty period: 12 months

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
   1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.10 JOB CONDITIONS

A. Coordination
   1. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.
   2. The Contractor shall provide door and frame manufacturer with an approved hardware schedule, templates and hand for all doors. Contractor shall advise door and frame manufacturer of any changes after information has been forwarded.
   3. Contractor will be completely responsible for coordination of information between hardware, door and frame manufacturer. Contractor shall coordinate throat dimensions and clearance at thresholds and sill conditions with adjacent construction. Any materials not properly coordinated shall be replaced by the Contractor at his own expense.
   4. Contractor shall coordinate frame preparation requirements with the access control installer prior to preparing submittals.
   5. Coordinate reinforcing and preparation for hardware at doors with lites, including lite frames. Requirements of Texas Accessibility Standards for maximum height above floor of the bottom of the vision lite may likely require door hardware to be mounted slightly lower than standard height in order to avoid a conflict between hardware and door lite frames. Pay particular attention to exit device mounting.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cold-rolled steel conforming to ASTM A1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications, and ASTM A 568/A 568M "Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low Alloy, Hot-Rolled and Cold-rolled, General Requirements for."

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process" and ASTM A 924/A 924M, "Standard Specification for General Requirements for Steel Steet, Metallic Coated by the Hot-dipped Process"

C. Door Frame Anchorage Devices: ASTM A 653/A, Commercial Steel (CS), Type B, with minimum G60metallic coating. Provide with minimum of 6 wall anchors and 2 adjustable base anchors, manufacturer's standard design. Provide UL anchors as required. Contractor is responsible to coordinate anchor types required with adjacent construction.
   1. Use metal tee anchors at frames in CMU masonry unless otherwise noted.

D. Exterior and Interior Door Frames: Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8, for physical performance level, and HMMA 867 for door construction, in depth and profiles indicated and to suit application. Furnished with 2 inches faces (4 inches head at masonry) and 5/8 inch stops. Strike jambs provided with 3 factory installed rubber bumpers, and two per door leaf at head of pair door frames. Provide UL rating as required. Frames fabricated of quality 16 gauge annealed steel. Exterior frames to have A60 coating. Interior frames can be standard CRS.
   1. At Air Locks, provide frames the full width of CMU and stud-framed walls, for protection of corners. Anchored to CMU construction.

E. Flush Doors: ANSI/SDI A250.8, 1-3/4 inch Flush type door with no visible edge seams. Polyurethane core . Reinforcements provided for all hardware. Exterior doors, and doors between conditioned and unconditioned spaces, shall have flush closing channel at top rail minimum and R factor of 4 when tested according to ASTM C518. Doors mortised for hardware. Provide fire rating as required.
   1. Faces constructed of quality annealed steel as follows:
      a. Extra Heavy Duty (Level 3), 16 gauge steel at exterior doors.
      b. Heavy Duty (Level 2), 18 gauge steel at interior doors.
   2. Use other core type(s) where required to achieve indicated R-values, STC ratings, and fire ratings, as approved by Architect.
   3. Where doors are indicated in STC rated partitions, the door STC rating shall be equal to or greater than the partition in which the door is located, unless otherwise noted.

F. Door Mullion: Provide complete heavy duty mullion at each pair of hollow metal doors indicated in door types to receive center mullions, except where removable mullions are indicated in the hardware schedule.
   1. Refer to Division 08, Section "Door Hardware" for doors to receive removable mullions. Provide filler blocks at removable mullions except where the frame profile provides support behind the full width of the mullion bracket at head conditions.

G. Accessory Materials: Provide complete fasteners, miscellaneous materials and accessories as required for complete installation including but not necessarily limited to the following:
   1. Grout mix shall provide a 4 inch maximum slump consistency, hand troweled in place. Grout mixed to a thin "pumpable" consistency shall not be used.
   2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
   3. Mineral-Fiber Frame Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.02 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. Mesker Door Inc.
4. Republic Doors and Frames.
5. Steelcraft; an Allegion brand.

2.03 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
   2. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
   3. Temperature-Rise Limit: Where indicated on Drawings, provide doors that have a maximum transmitted temperature end point of not more than 450 degree F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.04 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard-Duty Doors and Frames: Faces constructed of quality annealed steel in compliance with ANSI/SDI A250.8, ANSI/SDI A250.4, Level C. for physical performance level, and HMMA 867 for door construction, in depth and profiles indicated to suit application .
   1. Doors:
      a. Type: Typical Interior HM as indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches
      c. Face: Uncoated steel sheet, faces constructed of quality annealed steel with minimum A60 prime coating as follows:
         1) Heavy Duty (Level 2), 18 gauge steel at interior doors.
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
      f. Standard Core: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
      g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated and temperature-rise-rated doors.
      h. Stiffeners: Provide 22 gauge steel-stiffeners at 6 inches on-center internally welded at 5 inch on- center to integral core assembly, No stiffener face welding is permitted.
         1) Use other type(s) of steel stiffened cores may be used where required to achieve indicated R-values, STC ratings, and fire ratings, as approved by Architect.
      i. Hardware Reinforcements: Shop Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

1) Doors mortised for hardware. Provide fire rating as required. Reinforcements provided for all hardware.

j. Glazing Stops:
   1) Removable stops at interior frames located at interior (room) side of interior frames.

k. Divided Lite Door: 16 Gauge, 1-3/4 inch x 5 inch tubular top and side stiles and 10 inch bottom rail with mitered, face-welded corners. Doors shall be mortised, reinforced, drilled and tapped to receive mortise hardware. Door shall be similar to Ceco "Imperial", or approved equal. Provide insulated metal panel or 1/4 inch tempered glass as shown on drawings.

2. Frames: Furnished with 2 inch faces (4 inch head at masonry) and 5/8 inch stops. Strike jambs provided with three (3) factory installed rubber bumpers, and two per door leaf at head of pair door frames. Provide UL rating as required. Frames fabricated of quality 16 gauge annealed steel. Interior frames can be standard CRS
   a. Materials: Uncoated steel sheet, minimum thickness of 0.042 inch with minimum A60 prime coating..
   b. Construction: Full profile welded.
   c. Door Mullion: Provide complete heavy duty mullion at each pair of hollow metal doors indicated in door types to receive center mullions, except where removable mullions are indicated in the hardware schedule.
      1) Refer to Division 08, Section "Door Hardware" for doors to receive removable mullions. Provide filler blocks at removable mullions except where the frame profile provides support behind the full width of the mullion bracket at head conditions.
   d. Glazing Stops: Removable stops at interior frames located at interior (room) side of interior frames.
3. Accessory Materials: Provide complete fasteners, miscellaneous materials and accessories as required for complete installation including but not necessarily limited to the following:
   a. Hinge Reinforcement: Minimum 7 gauge (3/16 inch) plate 1-1/4 inch x 9 inches.
   b. Hardware Reinforcements: Shop Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
   c. Grout mix shall provide a 4 inch maximum slump consistency, hand troweled in place. Grout mixed to a thin "pumpable" consistency shall not be used.
   d. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.05 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Standard Exterior doors and frames, including doors and frames between conditioned and unconditioned or heated only spaces, shall have minimum R factor of 3.4 including insulated door, thermal-break frame and threshold, and flush closing channel at top rail. Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
   1. Doors:
      a. Type:Typical Exterior HM ,and doors between conditioned and unconditioned or heated only spaces, as indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.

c. Face: Uncoated steel sheet, faces constructed of quality annealed steel with minimum A60 prime coating.as follows:
   1) Extra-Heavy Duty (Level 3), 16 gauge steel at exterior doors.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
   1) Provide 22 gauge steel-stiffeners at 6 inches on-center internally welded at 5 inches on- center to integral core assembly, No stiffener face welding is permitted.
   2) Use other type(s) of steel stiffened cores may be used where required to achieve indicated R-values, STC ratings, and fire ratings, as approved by Architect.
i. Hinge Reinforcement: Minimum 7 gauge (3/16 inch) plate 1-1/4 inch x 9 inches.
j. Hardware Reinforcements: Shop Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

2. Frames:
   a. Materials: Uncoated steel sheet, minimum thickness of 0.059 inch, with minimum A60 prime coating.
   b. Construction: Full profile welded.
3. Accessory Materials: Provide complete fasteners, miscellaneous materials and accessories as required for complete installation including but not necessarily limited to the following:
   a. Hinge Reinforcement: Minimum 7 gauge (3/16 inch) plate 1-1/4 inch x 9 inches.
   b. Hardware Reinforcements: Shop Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
   c. Grout mix shall provide a 4 inches maximum slump consistency, hand troweled in place. Grout mixed to a thin "pumpable" consistency shall not be used.
   d. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.06 BORROWED LITES

A. Fabricate of Uncoated steel sheet, minimum thickness of 0.048 inch (18 gauge).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

E. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

F. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inchhigh unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

G. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick (18 gauge), cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

H. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.07 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.

B. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

C. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

D. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

E. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.08 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
   2. Frames shall have all joints mitered, continuous full welded and ground smooth. No putty or filler permitted at joints. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
      a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated. For removable stops, provide security screws at exterior locations.
4. Door Silencers: Except on weather-stripped frames or gasketed doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
1. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
2. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
3. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
4. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
5. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
6. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
7. Coordinate reinforcing and preparation for hardware at doors with lites including lite frames. Requirements of Texas Accessibility Standards for maximum height above floor of the bottom of the vision lite may likely require door hardware to be mounted slightly lower than standard height in order to avoid conflict between hardware and door lite frames. Pay particular attention to exit device mounting. Typically provide top of door handles or panic bar hardware no higher than 42" AFF.
8. All door frames mortised for 1-1/2 pair 4-1/2 x 4-1/2 standard weight hinges. Frames of 48 inch width shall have two (2) pair butts. (Re: Door Schedule and Hardware Schedule for Number and Location.) Frames mortised and reinforced for hinges, (7 ga. 1-1/4 inch x 10 inch min.), strikes, (12 gauge steel), and surface applied hardware, (12 ga. steel), as required.
    a. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
    b. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
9. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
10. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
11. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.
    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c.

D. Door Mullion: Provide complete heavy duty mullion at each pair of hollow metal doors except where removable mullions are indicated in the hardware schedule.
   1. Refer to Division 08, Section "Door Hardware" for doors to receive removable mullions. Provide filler blocks at removable mullions except where the frame profile provides support behind the full width of the mullion bracket at head conditions.

E. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with [butted] [or] [mitered] hairline joints.
   1. Half door and narrow door lite bottoms shall be 43 inches AFF.
   2. Provide stops and moldings flush with face of door, and with [beveled] [square] stops unless otherwise indicated.
   3. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   4. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
   5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
   6. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

F. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
   2. Doors and Frames for exterior openings shall be galvanized before primer is applied using a hot-dip coating of zinc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Check for coordination with electrical preparation, and other coordination items as identified in Part 1 of these specifications, and in the pre-installation conference.

D. Proceed with installation only after unsatisfactory conditions have been corrected

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
      c. Exercise extreme care when installing door frames. All door frames which are installed out of plumb, distorted and not level or in a manner which does not permit proper installation of doors, must be removed and replaced with new frames in a manner satisfactory to the Architect.
   2. Fire-Rated Openings: Install frames according to NFPA 80.
   3. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   4. All exterior door frames , doors between apparatus bay and living quarters and doors installed in CMU wall openings shall be grouted solid. Close off openings to wall cavities as indicated in Drawings and as required.
      a. Coat interior sides of frames to received grouting with a thin brush or spray coat of bituminous paint, to inhibit rusting and pitting.
   5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
   6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
   7. Clearances:
      a. Non-Fire-Rated Standard Steel Doors:
         1) Allow maximum of 1/16 inch clearance at head and jamb.
         2) Allow maximum of 1/2 inch clearance at floors.
         3) Allow maximum of 1/4 inch clearance at thresholds.
      b. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
   2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3. Smoke-Control Doors: Install doors according to NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.04 ADJUSTING, CLEANING AND PROTECTION

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
   1. Refer to Division 01, Substantial Completion Readiness Check list for additional list of final checks prior to requesting inspection.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint

D. Protect metal doors and frames and their finishes from damage and detrimental soiling during the remainder of construction.
   1. Repair and repaint hollow metal that is damaged or soiled, to eliminate evidence of damage, in a manner acceptable to Architect. Replace components that cannot be repaired.

E. Clean doors and frames prior to inspection for substantial completion. Touch up paint finish as required. Clean with products that will not damage finishes.

END OF SECTION

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Solid-core flush wood doors with plastic-laminate-faces .
      a. Interior Doors
   2. Light Frames
      a. Metal
   3. Fire Rated Wood Doors
   4. Factory finishing flush wood doors.

B. Related Requirements:
   1. Division 04 Section "Unit Masonry Assemblies".
   2. Division 05 Section "Cold-Formed Metal Framing".
   3. Section 06 40 23 "Interior Architectural Woodwork" for wood door frames[including 20-minute fire-rated wood door frames].
   4. Division 08 Section "Metal Doors and Frames".
   5. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.
   6. Division 08 Section "Door Hardware".
   7. Division 09 Section "Non-Structural Metal Framing
   8. Division 09 Section "Gypsum Board".
   9. Section 09 91 00 "Painting"

1.03 ACTION SUBMITTALS

A. Concurrent Review: Submit all door-related submittals together for concurrent review.

B. Product Data: For each type of product, including the following:
   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Door trim for openings.
   5. Door frame construction.
   6. Factory-machining criteria.
   7. Factory-finishing specifications.

C. Product Schedule: Door schedule indicating door location, type, size, fire protection rating, and swing. Coordinate with hollow-metal doors and frames schedule submittal, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

D. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
   1. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
   2. Details of frame for each frame type, including dimensions and profile.
   3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   4. Dimensions and locations of blocking for hardware attachment.
   5. Dimensions and locations of mortises and holes for hardware.
   6. Clearances and undercuts.
   7. Requirements for veneer matching.
   8. Doors to be factory finished and application requirements.

E. Samples for Verification:
   1. Plastic laminate, 6 inches square, for each color, texture, and pattern selected.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

D. Deliver doors to building after wet trades have been completed and building is within normal occupancy humidity conditions. Doors shall be delivered with manufacturer's name and identifying symbol on covering. Doors shall be stored flat with protective coverings provided to protect surfaces. Doors shall not be dragged over one another.

1.07 FIELD CONDITIONS

A. Comply with Manufacturer's environmental limitations.

B. Coordination:
   1. The Contractor shall provide door manufacturer with approved hardware schedules, templates and hand for all doors. Contractor shall advise door manufacturer of any changes after information has been forwarded. Contractor will be completely responsible for coordination between hardware, door and frame manufacturers. Any materials not properly coordinated shall be replaced by the Contractor at his own expense.
   2. Door manufacturer shall be responsible for properly coordinating information received by him so that doors are properly finished, machined and ready to hang.

C. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.08 WARRANTY

A. Special Warranty: : Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of veneer.
      b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
      c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer below..

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. ASSA ABLOY.
   2. Masonite Architectural
   3. Curtis Corp.
   4. Eggers by VT Industries.
   5. Graham; a Masonite company.
   6. Haley Brothers, Inc.
   7. Oshkosh Door Company.
   8. VT Industries Inc.

2.02 DOOR CONSTRUCTION, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A. "Architectural Wood Flush Doors"

B. WDMA I.S.1-A Performance Grade: Heavy Duty As indicated.
   1. Locations
      a. Heavy Duty unless otherwise indicated.
   2. Where the Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

C. Fire-Protection-Rated Doors: Doors noted to have a specific hourly label, fabricated in accordance with Underwriters' Laboratories requirements for label indicated. Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals.[Provide stiles with concealed intumescent seals.] Comply with specified requirements for exposed edges.
   3. Pairs: Provide formed-steel edges and astragals[with intumescent seals].
      a. Finish steel edges and astragals with baked enamel[same color as doors].

4. Mineral-Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
    a. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated [as needed to eliminate through-bolting hardware.] [as follows:]
        1) 5-inch top-rail blocking.
        2) 5-inch bottom-rail blocking, in doors indicated to have protection plates.
        3) 5-inch midrail blocking, in doors indicated to have armor plates.
        4) [4-1/2-by-10-inch lock blocks] [5-inch midrail blocking], in doors indicated to have exit devices.
5. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.03 DOORS FOR PLASTIC LAMINATE FINISH

A. Interior Solid-Core Doors:
1. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
    1) Locations
        a) Heavy Duty: ANSI/WDMA I.S. 1A, unless otherwise indicated on Drawings.
2. ANSI/WDMA I.S. 1A Grade: Custom.
3. Plastic-Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
4. Colors, Patterns, and Finishes: As indicated.
5. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
    c. Fire-Rated Pairs of Doors: Provide formed-steel edges and astragals with intumescent seals.
        1) Finish steel edges and astragals with baked enamel.
        2) Finish steel edges and astragals to match door hardware (locksets or exit devices).
    d. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
        1) Screw-Holding Capability: 475 lbf in accordance with WDMA T.M. 10.
6. Core for Non-Fire-Rated Doors:
    a. ANSI A208.1, [Grade LD-1] [Grade LD-2] particleboard.
    b. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
        1) Screw Withdrawal, Door Face: 475 lbf.
        2) Screw Withdrawal, Vertical Door Edge: 475 lbf.
7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
    a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

8. Construction: Doors shall be 5-ply and comply with AWI / WDMA PC5 construction. Doors shall be manufactured by the hot-press method, bonding faces, crossbands and core together in a single operation with Type I glue.

2.04 LIGHT FRAMES

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated on Drawings.

2.05 FABRICATION

A. Comply with the tolerance requirements of NWMA for prefitting. Machine doors for hardware requiring cutting of doors. Comply with final hardware scheduled and door frame shop drawings, and with hardware templates and other essential information required to ensure proper fit of doors and hardware.

B. Take accurate field measurements of hardware mortises in metal frames to verify dimensions and alignment before proceeding with machining in the factory.

C. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
   2. Comply with NFPA 80 requirements for fire-rated doors.

D. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. At doors with half door lites or a narrow door lite, top of door handle or panic bar shall be no higher than 42 inches AFF.
   3. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   4. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
   5. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
   6. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

E. Transom and Side Panels:
   1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
   2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
   3. Fabricate door and transom panels with full-width, solid-lumber[**, rabbeted,**] meeting rails.
   4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

F. Openings: Factory cut and trim openings through doors in the factory.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Half door lites and narrow lite bottoms shall be no lower than 43 inches AFF.
   3. Provide flush edgings for wood doors receiving panic devices or other hardware where typical molding would conflict with hardware. Coordinate with door hardware.
   4. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."
   5. Louvers: Factory install louvers in prepared openings.

2.06 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Install frames level, plumb, true, and straight.
   1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
   2. Anchor frames to anchors or blocking built in or directly attached to substrates.
      a. Secure with countersunk, concealed fasteners and blind nailing.
      b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
         1) For factory-finished items, use filler matching finish of items being installed.
   3. Install fire-rated doors and frames in accordance with NFPA 80.
   4. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:
   1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
      a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
   2. Machine doors for hardware.
   3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   4. Clearances:
      a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
      b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
      c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
      d. Comply with NFPA 80 for fire-rated doors.
   5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Clearance Tolerances for Factory Fitted Doors: Align in frames for uniform clearance at each edge.
   1. Provide 1/8 inch at heads, jambs, and between pairs of doors.
   2. Allow maximum of 3/16 inch over threshold or saddle.
   3. Allow maximum of 1/2 inch over decorative floor coverings.
   4. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

F. Clearance Tolerances for Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
   1. Allow maximum of 3/16 inch at jamb and head.
   2. Allow maximum of 1/4 inch over threshold or saddle.
   3. Allow maximum of 1/2 inch over decorative floor coverings.
   4. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.

G. Clearance Tolerances for Fire-Rated Doors: Install in accordance with NFPA 80 for fire rated doors, and the following maximum clearances, whichever is more stringent:
   1. 1/8 inch between door and frame.
   2. 3/8 inch between door bottoms and decorative floor finish.
   3. 1/8 inch between doors for pairs of doors.
   4. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

H. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 FIELD QUALITY CONTROL

A. Inspections:
   1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80.

3.04 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

C. Protect doors as recommended by door manufacturer to ensure that doors will not be damaged at time of Substantial Completion.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes access doors and frames for walls and ceilings.
   1. Provide all access doors and frames for walls and ceilings as indicated in Drawings and as required for access to equipment and by authorities having jurisdiction, whether or not locations for access doors and frames are specifically indicated in Drawings.

B. Related Requirements:
   1. Division 04 Section "Unit Masonry Assemblies".
   2. Division 05 Section "Metal Fabrications" for crawl space access ladders [and miscellaneous steel reinforcement at new floor openings].
   3. Division 06 "Rough Carpentry" for coordination of wood blocking.
   4. Section 07 72 00 "Roof Accessories" for roof hatches.
   5. Division 09 Section "Gypsum Board" for gypsum board assemblies.
   6. Division 09 Section "Acoustical Ceilings" for suspended acoustical tile ceilings.
   7. Division 09 Section "Ceramic Tiling".
   8. Division 21 & 22 Sections for Plumbing access requirements.
   9. Division 23 Sections for heating and air-conditioning duct access doors.
   10. Division 26-28 Sections for electrical access requirements

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain access doors and frames of each type through one source from a single manufacturer.

1.05 COORDINATION

A. Verification: Coordinate with other trades to determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, electrical, or other concealed work.

1. Size panels as required by controls to be accessed. Provide adequate sizes to service equipment accessed by doors and panels, and acceptable to authorities having jurisdiction.
2. For replacement of access doors in existing construction, field measure to match existing opening sizes.

1.06 PRODUCT DELIVERY AND STORAGE

A. Deliver products in manufacturers original packages, clearly marked with brand name and model number.

1.07 WARRANTY

A. Manufacturer shall guarantee against defects in material and workmanship for a period of one year minimum.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Acoustical Products, Inc.
   2. Acudor Products, Inc.
   3. Bilco.
   4. Babcock-Davis.
   5. JL Industries, Inc.; a division of the Activar Construction Products Group.
   6. Karp Associates, Inc.
   7. Larsens Manufacturing Company.
   8. Best Access Doors.

2.02 ACCESS DOORS AND FRAMES

A. Ceiling Access Door (where passage is required for service access): Flush Style Metal Access panel with perforated galvanized metal frame flanges for drywall tape and bedding, concealed non corroding two point pin hinge, and cylinder lock & key, equal to Acudor Products, Inc., DW5040
   1. Locations: Wall and ceiling.
   2. Size: 30 inch x 30 inch where intended for passage, and sizes as required for intended service purpose in other locations .

B. Flush Access Doors with Exposed Flanges (At CMU Partitions): Face of door flush with frame, with exposed flange and concealed hinge. concealed non corroding two point pin hinge, and cylinder lock & key, equal to Acudor Products, Inc., ED2002
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Acoustical Products, Inc.
      b. Bilco
      c. Best Access Doors.
   2. Door Size:24 inch x 36 inch where intended for passage, and sizes as required for intended service purpose in other locations .
   3. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage, factory primed.
   4. Frame Material: Same material, thickness, and finish as door.

5. Latch and Lock: Cam latch, screwdriver operated.

2.03 MATERIALS

A. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Stainless Steel Plate, Sheet, and Strip: ASTM A240/A240M or ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

D. Stainless Steel Flat Bars: ASTM A666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

E. Aluminum Extrusions: ASTM B221, Alloy 6063.

F. Aluminum Sheet: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

G. Frame Anchors: Same material as door face.

H. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.04 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
   2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
   1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.

E. Latch and Lock Hardware:
   1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.

F. Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

D. Installation: All access panel locations in Noise Critical Spaces shall be installed only where indicated on drawings. Location of additional proposed access panels shall be submitted by Contractor for approval.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 33 23 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Overhead coiling door assemblies including brackets, guides, tracks, hardware, operators, motors and installation accessories.
   1. Insulated OH Coiling Service doors.
   2. OH Coiling Door Operators
      a. Motorized Operation
   3. OH Coiling Door Finishes
      a. Steel and Galvanized Steel
         1) Baked-Enamel Finish

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.
   2. Section 08 36 13 - Sectional Doors
   3. Section 08 71 00 "Door Hardware"
   4. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed doors.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. Include description of automatic-closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices, detectors or replaceable fusible links, and other accessories.
   6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Manufacturer Certificates: Certify products meet or exceed specified requirements.

C. Sample Warranty: For special warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Distributor / Installer Qualifications: Doors shall be provided and installed by an Overhead Door Ribbon Distributor with at least the 5 previous years of continuous service as a distributor with a proven record of successful in-service performance, or equivalent qualifications if doors are provided by another Manufacturer. Submit statement of qualifications from the Manufacturer."
   1. Company specializing in performing Work of this section and approved by manufacturer, employing installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   2. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Design Criteria for standard exterior doors:
   1. Wind Loading: As indicated on Drawings.
   2. Cycle Life: Design doors of standard construction for normal use of up to 20 cycles per day, with minimum 50,000 cycle rated springs.
   3. Insulated Door Slat Material Requirements:
      a. Flame Spread Index of 0 and a Smoke Developed Index of 10 as tested per ASTM E84.
      b. Minimum Installed System Sound Transmission Class (STC) rating of 21 as tested per ASTM E90.
      c. Minimum R-value of 7.5 (U-factor of 0.125) as calculated using the ASHRAE Handbook of Fundamentals.
      d. Insulation is CFC-free.
   4. Air Leakage: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3, Air leakage <1.00 cfm/ft^2.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weather tight location.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Coordination: Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials. Coordinate power and access control requirements and their rough-in locations with other trades.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
   1. Manufacturer to warrant door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of overhead coiling door from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling-door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
   1. Design Wind Load: As indicated on Drawings.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   3. Operability under Wind Load: Design overhead coiling doors to remain operable under design wind load, acting inward and outward.

2.03 STANDARD OVERHEAD COILING DOOR ASSEMBLY

A. Manufactured Products: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Source Limitations: Obtain all components of overhead coiling door system, including framing and accessories, from single manufacturer.

B. BASIS OF DESIGN PRODUCTS
   1. Insulated Overhead Coiling Doors: Prefinished, galvanized rolling door with polyurethane insulated with thermal break construction, G90 galvanized 20 gauge interlocking flat faced steel slats 5/8 inch deep by 2-5/8 inch high with 24 gauge galvanized and primed back cover joint seals between sections, jamb seals on the ends and top seal against the header. Fit each slat with an endlock at each end to provide positive guide retention and ensure curtain alignment. Door as manufactured by Overhead Door Corp., "625 Series" Commercial Steel Doors, Model No. UFN1 with F265 "Stormtite Insulated Slats" or approved equal.

C. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

D. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to [**ASTM E283**] [**or**] [**DASMA 105**].

E. Insulated Door Assembly U-Factor: 0.45 Btu/degree F x sq. ft..

F. Door Curtain Material: Galvanized steel.

G. Bottom Bar: Heavy duty extruded galvanized steel with weatherseals. Pneumatic sensing edge consisting of removable looped neoprene weather-stripping extending full length door bottom. Fabricated from hot-dip galvanized steel and finished to match door.

H. Curtain Jamb Guides: Manufacturer's standard Galvanized steel with exposed finish matching curtain slats. Vertical guide to provide weathertight closing with bracket. Horizontal tracks reinforced adequately to prevent deflection

I. Hood: Match curtain material and finish .
   1. Shape: Round [**As indicated on Drawings**] <**Insert shape**>.
   2. Mounting: Face of wall.

J. Electric Door Operator:
   1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
   2. Operator Location: Wall.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use[; moving parts of operator enclosed or guarded if exposed and mounted at 8 ft. or lower].
   4. Motor Exposure: Interior.
   5. Motor Electrical Characteristics:
      a. Horsepower: 3/4 hp or as recommended by the manufacturer, whichever is greater.
      b. Voltage: 115 V ac, single phase, 60 Hz .
   6. Emergency Manual Operation: Chain type.
   7. Obstruction-Detection Device: Automatic photoelectric sensor.
      a. Sensor Edge Bulb Color: Black.
   8. Control Station(s): Where indicated on Drawings.

K. Curtain Accessories: Equip door with weatherseals.

L. Wall Mounting Condition: Face-of-wall mounting.

M. Door Finish:
   1. Baked-Enamel:Rust inhibitive, bonderized, baked-on prime coat and and a polyester top coat. Interior color shall be a manufacturers standard color. Color as selected by Architect from manufacturer's full range.
   2. Interior Curtain-Slat Facing: [Match finish of exterior curtain-slat face] [Finish as indicated by manufacturer's designations] [Finish matching Architect's sample] [Finish as selected by Architect from manufacturer's full range] <Insert finish>.

2.04 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.06 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Field measure openings prior to shop drawing submittal and fabrication. Verify opening sizes, tolerances and conditions are acceptable.

B. Examine substrates areas, supports and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

C. Coordinate and schedule work under this section with work of other sections so as not to delay job progress.

D. Examine locations of electrical connections.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION, GENERAL

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Coiling door shall be mounted as indicated on drawings with guides braced in accordance with manufacturer's recommendations for installation. Door, when installed, shall fit flush, tight and level to horizontal construction with side jambs properly plumbed and supported to meet design criteria. Provide all accessory brackets and shims as may be necessary for a complete installation.

D. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

E. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

F. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

G. Coordinate installation of electrical service and access control interface with other trades. Complete wiring from disconnect to unit components.

H. Coordinate installation of sealants and backing materials at frame perimeter as specified in Division 07, Section Joint Sealants• .

I. Install perimeter trim and closures.

J. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

K. Power-Operated Doors: Install automatic garage doors openers according to UL 325.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.

B. Perform the following tests and inspections[with the assistance of a factory-authorized service representative]:
   1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.05 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
   3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.06 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

D. Adjust hardware and operating assemblies for smooth and noiseless operation.

E. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

3.07 CLEANING AND PROTECTION

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Protect installed products until completion of project.

D. Touch-up, repair or replace damaged products before Substantial Completion.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to demonstrate and train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 36 13 - SECTIONAL DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Provide Upward Acting Sectional Door assemblies including brackets, guides, tracks, hardware, operators and installation accessories.
   1. BOD Upward Acting Full View Aluminum Sectional Doors

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.
   2. Division 08 Section "Overhead Coiling Doors"
   3. Division 08 Section "Door Hardware."
   4. Division 08 Section "Glazing."

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of sectional door and accessory.
   1. Submit manufacturer's product literature and color selection chart.
   2. Include construction details, material descriptions, dimensions of individual components, profile door sections, and finishes.
   3. For power-operated doors, include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: Prepare and submit shop drawings based on the Contract Documents to the Architect for review prior to ordering of materials..
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. Include diagrams for power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sectional doors to include in maintenance manuals.

B. Manufacturer's warranty.

C. Finish warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Distributor / Installer Qualifications: Doors shall be provided and installed by an Overhead Door Ribbon Distributor with at least the 5 previous years of continuous service as a distributor with a proven record of successful in-service performance, or equivalent qualifications if doors are provided by another Manufacturer. Submit statement of qualifications from the Manufacturer.• •
   1. Company specializing in performing Work of this section and approved by manufacturer, employing installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   2. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

C. Certifications: From Installer, that the installed doors will meet air infiltration requirements as required by local code, or as herein specified, whichever is more stringent.

D. Doors Design Criteria: Door system designed to withstand external or internal wind loads as indicated on Drawings.
   1. Design and install doors and seals to perimeter construction as required to prevent air leakage to meet or exceed local code requirements and IECC 2015: 0.40 CFM/ft2 or less, per ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf.

1.07 PROJECT CONDITIONS

A. Coordinate shop drawings and installation of overhead doors with other mechanical equipment, plumbing, and lighting in the apparatus bay. Inform architect of any conflicts. Doors and tracks shall be designed and installed to turn horizontal as high as possible. Lighting located above doors should be located to shine through glass panels in the doors. Coordinate with other trades to run wiring inside conduit horizontally at exposed roof deck, and concealed in CMU block vertically to the maximum extent possible.

B. Install door to seal to perimeter construction as required to prevent air leakage in excess of local code requirements.

C. Provide all bracing and supports for tracks as required for complete installation.

1.08 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of sectional doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Failure of components or operators before reaching required number of operation cycles.
      c. Faulty operation of hardware.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use; rust through.
      e. Delamination of exterior or interior facing materials.
   2. Warranty Period: Door manufacturer's 5-Year / 50,000 cycle Warranty on door.from date of Substantial Completion.

B. Finish Warranty: Manufacturer agrees to repair or replace components that show evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Anodized Finish: [3] [5] years.
   2. Kynar Paint Finish: 15 years.

C. Operator: Manufacturer's standard 2 year limited warranty against material and manufacturing defects.

D. Installer's Warranty: Installation shall be warranted by installer for a period of two years against defects in materials and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, GENERAL

A. Source Limitations:
   1. Obtain all doors , and related hardware and other accessories from a single manufacturer.
   2. Obtain all operators, and related hardware and other accessories from a single manufacturer.

B. Sectional Doors: Basis of Design for overhead doors is indicated Subject to compliance with requirements, provide the specified products, or comparable products by one of the following:
   1. Overhead Door Company

C. Operators: Provide Liftmaster operators as specified, or approved equal product.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Provide sectional doors that comply with performance requirements specified without failure from defective manufacture, fabrication, installation, or other defects in construction.

B. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: As indicated on Drawings.
   2. Testing: In accordance with ASTM E330/E330M or DASMA 108 for garage doors and complying with DASMA 108 acceptance criteria.
   3. Deflection Limits: Design sectional doors to withstand design wind loads without evidencing permanent deformation or disengagement of door components.
      a. Deflection of door sections in horizontal position (open) shall not exceed 1/120 of door width.
      b. Deflection of horizontal track assembly shall not exceed 1/240 of door height.

2.03 SECTIONAL-DOOR ASSEMBLY <Insert drawing designation>

A. BOD Full View Aluminum Sectional Doors: Design for overhead doors is based on products as manufactured by Overhead Door Company, Model 521, full view aluminum sectional door. Subject to compliance with requirements, provide the specified products, or approved equal products.
   1. Other acceptable Manufacturers that may provide products that can be used include:
      a. Overhead Door Company

2. Panel Sections: 2-1/8 inches (54 mm) thick extruded 6053-T5 aluminum, with integral reinforcing fin. Enclosed top and bottom rails 3-1/2 inches (89 mm) wide, meeting rails 2-13/16 inch (71.4 mm) wide, and end stiles 3-1/2 inches (89 mm) wide, with meeting rails meeting to form a tongue-and-groove joint and bottom rail configured to retain U-shaped flexible PVC astragal. Glazing and solid panels installed and sealed with butyl tape and locking retainer.
3. Operators for Motorized Doors:
    a. General: Provide electric door operator provided by door manufacturer for door with operational life specified complete with electric motor and factory pre-wired motor controls, starter, gear-reduction unit, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation. Comply with NFPA 70.
        1) Solenoid-operated brake.
    b. Disconnect Device: Provide hand-operated disconnect or mechanism for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
    c. Design operator so motor may be removed without disturbing limit switch adjustment and without affecting emergency auxiliary operator.
    d. Provide control equipment complying with NEMA ICS1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, AC or DC.
    e. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motor, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate door in either direction, from any position, at not less than 2/3 fps (0.2 m/s) and not more than 1 fps (.03m/s), without exceeding nameplate ratings or considering service factor.
        1) Coordinate wiring requirements and electrical characteristics of motors with building electrical system.
    f. Remote Control Station: Provide momentary contact, recess mounted 3-button control station with push - button controls labeled "Open", "Close" and "Stop".
    g. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
        1) Sensor Edge: Provide each motorized door with an automatic safety sensing edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cord. Sensing edge shall be operated by: Electric
    h. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
    i. Provide auxiliary chain hoist: for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

B. Electric Motor
1. Manufacturer: Liftmaster
2. Motor design: 1 HP
    a. Single Phase, 120/230V.
3. Operation: Variable speed direct drive.

4. Operator Speed: Travels an average of 24 inch in the up direction and between 12 inch -18 inch in the down direction, depending on door type and drum size. Includes soft start/stop ramps.
5. Motor: Listed by Underwriters Laboratories. Meet UL 325.
    a. LiftMaster Logic 5.0 motor control, UL-approved microprocessor solid-state type and shall include the capability to select one of 7 wiring types; additional features shall include a maintenance alert diagnostic system, programmable Timer-to-Close with timer defeat input, mid-stop programming capabilities and a maximum run timer to provide motor overrun protection; motor control shall be housed in a NEMA 1 enclosure integral to the operator and shall conform to ANSI/NEMA ICS 6.
    b. Radio Receiver: LiftMaster Logic 5.0 on-board, 3-channel receiver with standard external antenna; equipped to accept Security+ 2.0 Rolling Code Technology remote controls and trinary DIP switch remote controls, with memory up to (30) 3-button remote controls, plus 30 wireless keypads, or an unlimited number of trinary DIP switch remote controls. Tri-band frequency (310/315/390 MHz) sends multiple radio signals to bypass radio interference.
        1) If frequencies available in standard available receivers do not match Fire Department's standard frequency, then provide additional supplementary external receiver as required to comply with controls operation as specified in Performance Requirements. The Fire Department is in process of confirming the standard frequency(ies) they will use, for bid purpose assume a supplementary receiver will be required.
6. Wall controller: Provide separation of low and high voltage wiring and include functionality of 3-button station; set door profile and programming limits, and performs diagnostics.
7. Floor-level programming: Set limits, door profile, operating modes, and select photo entrapment devices via wall controller from standing height.
8. Limit setting: Electronic pushbutton via wall controller.
9. Manual Hoist: Manual hoist with integral manual operation protection circuit.
10. Cable Tension Monitor: Mitigates door operation when cable slackening occurs.
11. Push-button operated control stations: Heavy Duty, recess mount type with open, close, and stop buttons for interior wall mounting over recessed electrical box in wall shall be NEMA Type 1 with maintenance alert indicator to signal intervals for routine door and operator maintenance. Provide number and locations as indicated on drawings.
    a. Where installed in banks of buttons, coordinated with electrician to arrange button controls in a grid pattern, to receive signage indicating the bay (bay 1, 2, etc. arranged horizontally) and the type or location of doors [and coiling grilles] (each bay's controls arranged vertically in columns, from front control on top to rear bay control below).
12. Safety Equipment
    a. NEMA 4X Monitored Photo Sensors: LiftMaster CPS-OPEN4 Monitored Photo Eyes (commercial thru-beam) and CPS-RPEN4 Monitored Retro-reflective Photo Eyes, fully monitored, non-contact, photo beam reversing photo sensor system with NEMA 4X watertight/corrosion-resistant enclosure shall reverse, in conjunction with the operator, a closing door to the full open position when an obstruction is sensed; photo sensors shall be mounted no higher than 6 inches maximum above the floor.
        1) Provide a second set of beam sensors per opening at 3 inch - 0 inch• • or other elevation as directed by the Fire Department, to detect interference of high clearance to ground apparatus such as fire engines and ladder trucks. Confirm desired mounting elevations for each opening with Fire Department representative in field.

b. NEMA 6 Monitored Optical Edge System (OES): Shall provide a means to attach a 2-wire monitored sensing edge to a LiftMaster Logic 5.0 operator for continuous monitoring purposes; the edge, in conjunction with operators, shall reverse a closing door to the full open position when an obstruction is sensed; sensing edge ordered separately and can be field-cut to required length.
   1) Provide battery operated if prefered by the owner.
c. Lighted Gate Arms: GateArms• • (1130 NW 7th St., Homestead, FL 33030, 844-428-3276) 10' long Single Sided LED-Illuminated Door Safety Light Kit with LED Controller Device at the following locations: Interior side of apparatus bay doors on the exit direction side of pull-through bays & Jamb mounted at the exterior side of apparatus bay doors on the return side of pull-through bays. Provide all wiring, programing and aluminum mounting tracks per manufacturers recommendations, coordinate with the owner.

C. Operation Cycles: Door components and operators capable of operating for not less than 50,000 operation cycles. One operation cycle is complete when door is opened from closed position to the open position and returned to closed position.

D. Track: Manufacturer's standard, galvanized-steel, high-lifttrack system. Provide complete system including brackets, bracing, and reinforcement to ensure rigid support of ball-bearing roller guides.

E. Windows: Manufacturer's standard window units of shape and size and in locations indicated on Drawings. Set glazing in vinyl, rubber, or neoprene glazing channel. Provide removable stops of same material as door-section frames. Provide the following glazing:
   1. Clear Float Glass (tempered where required): 6mm thick and complying with ASTM C1036, Type I, Class 1, Quality-Q3.

F. Metal Finish: Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.
   1. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Verify wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

C. Verify electric power is available and of correct characteristics.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sectional doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; in accordance with manufacturer's written instructions.

1. Install overhead doors and track in accordance with approved shop drawings.
2. Coordinate installation with adjacent work to ensure proper clearances and allow for maintenance.
3. Anchor assembly to wall construction and building framing without distortion or stress.

B. Tracks:
1. Securely support and brace door tracks suspended from structure. Secure tracks to structural members only. Door, when installed, shall fit flush, tight and level to floor construction with side jambs properly plumbed and supported to meet design criteria. Provide all accessory brackets and shims as may be necessary for a complete installation.
2. Fasten vertical track assembly to opening jambs and framing with fasteners spaced not more than 24 inches apart.
3. Hang horizontal track assembly from structural overhead framing with angles or channel hangers attached to framing by welding or bolting, or both. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

C. Accessibility: Install sectional doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install automatic garage doors openers in accordance with UL 325.

3.03 STARTUP SERVICES

A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust doors and seals to provide weather-resistant fit around entire perimeter.

D. Touchup Painting Galvanized Material: Immediately after welding galvanized materials, clean welds and abraded galvanized surfaces and repair galvanizing to comply with ASTM A780/A780M.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain sectional doors.

B. Fully test operation of the doors prior to owner demonstration and training. Demonstrate operation to Owner’s satisfaction during Owner demonstration and training. Testing shall include but is not necessarily limited to the following:
1. Test and demonstrate each door for smooth operation.
a. If each door does not operate smoothly, make required adjustments and repeat demonstration for those doors after corrections are made.
2. Test and demonstrate radio control reception to the required distance for each receiver and door.

a. In the event that reception is unsatisfactory, make required adjustments and repeat demonstration for those doors after corrections are made.

3. Test door safety devices for proper function. Make adjustments as required.
4. Test other controls and control interlocks for proper function, as applicable.
5. Test that operating all doors simultaneously does not trip breakers.

C. Conduct training of Owner's personnel in compliance with Division 01, Section "Demonstration and Training".
1. Include time-to-close programming and other programmable functions in Owner training.

END OF SECTION 08 36 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.
   2. Aluminum-framed entrance door systems.
   3. Aluminum Finish
      a. Color Anodic

B. Related Requirements:
   1. Division 05 Section - "Metal Fabrications".
   2. Division 06 Section - "Rough Carpentry".
   3. Division 07 Section - "Thermal Insulation".
   4. Division 07 Section - "Sheet Metal Flashing and Trim".
   5. Division 07 Section - "Joint Sealants".
   6. Division 07 Section - "Firestopping".
   7. Division 08 Section - "Door Hardware".
   8. Division 08 Section - "Glazing" for glass properties
   9. Division 12 Section - "Window Treatments".

1.03 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

B. Coordinate with glass supplier to insure overall fenestration compliance with current energy code requirements.

1.04 PREINSTALLATION MEETINGS

1.05 ACTION SUBMITTALS

A. Concurrent Review: Submit all doors and hardware related submittals together with the scope of this Section, for concurrent review. Coordinate with specifications sections on Hollow Metal Doors and Frames. Flush Wood Doors and Hardware.

B. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: For aluminum-framed entrances and storefronts based on the Contract Documents . Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
   4. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

D. Finish Samples for Verification: Submit three samples of each required aluminum finish on aluminum plates or extrusions.

E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware and all security and access control electronic components, including raceways for electrified strikes, push pads, electrical devices mounted to storefronts, etc. . . Submit for concurrent review with other door and hardware submittals.

F. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle material and components to avoid damage. Protect curtain wall material against damage from elements, construction activities, and other hazards before, during and after curtain wall installation.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.08 WARRANTY

A. Installer shall submit a written guarantee to the Owner, guaranteeing storefront system for a period of 2 years from the date of Substantial Completion against leaks and defects in the system.

B. Special Manufacturer Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements, do not function properly or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components. All hardware installed by manufacturer shall be covered by warranty.
   2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to fade, chalk, crack, check, peel, and failure of coatings to adhere to metal.
   2. Anodic Finish: 10 years from date of delivery.

D. Door manufacturer's warranty shall provide for a period of 10 years from date of Substantial Completion. All hardware installed by manufacturer shall be covered by warranty.

1.09 MAINTENANCE MATERIALS

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance, storefront system, including framing and accessories, from single manufacturer to the greatest extent possible.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure also includes the following:
      a. Deflection exceeding specified limits.

b. Thermal stresses transferring to building structure.
c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
d. Glass breakage.
e. Noise or vibration created by wind and thermal and structural movements.
f. Loosening or weakening of fasteners, attachments, and other components.
g. Sealant Failure.
h. Failure of operating units.

B. Design Requirements:
1. Construction Drawings are diagrammatic and do not purport to identify nor solve problems of thermal or structural movement, glazing, anchorage, or moisture disposal.
2. Requirements shown by details in Drawings are intended to establish basic dimension of units, sight lines and profiles of members.
3. Provide concealed fastening, and all necessary blocking, shims, etc. for anchorage to substrates and framed entrances indicated.
4. Provide entrance and storefront systems, including necessary modifications, to meet specified requirements and maintaining visual design concepts.
5. Attachment considerations are to take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
6. Provide for expansion and contraction due to structural movement without detriment to appearance or performance.
7. Stresses placed on structural silicone sealants shall be kept within sealant manufacturer's recommended maximum.

C. Structural Loads:
1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
3. Cantilever Deflection: Where framing members overhang an anchor point, as follows:
a. Perpendicular to Plane of Wall: No greater than 1/240 of clear span plus 1/4 inch for spans greater than 11 feet 8-1/4 inches or 1/175 times span, for spans of less than 11 feet 8-1/4 inches.

E. Energy Performance: Certified and labeled by manufacturer for energy performance, based on ratings established by NFRC., as follows:
1. Air Leakage:
a. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. for a pair of doors and not more than 0.5 cfm/sq. ft. for a single door, at a static-air-pressure differential of [1.57 lbf/sq. ft.] [6.24 psf] <Insert value>.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2. Interior Ambient-Air Temperature: 75 deg F.

G. Brake Metal: Provide in thicknesses as required to prevent oil canning, including for exterior brake metal oil canning that may be caused by design wind loads. Additionally, thickness may be greater but shall not be less than minimum thicknesses as specified elsewhere in these specifications, or minimum thicknesses as indicated in Drawings. Contractor shall include necessary thicknesses in his bid.

2.03 STOREFRONT SYSTEMS

A. Basis-of-Design Product: 2" x 4-1/2", and 2" x 6" where indicated or required by span, storefront glazing system, thermally broken at exterior and non-thermal at interior applications. Subject to compliance with requirements, provide the named glazing systems as manufactured by Oldcastle Building Envelope, Terrell TX or comparable product by one of the following:
1. EFCO Corporation.
2. CRL - US Aluminum
3. Kawneer North America, an Arconic Company
4. YKK AP America.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

D. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from stainless steel.

E. Aluminum subsills: Provide Manufacturer's subsills where framing sits on slab, and other locations as required by Manufacturer. Manufacturer's subsill does not constitute a substitute for the continuous aluminum sill flashing with end dams as indicated in Drawings.

F. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

G. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

H. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

I. Glazing Systems
1. Glazing: As specified in Division 8 Section "Glazing."
2. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.
3. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.04 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members, with glazing pockets sized for specified insulated glazing. . Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Wide stile; 5-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
    a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.05 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware:
1. Factory install entrance door hardware provided by Manufacturer to the greatest extent possible.
2. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
3. Weather-stripping / gasketing: Manufacturer's standard replacement stripping of molded neoprene gaskets complying with ASTM D-2000. At exterior doors, provide compression weather stripping. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
4. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
5. At double doors specified to receive removable mullions, provide filler blocks as required for complete support above removable mullion top brackets.
6. Refer to Division 08, Section "Door Hardware" for more information.
7. Reinforce doors as required for installing entrance door hardware.

2.06 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

2.07 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
3. Extruded Structural Pipe and Tubes: ASTM B429/B429M.
4. Structural Profiles: ASTM B308/B308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M
2. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
3. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.

C. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

2.08 ACCESSORIES

A. Aluminum Trim: Provide brake metal trim in locations specifically shown in Drawings and other locations as required for complete installation. Thicknesses indicated in Drawings and specifications are minimum thicknesses regardless of minimum thickness to prevent oil canning. Provide greater thickness than indicated minimum thicknesses where required to prevent oil canning. Contractor is responsible to determine required thicknesses per delegated design requirements (refer to Part 1 of these specifications).

B. Aluminum Sills: Where indicated in Drawings, (or where sill dimension is too small for solid surface, quartz), provide interior aluminum window sills with nominal 2 inch vertical return at inside face of wall, hemmed bottom edge, and hemmed and closed ends. Match finish of adjacent window.

C. Anchoring Devices: Provide plates, angles, steel frame bracing, wind bracing, spacers, clips and other devices necessary to support aluminum framing and glass. Design of connections shall be fabricator's responsibility. Submit shop drawing for approval.

D. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 7 Section "Joint Sealants."
   1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

F. Rigid PVC Filler.

2.09 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Profiles with solid back extrusions, or with filler plates, as required to receive membrane flashings at jamb flashings (locations where metal jamb flashing is not otherwise indicated).
   3. Accurately fitted joints with ends coped or mitered.
   4. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
   5. Physical and thermal isolation of glazing from framing members.
   6. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: Black As selected by Architect from full range of industry colors and color densities.

B. Miscellaneous Steel Bracing (Concealed): One (1) shop coat of red oxide primer.

2.11 SOURCE QUALITY CONTROL

A. Source Quality Control: Representative samples of color anodized finish shall meet or exceed following tests: ASTM B224, thickness of coating; and ASTM B117, neutral salt spray.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure non-movement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Set continuous sill members and all perimeter flashing in full sealant bed as specified in Division 7 Section "Joint Sealants" to produce weathertight installation. Install membrane flashing tape at jambs lapped into sill pan flashing or subsill as applicable. (Refer to Division 7 “Bituminous Damp proofing and “Air Barriers Sections).

G. No fastener penetrations are allowed through the one-piece metal sill pans except where such fasteners are unavoidable as required to attach vertical window framing or supports in multiple window or ribbon window configurations. Where fasteners through the sill pan are unavoidable, fasteners shall penetrate through self-healing membrane flashing that is applied a minimum of 2” wide to the top surface of the sill pan at each fastener, or other equal waterproofing method at fastener penetrations if approved by the Architect.

H. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

J. Install joint filler behind sealant as recommended by sealant manufacturer.

K. Install perimeter joint sealants as specified in Division 7 Section "Joint Sealants" to produce weathertight installation.

L. Install glazing as specified in Division 8 Section "Glazing."

M. Install components plumb and true in alignment with established lines and grades.

N. Acoustical Installation: Install interior storefronts with 1/2" thick interior glass types and exterior storefront with laminated IGU glass types, to comply with sound rating performance requirements as specified, and the following:
   1. Pack frame voids with mineral fiber batts.

3.03 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.04 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.05 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.06 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.

2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
    a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
    b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
4. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.
5. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.07 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
    1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

3.08 PROTECTION AND CLEANING

A. Protect aluminum framing and/or doors during construction by masking members with approved cardboard and paper as recommended by manufacturer. Take particular care in protecting openings and doors from damage during construction.

B. Upon completion, remove trimmings and other debris. Replace broken, scratched, chipped or other damaged glazing. Remove excessive sealant, mastic and other marks from adjacent surfaces, and wash with clean water. Cleaning of glazing must be done in strict compliance with manufacturer's recommendations.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.

END OF SECTION 08 41 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. Mechanical and electrified door hardware
   2. Electronic access control system components

B. Section excludes:
   1. Windows
   2. Cabinets (casework), including locks in cabinets
   3. Signage
   4. Toilet accessories
   5. Overhead doors

C. Related Sections:
   1. Division 01 "General Requirements" sections for Allowances, Alternates, Owner Furnished Contractor Installed, Project Management and Coordination.
   2. Division 06 Section "Rough Carpentry"
   3. Division 06 Section "Finish Carpentry"
   4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
   5. Division 08 Sections:
      a. "Metal Doors and Frames"
      b. "Flush Wood Doors"
      c. "Stile and Rail Wood Doors"
      d. "Interior Aluminum Doors and Frames"
      e. "Aluminum-Framed Entrances and Storefronts"
      f. "Stainless Steel Doors and Frames"
      g. "Special Function Doors"
      h. "Entrances"
   6. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
   7. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

A. UL LLC
   1. UL 10B - Fire Test of Door Assemblies
   2. UL 10C - Positive Pressure Test of Fire Door Assemblies
   3. UL 1784 - Air Leakage Tests of Door Assemblies
   4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute
   1. Sequence and Format for the Hardware Schedule
   2. Recommended Locations for Builders Hardware
   3. Keying Systems and Nomenclature
   4. Installation Guide for Doors and Hardware

C. NFPA - National Fire Protection Association

1. NFPA 70 - National Electric Code
2. NFPA 80 - 2016 Edition - Standard for Fire Doors and Other Opening Protectives
3. NFPA 101 - Life Safety Code
4. NFPA 105 - Smoke and Draft Control Door Assemblies
5. NFPA 252 - Fire Tests of Door Assemblies

D. ANSI - American National Standards Institute
1. ANSI A117.1 - 2017 Edition - Accessible and Usable Buildings and Facilities
2. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties
3. ANSI/BHMA A156.28 - Recommended Practices for Keying Systems
4. ANSI/WDMA I.S. 1A - Interior Architectural Wood Flush Doors
5. ANSI/SDI A250.8 - Standard Steel Doors and Frames

1.03 SUBMITTALS

A. General:
1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
2. Prior to forwarding submittal:
   a. Review drawings and Sections from related trades to verify compatibility with specified hardware.
   b. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.

B. Action Submittals:
1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
   a. Wiring Diagrams: For power, signal, and control wiring and including:
      1) Details of interface of electrified door hardware and building safety and security systems.
      2) Schematic diagram of systems that interface with electrified door hardware.
      3) Point-to-point wiring.
      4) Risers.
3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
   a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
4. Door Hardware Schedule:
   a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
   b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.
   c. Indicate complete designations of each item required for each opening, include:

1) Door Index: door number, heading number, and Architect's hardware set number.
2) Quantity, type, style, function, size, and finish of each hardware item.
3) Name and manufacturer of each item.
4) Fastenings and other pertinent information.
5) Location of each hardware set cross-referenced to indications on Drawings.
6) Explanation of all abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for hardware.
8) Door and frame sizes and materials.
9) Degree of door swing and handing.
10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.

5. Key Schedule:
   a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
   b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
   f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.

C. Informational Submittals:
   1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
   2. Provide Product Data:
      a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
      b. Include warranties for specified door hardware.

D. Closeout Submittals:
   1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
      a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
      b. Catalog pages for each product.
      c. Final approved hardware schedule edited to reflect conditions as installed.
      d. Final keying schedule
      e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
      f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.

E. Inspection and Testing:
   1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
      a. Fire door assemblies, in compliance with NFPA 80.

b. Required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

A. Qualifications and Responsibilities:
   1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
   2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
   3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
      a. For door hardware: DHI certified AHC or DHC.
      b. Can provide installation and technical data to Architect and other related subcontractors.
      c. Can inspect and verify components are in working order upon completion of installation.
      d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
   4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:
   1. Fire-Rated Door Openings:
      a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
      b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
   2. Smoke and Draft Control Door Assemblies:
      a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
      b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. at tested pressure differential of 0.3-inch wg of water.
   3. Electrified Door Hardware
      a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
   4. Accessibility Requirements:
      a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.

C. Pre-Installation Meetings

1. Keying Conference
    a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
        1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
        2) Preliminary key system schematic diagram.
        3) Requirements for key control system.
        4) Requirements for access control.
        5) Address for delivery of keys.
2. Pre-installation Conference
    a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Inspect and discuss preparatory work performed by other trades.
    c. Inspect and discuss electrical roughing-in for electrified door hardware.
    d. Review sequence of operation for each type of electrified door hardware.
    e. Review required testing, inspecting, and certifying procedures.
    f. Review questions or concerns related to proper installation and adjustment of door hardware.
3. Electrified Hardware Coordination Conference:
    a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.

C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.

D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.07 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
   1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
   2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
      a. Mechanical Warranty
         1) Locks
            a) Schlage ND Series: 10 years
         2) Exit Devices
            a) Von Duprin: 10 years
         3) Closers
            a) LCN 4000 Series: 30 years
      b. Electrical Warranty
         1) Locks
            a) Schlage: 3 years
         2) Exit Devices
            a) Von Duprin: 3 years

1.08 MAINTENANCE

A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards. After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."
   1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.

B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance with section 01 25 00.

C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.

D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fabrication
   1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
   2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
   3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.

B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
   1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

C. Cable and Connectors:
   1. Where scheduled in the hardware sets, provide each item of electrified hardware and wire harnesses with number and gage of wires enough to accommodate electric function of specified hardware.
   2. Provide Molex connectors that plug directly into connectors from harnesses, electric locking and power transfer devices.
   3. Provide through-door wire harness for each electrified locking device installed in a door and wire harness for each electrified hinge, electrified continuous hinge, electrified pivot, and electric power transfer for connection to power supplies.

2.03 HINGES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Ives 5BB series

B. Requirements:
   1. Provide hinges conforming to ANSI/BHMA A156.1.
   2. Provide five knuckle, ball bearing hinges.
   3. 1-3/4 inch thick doors, up to and including 36 inches wide:
      a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches high
      b. Interior: Standard weight, steel, 4-1/2 inches high
   4. 1-3/4 inch thick doors over 36 inches wide:
      a. Exterior: Heavy weight, bronze/stainless steel, 5 inches high
      b. Interior: Heavy weight, steel, 5 inches high
   5. 2 inches or thicker doors:
      a. Exterior: Heavy weight, bronze or stainless steel, 5 inches high
      b. Interior: Heavy weight, steel, 5 inches high
   6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
   7. Provide three hinges per door leaf for doors 90 inches or less in height, and one additional hinge for each 30 inches of additional door height.
   8. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
      a. Steel Hinges: Steel pins
      b. Non-Ferrous Hinges: Stainless steel pins

c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

9. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Manufacturers:
1. Scheduled Manufacturer:
a. Ives

B. Requirements:
1. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
2. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum.
3. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
4. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
5. On fire-rated doors, provide aluminum geared continuous hinges classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
6. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
7. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:
1. Scheduled Manufacturer and Product:
a. Von Duprin EPT-10

B. Requirements:
1. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware.
2. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:
1. Scheduled Manufacturer:
a. Ives

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless-steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch steel or brass rods at doors up to 90 inches in height. For doors over 90 inches in height increase top rods by 6 inches for each additional 6 inches of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 CYLINDRICAL LOCKS - GRADE 1

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Schlage ND series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
   2. Indicators: Where specified, provide escutcheon with lock status indicator window on top of lockset rose:
      a. Escutcheon height (including rose) 6.05 inches high by 3.68 inches wide.
      b. Indicator window measuring a minimum 3.52-inch by .60 inch with 1.92 square-inches of front facing viewing area and 180-degree visibility with a total of .236 square-inches of total viewable area.
      c. Provide snap-in serviceable window to prevent tampering. Lock must function if indicator is compromised.
      d. Provide messages color-coded with full text and symbol, as scheduled, for easy visibility.
      e. Unlocked and Unoccupied message will display on white background, and Locked and Occupied message will display on red background.
   3. Cylinders: Refer to "KEYING" article, herein.
   4. Provide locks with standard 2-3/4 inches backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
   5. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
   6. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
   7. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
   8. Provide electrified options as scheduled in the hardware sets.
   9. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
      a. Vandlgard: Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
      b. Lever Design: Sparta (SPA)

2.08 EXIT DEVICES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Von Duprin 99/33A series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1 and UL listed for Panic Exit or Fire Exit Hardware.
   2. Cylinders: Refer to "KEYING" article, herein.

3. Provide grooved touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
4. Touchpad must extend a minimum of one half of door width. No plastic inserts are allowed in touchpads.
5. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
6. Provide exit devices with weather resistant components that can withstand harsh conditions of various climates and corrosive cleaners used in outdoor pool environments.
7. Provide flush end caps for exit devices.
8. Provide exit devices with manufacturer's approved strikes.
9. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
10. Mount mechanism case flush on face of doors or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
11. Provide cylinder or hex-key dogging as specified at non fire-rated openings.
12. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
13. Provide electrified options as scheduled.
14. Top latch mounting: double- or single-tab mount for steel doors, face mount for aluminum doors eliminating requirement of tabs, and double tab mount for wood doors.
15. Provide exit devices with optional trim designs to match other lever and pull designs used on the project.

2.09 POWER SUPPLIES

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. Schlage/Von Duprin PS900 Series

B. Requirements:
   1. Provide power supplies approved by manufacturer of supplied electrified hardware.
   2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
   3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
   4. Provide power supplies with the following features:
      a. 12/24 VDC Output, field selectable.
      b. Class 2 Rated power limited output.
      c. Universal 120-240 VAC input.
      d. Low voltage DC, regulated and filtered.
      e. Polarized connector for distribution boards.
      f. Fused primary input.
      g. AC input and DC output monitoring circuit w/LED indicators.
      h. Cover mounted AC Input indication.
      i. Tested and certified to meet UL294.
      j. NEMA 1 enclosure.
      k. Hinged cover w/lock down screws.
      l. High voltage protective cover.

2.10 CYLINDERS

A. Manufacturers and Products:
   1. Scheduled Manufacturer:
      a. Schlage
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide cylinders/cores compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset; manufacturer's series as indicated. Refer to "KEYING" article, herein.
   2. Provide cylinders in the below-listed configuration(s), distributed throughout the Project as indicated.
      a. Open: cylinder with full sized interchangeable core (FSIC) core with open keyway

2.11 KEYING

A. Scheduled System:
   1. Existing factory registered system:
      a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:
   1. Construction Keying:
      a. Temporary Construction Cylinder Keying.
         1) Provide construction cores that permit voiding construction keys without cylinder removal, furnished in accordance with the following requirements.
            a) Split Key or Lost Ball Construction Keying System.
            b) 3 construction control keys, and extractor tools or keys as required to void construction keying.
            c) 12 construction change (day) keys.
         2) Owner or Owner's Representative will void operation of temporary construction keys.
   2. Permanent Keying:
      a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
         1) Master Keying system as directed by the Owner.
      b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
      c. Provide keys with the following features:
         1) Material: Nickel silver; minimum thickness of .107-inch
      d. Identification:
         1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
         2) Identification stamping provisions must be approved by the Architect and Owner.
         3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE".
         4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.

5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

e. Quantity: Furnish in the following quantities.
   1) Permanent Control Keys: 3.
   2) Master Keys: 6.
   3) Change (Day) Keys: 3 per cylinder/core that is keyed differently
   4) Key Blanks: Quantity as determined in the keying meeting.

2.12 KEY CONTROL SYSTEM

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Telkee

B. Requirements:
   1. Provide key control system, including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer, with capacity for 150% of number of locks required for Project.
      a. Provide complete cross index system set up by hardware supplier, and place keys on markers and hooks in cabinet as determined by final key schedule.
      b. Provide hinged-panel type cabinet for wall mounting.

2.13 DOOR CLOSERS

A. Manufacturers and Products:
   1. Scheduled Manufacturer and Product:
      a. LCN 4010/4110 series
   2. Acceptable Manufacturers and Products:
      a. No Substitute

B. Requirements:
   1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Certify surface mounted mechanical closers to meet fifteen million (15,000,000) full load cycles. ISO 9000 certify closers. Stamp units with date of manufacture code.
   2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
   3. Cylinder Body: 1-1/2-inch diameter with 11/16-inch diameter double heat-treated pinion journal.
   4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
   5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
   6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.
   7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers. When closers are parallel arm mounted, provide closers which mount within 6-inch top rail without use of mounting plate so that closer is not visible through vision panel from pull side.
   8. Pressure Relief Valve (PRV) Technology: Not permitted.
   9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).

10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.14 DOOR TRIM

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives

B. Requirements:
   1. Provide push plates, push bars, pull plates, pulls, and hands-free reversible door pulls with diameter and length as scheduled.

2.15 PROTECTION PLATES

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives

B. Requirements:
   1. Provide protection plates with a minimum of 0.050 inch thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
   2. Sizes plates 2 inches less width of door on single doors, pairs of doors with a mullion, and doors with edge guards. Size plates 1 inch less width of door on pairs without a mullion or edge guards.
   3. At fire rated doors, provide protection plates over 16 inches high with UL label.

2.16 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturers:
      a. Glynn-Johnson

B. Requirements:
   1. Provide overhead stop at any door where conditions do not allow for a wall stop or floor stop presents tripping hazard.

2.17 DOOR STOPS AND HOLDERS

A. Manufacturers:
   1. Scheduled Manufacturer:
      a. Ives

B. Provide door stops at each door leaf:
   1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
   2. Where a wall stop cannot be used, provide universal floor stops.
   3. Where wall or floor stop cannot be used, provide overhead stop.
   4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.18 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:
   1. Scheduled Manufacturer:

a. Zero International

B. Requirements:
1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
4. Size thresholds 1/2 inch high by 5 inches wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.19 SILENCERS

A. Manufacturers:
1. Scheduled Manufacturer:
a. Ives

B. Requirements:
1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.20 DOOR POSITION SWITCHES

A. Manufacturers:
1. Scheduled Manufacturer:
a. Schlage

B. Requirements:
1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches between switch and magnetic locking device.

2.21 FINISHES

A. FINISH: BHMA 626/652 (US26D); EXCEPT:
1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Latch Protectors: BHMA 630 (US32D)
9. Weatherstripping: Clear Anodized Aluminum
10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
   4. Installation Guide for Doors and Hardware: DHI TDH-007-20

B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.

F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.

I. Lock Cylinders:
   1. Install construction cores to secure building and areas during construction period.
   2. Replace construction cores with permanent cores as indicated in keying section.
   3. Furnish permanent cores to Owner for installation.

J. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
   1. Conduit, junction boxes and wire pulls.
   2. Connections to and from power supplies to electrified hardware.
   3. Connections to fire/smoke alarm system and smoke evacuation system.

4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Connections to panel interface modules, controllers, and gateways.
6. Testing and labeling wires with Architect's opening number.

K. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

L. Continuous Hinges: Re-locate the door and frame fire rating labels where they will remain visible so that the hinge does not cover the label once installed.

M. Door Closers & Auto Operators: Mount closers/operators on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers/operators so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.

N. Overhead Stops/Holders: Mount overhead stops/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

O. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

P. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

Q. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

R. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

S. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

T. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.03 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.04 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items per manufacturer's instructions to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.05 DOOR HARDWARE SCHEDULE

A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.

B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.

C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.

D. Hardware Sets:

Hardware Group No. 001

PROVIDE EACH RU DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MORTISE CYLINDER	20-061 ICX W/KEYED CONST. CORE (AS REQ)	626	SCH
1	EA	FSIC PERMANENT CORE	23-030 (AS REQ)	626	SCH
		NOTE	BALANCE OF HARDWARE BY DOOR MFR		

-COORDINATE HARDWARE REQUIREMENTS WITH DOOR MANUFACTURER PRIOR TO SUBMITTALS.
-REMOVE CYLINDER AND CORE IF NOT REQUIRED.

Hardware Group No. 103

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE/OFFICE LOCK	ND50TD SPA	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 205

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	SET	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER

Hardware Group No. 210

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB51P/FB61P AS REQ	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80TD SPA	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	SET	MEETING STILE	8193AA (2 PCS - 1 SET) (OMIT @ NON-RATED DOORS)	AA	ZER

Hardware Group No. 341

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK W/ OUTSIDE INDICATOR	ND40S SPA OS-OCC	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 401G

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S SPA	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	SET	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	544A	A	ZER

Hardware Group No. 503

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70TD SPA	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER

Hardware Group No. 510

PROVIDE EACH PR DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CONST LATCHING BOLT	FB51P/FB61P AS REQ	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	ND70TD SPA	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	SET	MEETING STILE	8193AA (2 PCS - 1 SET) (OMIT @ NON-RATED DOORS)	AA	ZER

Hardware Group No. 731

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PANIC HARDWARE	99-L-BE-17 LENGTH AS REQ	626	VON
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 903

PROVIDE EACH SL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	BARN DOOR SYSTEM	SD10 X 6.6/8.0 AS REQ X J STRAP	630	SCH
1	EA	LONG DOOR PULL	(1 SET) PR 9266F 36" (MOUNT BACK TO BACK)	630	IVE

HARDWARE SET IS A GUIDELINE

-VERIFY AND COORDINATE ALL HARDWARE WITH DOOR/FRAME MANUFACTURER PRIOR TO SUBMITTALS.

-CONFIRM TRACK CAN SUPPORT DOOR WEIGHT AND SIZE.

-PROVIDE STOP IN TRACK TO KEEP DOOR 4" INTO OPENING WHEN IN FULLY OPEN POSITION.

-ENSURE 32" OF CLEAR WIDTH IS MAINTAINED IN OPENING.

Hardware Group No. C201

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1 4.5 X 4.5 CON TW8	652	IVE
1	EA	EU STOREROOM LOCK	ND80TDEU SPA RX CON 12V/24V DC	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
1	EA	GASKETING	488S PSA H & J (USE SILENCERS @ NON-RATED DOORS)	BK	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	CREDENTIAL READER BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	679-05 TYPE AS REQ	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)	LGR	SCE

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.

-FREE EGRESS BY LEVER.

-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.

Hardware Group No. C207GW

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 CON TW8	652	IVE
1	EA	EU STOREROOM LOCK	ND80TDEU SPA RX CON 12V/24V DC	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	OH STOP	900S SERIES X SIZE & MTG AS REQ	630	GLY
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	SET	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	544A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	CREDENTIAL READER BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	679-05 TYPE AS REQ	BLK	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)	LGR	SCE

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY LEVER.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.

Hardware Group No. C711

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-L-NL-17-CON LENGTH AS REQ	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4011/4111 X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	CREDENTIAL READER BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	679-05 TYPE AS REQ	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)		VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.

Hardware Group No. C715

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-CON LENGTH AS REQ	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	SET	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	CREDENTIAL READER BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	679-05 TYPE AS REQ	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)		VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.

Hardware Group No. C715A

PROVIDE EACH SGL DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	E. HINGE	112XY EPT	628	IVE
1	EA	POWER TRANSFER	EPT10 CON	689	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-33A-NL-OP-CON LENGTH AS REQ	626	VON
1	EA	RIM CYLINDER	20-057 ICX W/KEYED CONST. CORE	626	SCH
1	EA	FSIC PERMANENT CORE	23-030	626	SCH
1	EA	90 DEG OFFSET PULL	8190-O 10"	630	IVE
1	EA	SURFACE CLOSER	4111 SCUSH X MTG BRKT, SPCR & PLATE AS REQ	689	LCN
1	EA	RAIN DRIP	142AA DW + 4" (OMIT @ COVERED OPENINGS)	AA	ZER
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR		
1	EA	DOOR SWEEP	8198AA	AA	ZER
1	EA	THRESHOLD	65A	A	ZER
1	EA	WIRE HARNESS (IN DOOR)	ALLEGION CONNECT TYPE & LENGTH AS REQ		SCH
1	EA	WIRE HARNESS (TO POWER SUPPLY)	CON-6W - CONNECTION LEADS		SCH
1	EA	CREDENTIAL READER	CREDENTIAL READER BY SECURITY CONTRACTOR		
1	EA	DOOR CONTACT	679-05 TYPE AS REQ	BLK	SCE

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	POWER SUPPLY	PS902 900-2RS 900-BBK 120/240 VAC (OMIT 2RS BOARD WHERE NOT REQ)		VON

-INGRESS BY THE CREDENTIAL READER OR KEY OVERRIDE.
-FREE EGRESS BY THE PUSH PAD.
-COORDINATE POWER SUPPLY WITH SECURITY CONTRACTOR PRIOR TO SUBMITTALS.

END OF SECTION

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Provide all glass and glazing products as shown on the drawings, specified herein and as required for proper installation.

B. Section Includes but is not limited to:
   1. Monolithic Glass products
      a. Clear Annealed Float Glass
      b. Tinted Annealed Float Glass
      c. Fully Tempered Safety Glass
      d. Mirror Glass
      e. UV-Stabilized Polycarbonate
   2. Insulating glass.
      a. Low-E/Tinted Insulating Glass
   3. Glazing Sealant
   4. Glazing tapes.
   5. Glazing Gaskets
   6. Miscellaneous glazing materials.

C. Related Requirements:
   1. Division 05 - Section "Metal Fabrications"
   2. Division 08 - All Door and Window Sections
   3. Division 08 - Section "Aluminum Entrances and Storefronts"

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. FGMA - Flat Glass Marketing Association

E. Interspace: Space between lites of any insulating glass unit that contains dehydrated air or a specified gas.

F. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturers written instructions. Defects include peeling, cracking and other indications of deterioration in metallic coating.

G. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturers written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.04 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

B. Coordinate with storefront wall, curtain wall and/or window unit systems to insure overall fenestration compliance with current energy code requirements.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For sealants, indicating VOC content.

B. Shop Drawings:
   1. Review curtain wall and window shop drawings and submit acceptance of details as suitable for proposed glass products.

C. Glass Samples: Submit 12-inch square samples of each type of glass indicated except for clear monolithic glass products, and 12-inch long samples of each color required (except black) for each type of sealant or gasket exposed to view.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: Certificate of Compliance for all glass product other than clear monolithic vision glass 12 inches square all glass products.
   1. Insulating Glass Certification: Submit data verifying compliance with IGCC, Class A level.

C. Wind Pressure and Thermal Stress Analysis: Submit thermal stress analysis of glass where thermal stress may occur.

D. Sample Warranties: For special warranties.

1.07 QUALITY ASSURANCE

A. Coordination: Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

B. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the inspecting and testing agency, Insulating Glass Certification Council.

C. Energy Code Compliance: Coordinate all exterior glazing with applicable framing systems to assure compliance with current applicable energy codes before product submittals. If revisions to specified products are required coordinate revised products with the architect and owner.

D. Installation Criteria: FGMA "Glazing Manual", in addition to any other referenced standards.

E. Single Source fabrication responsibility: Fabrication processes, including Low E and reflective coatings, insulating, laminating, silkscreen, and tempering, shall be fabricated by a single Fabricator.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 degree F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

C. Plate Mirrors: Provide a written 5-year warranty against de-silvering and other visual defects, from the date of Substantial Completion.

D. Glazing installer shall coordinate glass and glazing installation with framing systems, and install glass and glazing in accordance with manufacturer's instructions, so that the Warranty is maintained.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

C. Basis of Design Products: Basis of Design products are indicated in the Glass Schedule later in this section. Provide Basis of Design products, or equal products as approved by Architect.

D. Manufacturers: Subject to compliance with Requirements, Manufacturers offering products acceptable for use on this project include the following:
   1. AGC Glass North America.
   2. Guardian Glass.
   3. Viracon Inc.
   4. Vitro Architectural Glass (Formerly PPG Ideascapes).

2.02 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Provide glass lites in the thickness and strengths (annealed or heat-treated) to meet or exceed the following criteria based on analysis of Project loads and in-service conditions. Glass thicknesses indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for various size openings in nominal thicknesses indicated, but not less than thicknesses complying with ASTM E1300 and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
   1. Design Wind Pressures: As indicated on Drawings.
      a. Wind Design Data: As indicated on Drawings.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II, or Category IV Risk Factor as indicated in glass schedule.
   1. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

D. Insulating glass products are to be permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:
   1. Insulating Glass Certification Council (IGCC).

E. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 degree F, ambient; 180 degree F, material surfaces.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x degree F.
   5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
   6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. GANA (Glass Association of North America) Publications
      a. GANA Glazing Manual
      b. Laminated Glazing Reference Manual
      c. Tempering Division - Engineering Standards Manual
   2. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   3. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
   4. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
   5. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
   6. Consumer Product Safety Standard 16 CFR 1201, Category II
   7. LSGA (Laminators Safety Glass Association Inc.) Publications.
   8. Federal Spec. MIL-P-46144, Polycarbonate Sheet

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 1/4 inch 6 mm.
   2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Glass Mirrors: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
   1. Clear Glass: Mirror Select Quality.

2.05 INSULATING GLASS

A. Insulating-Glass Units (IGU): Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190. and complying with other requirements specified.
   1. ASTM E773 Seal Durability of Sealed Insulating Glass Units
   2. ASTM E774 Sealed Insulating Glass Units
   3. Sealed insulating glass units to be double sealed with a primary seal of black (or gray) polyisobutylene and a secondary seal of black (or gray) silicone.
   4. Lites shall be separated by an [aluminum] [stainless steel] [high-performance non-metallic] spacer with 3 bent corners and 1 keyed- soldered corner, or 4 bent corners and a straight butyl injected zinc plated steel straight key joint, to provide a hermetically sealed and dehydrated air space.
      a. [Aluminum Spacer Finish]: [Manufacturer's standard] [Mill Finish] [Clear Anodic Finish] [Color Anodic Finish: <Black> <Bronze>] [Powder Coated Aluminum, [black color] [in color as selected by Architect]].
   5. Units shall be certified for compliance with seal classification "CBA" by the Insulating Glass Certification Council (IGCC) and tested in accordance with the above ASTM Test Methods.
   6. Tinted glass units heat strengthened as recommended by manufacturer to protect against breakage due to thermal stress.

2.06 GLAZING SEALANTS

A. General:
   1. Cleaners, Primers, and Sealers Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
1. Compatibility Testing: Prior to application of sealants, test gaskets, spacers, setting blocks, and other glazing accessories being provided for project to determine compatibility with structural silicone sealants.
a. Submit representative samples of accessories to manufacturer for factory testing.
b. Perform testing in accordance with ASTM C1087.
c. Incompatible accessories shall be replaced with ones recommended by and tested by manufacturer as acceptable.

C. Adhesion Testing: Prior to application of sealants, test each application condition to ensure sealant satisfactorily adheres to substrate.
1. Conduct test in field or by submission of representative substrate sample to manufacturer for factory test.
2. Apply sealant to sample substrate and perform hand-pull tab test in accordance with ASTM C 1193, Method A.
3. Determine if primer is required. If so, re-test using primer.

D. Basis of Design Products:
1. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT , G, A, and O; SWRI validation.
a. Basis of Design Product: Dow Corning Corporation, 795 Silicone Building Sealant.
b. Application: Typical glazing application, unless otherwise indicated.

2.07 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
1. Elastomeric material with Shore A durometer hardness of 85, plus or minus 5.
2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks: Elastomeric material with Shore A durometer hardness as needed to limit glass lateral movement (side walking) per manufacturer's written instructions.
1. Type recommended in writing by sealant or glass manufacturer.

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.08 Miscellaneous mirror mounting materials

A. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
   1. Adhesive shall have a VOC content of not more than 70 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Mounting Accessories: Brushed stainless steel (Type 302) mirror clips similar to KV277 at bottom and KV278 at top in number as required to accommodate size of mirror.

2.09 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 degree F ambient; 180 degree F material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Carefully inspect and verify all job site conditions and measurements. Field verify all existing conditions and dimensions which receive glazing.

B. Examine framing, glazing channels, stops, and all conditions under which work is to be performed with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Verify prepared openings for glazing are correctly sized and within tolerance.
   3. Presence and functioning of weep systems.
   4. Minimum required face and edge clearances.
   5. Effective sealing between joints of glass-framing members.
   6. Identify conditions detrimental to proper or timely completion.
   7. Verify glazing channels are free of burrs, irregularities, and debris.
   8. Verify glass is free of edge damage or face imperfections.
   9. Inspect door and frames to determine that frames, sash, and stops are set true and straight. Sash rabbets and stops shall be clean and dry at time of glazing.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide glass manufacturer's recommended edge clearances when sizing glass.

B. Remove protective coatings from surfaces to be glazed.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrates indicated under the project conditions.
   1. Clean glazing channels and other framing members receiving glass immediately before glazing.
   2. Remove coatings not firmly bonded to substrates.
   3. Clean glass and glazing surfaces to remove dust, oil, and contaminants, and wipe dry.

D. Verify measurements of sash and openings at Project.
   1. Dimensions shown or indicated are given only as a guide for estimating purposes, and actual size shall be determined by measurement of the actual openings. Accurately cut glass to fit openings with proper clearances and setting block height.

E. Coordinate with and check Shop Drawings furnished by other suppliers of Work affecting this Section to avoid field installation problems.

F. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

G. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

H. Before glazing metal sash, remove oil, lacquer, or other material to which the compound will not readily adhere or which will tend to delaminate from metal and cause a leak through the glazing seal.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by **.**

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
   1. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
   2. Set glass with reams (waves) running horizontally. Set glass with factory attached labels in place.

I. Install plumb, level, square, true to line, and without warp or rack Provide all fasteners required for installation.

J. Except where curtain wall, window, entrance or glass manufacturer recommends otherwise, comply with Flat Glass Marketing Association (FGMA) Sealant Manual and FGMA Glazing Manual.

K. Material installed in a full bed of sealant, tooling finished surfaces smooth.

L. Glazing to fit line in rabbet with all edges straight and true. Size substantially as shown on the drawings, however Contractor shall fill sash and openings as actually constructed whether more or less than sizes given.

M. Do not apply glazing materials at temperatures below manufacturer's recommendations or to damp or frosted surfaces. Apply glazing material according to the manufacturer's instructions using proper primers as required.

N. Setting Blocks: Set glass using neoprene setting blocks and spacers to insure proper edge clearance and uniform beads of compound. Clearances shall conform to FGMA Glazing Manual requirements. Center glass in glazing rabbets.
   1. Place setting blocks at locations recommended by glass manufacturer, generally between 1/4 points and 6 inches from corner, except at glazed doors.
   2. At glazed doors, provide one block at sill, located 3 inches up from edge of glass at hinge side; one block at hinge side jamb, located 3 inches up from lower edge of glass; one block at head, located 3 inches from edge of glass at latch side of door; and, one block at jamb at lock side of door, located 3 inches down from edge of glass at top corner.
   3. Use blocks of length required to properly support glass. Offset approximately 1 inch from shims.
   4. Butt glazing requirements: Apply mildew resistant silicone sealant to flush depth of joint as indicated by sealant manufacturer.

O. Glass Installation in Steel (Hollow Metal) Frames:
   1. Glaze frames using pre-shimmed tape on both sides. Firmly glaze in place with joints sealed, free of rattles.
   2. Set glass on setting blocks with a full bed of sealant or glazing tape.

P. Glass Installation in Aluminum Frames:
   1. Glaze aluminum frames using preformed EPDM elastomeric glazing extrusion separately or in combination with sealant and pre-shimmed glazing tape in compliance with aluminum frame supplier's recommendations.
   2. Set glass on setting blocks as recommended by manufacturer.
   3. Apply tape and/or sealant to produce uniform sight line even with frame.
   4. Set glass in gaskets with corners sealed.

Q. Glazing Sealant: Along entire bottom edge of light, and up at least 6 inches at each jamb, gun in continuous full bed of sealant to fill voids.
   1. Fill entire space, full width of pane, full depth of glass, with sufficient sealant to form heel along inside face and edge of glass.
   2. At other edges (top and sides) gun in continuous heel bead of sealant along edges of glass perimeter to set stop against and into, acting as fill between glass and stop.
   3. Immediately after setting glass, at entire perimeter of glass, gun in sealant between stop and glass so space above spacer is completely filled, without voids.
   4. Place sealant flush with daylight edge of stops, with slight watershed at exterior. Provide straight, smooth surface meeting at opening corners with sharp intersection.
   5. Leave no sealant on exposed surfaces of stops and glass.

R. Wedge-Shaped Gaskets (Where wedge-shaped gaskets are indicated):
   1. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

D. Mirrors installed using mirror glazing angles, concealed clips and mirror setting mastic. Mastic applied on substrate in spot application, spacing and sizes as recommended by mirror manufacturer for use intended.
   1. General Contractor shall coordinate with electrician to provide mirrored plates for outlets and switches installed in areas of mirror wall at [fitness room] <insert locations>.

3.07 FIELD QUALITY CONTROL

A. Water / Hose Testing: Refer to Division 01 requirements.
   1. In event of failed testing, additional testing will be performed, at Contractor's expense, to determine compliance of corrected Work with specified requirements.

B. Correct deficiencies in or remove and replace components that inspections and test reports indicate do not comply with specified requirements.

3.08 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.
   1. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

B. Protect glass from damage or contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
   2. Contractor shall assume all responsibility for breakage and shall replace cracked, broken, scratched or otherwise defective glazing.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Remove all non-permanent labels, excess sealant, paint and other foreign substances. Wash glass as recommended in writing by glass manufacturer.

3.09 MONOLITHIC GLASS SCHEDULE

A. Clear Glass [Type MG#1a]: Annealed float glass per ASTM C 1036, Type I (transparent glass, flat), Class 1 (clear), Quality-Q3 (glazing select).
   1. Minimum Thickness: 1/4 inch 6 mm.
   2. Application: (at interior storefront system).

B. Clear Glass [Type MG#1c]: Fully tempered float glass per ASTM C 1036, Type I (transparent glass, flat), Class 1 (clear), Quality Q3 (glazing select), and heat-treated to comply with ASTM C 1048, Kind FT (fully tempered)..
   1. Minimum Thickness: 1/4 inch 6 mm.
   2. Application: Where Safety glazing required by code and as shown on the drawings (at interior storefront system).
   3. Safety glazing required.

C. Tinted Glass Type [MG#4]: Fully tempered float glass.
   1. Basis-of-Design Product: Vitro Solargray.
   2. Tint Color: Gray.
   3. Minimum Thickness: 3/8 inch 10mm.
   4. Application: Exterior storefront entrance doors where Safety glazing required by code and as shown on the drawings. Tinted to match exterior insulated, tinted glazing.
   5. Safety glazing required.

3.10 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Tinted Insulating Glass [Type IG#7]:
   1. Basis-of-Design Product: Vitro Glazings Solarban 60, Solargray.
   2. Overall Unit Thickness: 1 inch.
   3. Minimum Thickness of Each Glass Lite: 1/4 inch <Insert thickness>.
   4. Outdoor Lite: Tinted fully tempered float glass. (Fully tempered where indicated).
   5. Tint Color: [Blue] [Blue-green] [Bronze] [Green] [Gray] <Insert color>.
   6. Interspace Content: Air.
   7. Indoor Lite: Clear annealed float glass. (Fully tempered where indicated).
   8. Low-E Coating: Pyrolytic on second surface.
   9. Safety glazing where required.

END OF SECTION 08 80 00

SECTION 08 83 00 - MIRRORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures. (Reference Specification Section 01 31 oo) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Silvered flat glass mirrors.
   1. Annealed Monolithic Glass
   2. Tempered Monolithic Glass

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors in accordance with mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.04 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

PART 2 - PRODUCTS

2.01 SOURCE LIMITATIONS

A. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

B. Source Limitations for Mirror Accessories: Obtain mirror-glazing accessories from single source.

2.02 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C1503; manufactured using copper-free, low-lead mirror coating process.

B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.
   1. Nominal Thickness: 6.0 mm.

C. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.
   1. Nominal Thickness: 6.0 mm.

D. Safety Glazing Products: For tempered mirrors, provide products that comply with 16 CFR 1201, Category II.

2.03 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. C.R. Laurence Co., Inc.
      b. Pecora Corporation.

2.04 MIRROR HARDWARE

A. Mirrors installed using mirror glazing angles, concealed clips and mirror setting mastic. Mastic applied on substrate in spot application, spacing and sizes as recommended by mirror manufacturer for use intended.
   1. General Contractor shall coordinate with electrician to provide mirrored plates for outlets and switches installed in areas of mirror wall at fitness room.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.05 FABRICATION

A. Shop fabricate mirrors to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts, so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished .
   1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
   2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

D. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint, as recommended in writing by film-backing manufacturer, to produce a surface free of bubbles, blisters, and other imperfections.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.02 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.03 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced National Glass Association (NGA) publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
   1. NGA Publications: "Laminated Glazing Reference Manual," "Glazing Manual" and "Installation Techniques Designed to Prolong the Life of Flat Glass Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

3.04 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

D. Clean exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Clean mirrors as recommended in writing by mirror manufacturer and NGA's publication "Proper Procedures for Cleaning Flat Glass Mirrors."

END OF SECTION 08 83 00

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:
1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.
2. Division 06 Section Rough Carpentry
3. Division 07 Section Thermal Insulation
4. Division 09 Section Gypsum Board
5. Division 09 Section Metal Support Systems
6. Division 09 Section Acoustical Insulation
7. Divisions 10 and 11, and other Sections as applicable, for coordination of accessories and equipment requiring blocking in walls

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product or system.

1.04 INFORMATION SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners, firestop tracks, as provided by International Code Council – Evaluation Service (ICC-ES).

1.05 QUALITY ASSURANCE

A. Metal Support Standard: ASTM C754.

B. Metal Stud Standard: Fed Spec QQS-698 and QQS-775E, Class D.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials with manufacturer's label attached. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Protect materials from dampness or wetting. Remove any damaged materials.

B. Protect metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by, and displaying a classification label from an independent testing agency acceptable to the authority having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
   2. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable UL design numbers.
   3. In the event that requirements of assembly numbers referenced conflict with other Contract Document requirements, conform to assembly requirements.

B. Horizontal Deflection: Limit deflection of partitions/ceilings to following limits, based on design load.
   1. Partitions to receive tile, plaster, adhered stone, or similar heavy finish materials: L/240.
   2. For typical wall assemblies, limited to 1/120.
   3. Comply with minimum stud gauges required elsewhere in these specifications, the most stringent requirement shall prevail. If partition height exceeds stud manufacturer's limiting height for applicable loading and deflection, install bracing above ceiling, decrease stud spacing, or increase stud gauge.
   4. Limit deflection of ceilings to L/360.

2.02 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for steel unless otherwise indicated.
   2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Tracks: ASTM C 645.Standard with manufacturer for type and size stud utilized, same finish. Furnish all necessary miscellaneous accessories such as clips, brackets, etc.
   1. Metal Framing: Provide light gauge metal framing and accessories supplied by one manufacturer throughout. Provide standard gauges of galvanized steel channel studs at size and spacings indicated on drawings, and as follows:
      a. Where distance between horizontal bracing is greater than 12 feet - 0 inch, 18 gauge minimum [and as required by performance requirements for horizontal deflection].
      b. Where distance between horizontal bracing is greater than 18 feet - 0 inch, 16 gauge minimum [and as required by performance requirements for horizontal deflection].
      c. Minimum 20 gauge studs where greater gauge is not otherwise required.
      d. Depths: As indicated in Drawings .
   2. Steel Studs and Tracks:
      a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
         1) ClarkDietrich Building Systems.
         2) MarinoWARE.
         3) MBA Building Supplies.
         4) MRI Steel Framing, LLC.

C. Slip-Type Head Joints: Where indicated, providethe following:
   1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.
      a. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
         1) CEMCO; California Expanded Metal Products Co.; Deflex Clips.
         2) ClarkDietrich Building Systems; [FTC3][FTC5].
   2. Double-Track System: ASTM C 645 top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track. Basis of Design product: Clark-Dietrich DoubleTrack system, Clark-Dietrich BlazeFrame for fire resistant assemblies or Clark-Dietrich Contour Track system for curves, bends and variable radii and arches.
   3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: available products that may be incorporated into the Work include, but are not limited to, the following:
         1) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
         2) MBA Building Supplies; [FlatSteel Deflection Track][Slotted Deflecto Track].
         3) Steel Network, Inc. (The); [VertiClip SLD][VertiTrack VTD].
         4) Superior Metal Trim; Superior Flex Track System (SFT)
         5) Telling Industries; [Vertical Slip Track][Vertical Slip Track II].
   4. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) ClarkDietrich Building Systems; BlazeFrame.
         2) Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
         3) Grace Construction Products; FlameSafe FlowTrak System.
         4) Hilti CFS-TTS firestop top track seal
         5) Metal-Lite; The System.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. ClarkDietrich Building Systems.
      b. MRI Steel Framing, LLC.
   2. Minimum Base-Steel Thickness: 26 gauge, 0.0179 inch [As indicated on Drawings] [0.0269 inch] [0.0296 inch] [0.0329 inch] <Insert thickness>.

E. Stud Spacer bars: 7/8 inch x 7/8 inch x 50 inches long right angle bar pre-notched 12 inch, 16 inch, and 24 inch centers. (20 gauge.)

F. Cold-Rolled Channel Bridging: Steel, 16 gauge 0.0598-inch minimum base-steel thickness, with minimum 1/2-inch- wide flanges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ClarkDietrich Building Systems.
   b. MRI Steel Framing, LLC.
2. Depth: .
3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ClarkDietrich Building Systems.
   b. MRI Steel Framing, LLC.
2. Minimum Base-Steel Thickness: 20 gauge, 0.0359 inch .
3. Depth: .

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. ClarkDietrich Building Systems.
   b. MRI Steel Framing, LLC.
2. Configuration: .
3. Provide J or C shaped track and channels with non-slotted web to frame around openings where required and where indicated in Drawings for fire rated construction and / or for screw attachment or support of windows. 16 gauge where required to prevent flame spread at cavity wall construction.

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: .
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

J. Slide Clips: Provide minimum 600 pound lateral capacity design load thickness, or as shown on drawings. Provide prefabricated clips as manufactured by Clark Dietrich Framing Systems, or equal. Install as shown on drawings.

K. Framed openings: Galvanized steel one piece header and jamb studs meeting or exceeding the requirements of ASTM C 754.

L. Blocking and Backing Plates: Refer to Division 06, Section "Rough Carpentry".
1. Minimum 20 <insert minimum gauge> gauge, galvanized sheet steel backing plates.

M. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to [5] <Insert number> times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
      a. Type: Cast-in-place anchor, designed for attachment to concrete forms
   2. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES as appropriate for the substrate.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Flat Hangers: Steel sheet, .

E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

F. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Armstrong World Industries, Inc; Drywall Grid Systems.
      b. Chicago Metallic Corporation; .
      c. United States Gypsum Company; .

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Sealer Gaskets: 5-12 inch x 3/8 inch closed cell foam and adhesive backed peel and stick membrane, equal to Protecto Wrap (800-759-9727) "Triple Guard Energy Sill Sealer." Provide at all exterior metal studs in contact with floor slab.

C. Exterior Soffit Uplift Bracing: Vertical bracing shall be 3-5/8 inch 18 gauge steel studs.

D. Isolation Strip at Exterior Walls: Providethe following:
   1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

E. Door frame Grout: Equal to USG Durabond 90 Joint Compound, Multi-Purpose.

F. Hanger Wire: ASTM A 641, 9 Gauge galvanized steel wire.

G. Insulation:
   1. Thermal Insulation: Refer to Division 07, Section "Thermal Insulation".
   2. Acoustical Insulation: Refer to Division 09, Section "Acoustical Insulation".
   3. Fire Resistant Assemblies: Provide mineral fiber insulation according to the requirements of the fire rated assembly, except where greater thickness is indicated for partitions that also carry an acoustical rating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Interface and Coordination with Other Work:
   1. Coordinate support framing and blocking requirements of all construction to be attached to gypsum board assemblies.
   2. At partitions indicated to receive thermal or acoustical batts, pack insulation into cavities while framing is being fabricated for stud packs, box headers, and other framing cavities that will be inaccessible upon erection of framing.
   3. Coordinate installation with joints in adjacent construction designed to reduce transmission of sound. Do not install gypsum board assemblies in a manner to create an acoustical bridge across such joints and conditions. Conditions include but are not limited to the following:
      a. Floor and slab acoustical isolation and similar construction details.
      b. Acoustical isolation of structural members and components.
      c. Mechanical ductwork acoustical joints and construction.

C. Proceed with installation only after systems coordination and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
   2. Coordinate ceiling access panel locations with MEP required access locations in a way to minimize access locations and aesthetic impact. Coordinate access locations with the architect, general contractor and mechanical, electrical and plumbing superintendents on the project before ceiling suspension installation begins.

B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Steel studs cut to proper length, plumbed and aligned, continuous runner tracks attached to structure at intervals not to exceed stud spacing specified. Anchor all exterior studs and studs adjacent to window and door frames, partition intersections and corners to runner flanges.

D. Studs for partitions indicated to be fire rated or to include sound batts shall extend to deck, unless noted otherwise.

E. Where partitions abut ceiling or deck construction or vertical structural elements, provide slip or cushion type joint between partition and structure as recommended by stud manufacturer.

F. Install double studs at all jambs, and at head conditions not requiring box beams, at all windows & doors.

G. Studs shall either extend to structure for anchorage/bracing, and or be braced with alternating kickers at 4 inch - 0 inch on center maximum.

H. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Install, or coordinate installation of wood blocking by other trade as applicable, for all such construction.

I. Install bracing at terminations in assemblies.

J. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: unless otherwise indicated.
2. Multilayer Application: unless otherwise indicated.
3. Tile Backing Panels: unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb unless otherwise indicated.
b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Optional Framed Openings: Galvanized-steel, one-piece header and jamb studs may be used at door and window opening in lieu of built-up members.
   a. Minimum Base-Steel Thickness: Not less than required for adjacent framing, and as required by design.
   b. Web Sizes: To match adjacent wall framing unless otherwise indicated.
   c. Available Products and Manufacturer include, but are not limited to:
      1) Cemco; ProX Header
      2) ClarkDietrich; RedHeader PRO
      3) MarinoWare; Quick Frame
   d. An potential advantage of these systems is a reduction in the number of locations that must be packed with batt insulation as the framing is erected.
5. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
   a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
6. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
7. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:
1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:
1. Erect insulation (specified in Section 07 21 00 "Thermal Insulation") horizontally and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. At window and door openings, provide C or J shaped perimeter furring or tracks where detailed in Drawings and where required for fastening window framing.
3. Provide perimeter framing or tracks of solid profile without cut-outs, where detailed in Drawings and where required for flame spread prevention into cavity. Framing sized to fill space from face of sheathing to back side of loose lintel, masonry veneer, or other non-combustible finish material.At jambs and heads of openings in fire rated cavity walls, install 16 gauge C or J shaped

G. Fastenings for Wall Supported Items: Provide and install 12 gauge wall reinforcing plates 6 inch high (minimum) x 1 stud space wide or 2 x 8 (minimum) x 1 stud space fire retardant wood blocking, unless specified otherwise at all stud wall areas receiving grab bars, toilet partitions, wall bumpers and other wall mounted accessories. Plates welded or screwed to studs.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.05 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Main runner carrying channels attached to structure with hangar spacing as required to meet requirements of ASTM C 754, and other criteria as specified. Cross furring 3/4 inch channels attached to main runners
   3. Deflection limited to 1/360 of span.
   4. Maximum allowable spacing of main runners, 48 inch O.C.; and cross furring 24 inch maximum O.C. At openings which interrupt main runners or furring channels, reinforce grille with 3/4 inch channels wire tied to and parallel to main runner channels.
   5. Maximum allowable spacing of hangers 48 inch O.C.
   6. Install uplift bracing to structure at exterior locations, air lock vestibules, [Apparatus Bay,]and at other spaces subject to wind uplift or sudden changes in air pressure.
      a. Install uplift bracing to structure at 4 foot - 0 inches on center each way
   7. Install uplift bracing to structure at [8 foot - 0 inches] <insert dimension> on center each way in [gymnasium] <and/or insert locations subject to lift due to impacts>.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards unless more stringent requirements are specified.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes: Provide gypsum drywall as shown on the drawings and as herein specified.
   1. Interior gypsum board.
      a. Type X gypsum board
      b. Mold-Resistant gypsum board
   2. Glass-Mat Gypsum Sheathing Board
   3. Tile backing panels.
      a. Cementitious Backer Units
   4. Trim accessories
      a. Interior Trim
         1) Galvanized Steel
      b. Exterior Trim
         1) Galvanized Steel
      c. Interior Joint Treatment
      d. Exterior Joint Treatment
   5. Sound-attenuation blankets.
   6. Texture finishes.
      a. Level Four (4)

B. Related Requirements:
   1. Division 06 Section "Rough Carpentry".
   2. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
   3. Division 06 Section "Architectural Woodwork", for coordination of metal framed cabinet supports.
   4. Division 07 Section "Thermal Insulation".
   5. Division 07 for additional requirements for fire stopping and sealants installed with gypsum board assemblies.
   6. Section 07 92 19 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
   7. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
   8. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
   9. Division 9 Section "Painting".
   10. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.03 ACTION SUBMITTALS

A. Certificate: Furnish certificate evidencing that material meets or exceeds specification and fire rating requirement.

B. Samples for Verification: For the following products:
   1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.
   2. Textured Finishes: Textured panels, approximately 12" square for each interior paint color indicated. Provide approximate 1" stepped application along one edge to demonstrate each layer.

1.04 QUALITY ASSURANCE

A. Tolerances: 1/8 inch Offsets between planes of board faces and 1/4 inch in 8 inch - 0 inch for plumb, level, warp and bow.

B. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials with manufacturer's label attached. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging. Protect materials from dampness or wetting. Remove any damaged materials.

B. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".

1.06 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency, and displaying a classification label from, an independent testing agency acceptable to the authority having jurisdiction.
   1. Fire-Resistance-Rated Assemblies: Indicated by design designations from GA-600, "Fire Resistance Design Manual."
   2. Construct assemblies to achieve fire resistance ratings indicated on Drawings, in accordance with applicable UL design numbers.
   3. In the event that requirements of assembly numbers referenced conflict with other Contract Document requirements, conform to assembly requirements

2.02 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum.
      b. CertainTeed Corporation.
      c. Georgia-Pacific Gypsum LLC.
      d. National Gypsum Company.
      e. PABCO Gypsum.
      f. USG Corporation.
   2. Thickness: 5/8 inch.
   3. Long Edges: Tapered.
   4. Location: Typical unless noted otherwise.

B. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum.
      b. CertainTeed Corporation.
      c. Georgia-Pacific Gypsum LLC.
      d. National Gypsum Company.
      e. PABCO Gypsum.
      f. USG Corporation.
   2. Core: 5/8 inch, Type X.
   3. Long Edges: Tapered.
   4. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
   5. Location: At painted wall surfaces in restrooms, laundry, extractor, kitchen areas, custodial, and similar wet and washable locations, except for backer board installed behind tile.

2.04 EXTERIOR GYPSUM

A. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Gypsum.
      b. CertainTeed Corporation.
      c. Georgia-Pacific Gypsum LLC.
      d. National Gypsum Company.
      e. USG Corporation.
   2. Core: As indicated.

2.05 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Wonderboard by Custom Building Products
      b. DUROCK Cement Board by USG Corporation
   2. Thickness: 5/8 inch.
   3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
   4. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.
   1. Galvanized Steel: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
      a. Shapes:
         1) Metal Edge Trim: Standard trim of galvanized steel with either knurled and perforated or expanded flanges and beaded for concealment of flange in joint compound. Equal to USG 200 or 400 Series. Apply where board abuts or terminates at another material.
            a) L-Bead: L-shaped; exposed long flange receives joint compound; use at exposed panel edges.
            b) J-Mold: Metal J-molds; exposed flange receives joint compound, use at all panel edges abutting dissimilar materials.
         2) Cornerbeads: Equal to USG Dur-A-Bead. Use at outside corners.
         3) Expansion (control) joint - Metal V-shape control joints. Use where indicated and at changes in backup material and in partitions at 30 inch - 0• • inch o.c. maximum, and at large gypsum board ceiling areas at 20 inch - 0 inch o.c. maximum. Also provide at both sides all interior and exterior window & door frames.

B. Exterior Trim: ASTM C1047.
   1. Galvanized Steel: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
      a. Shapes:
         1) Cornerbead.

2) LC-Bead: J-shaped; exposed long flange receives joint compound.
3) Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

2.07 INTERIOR JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: As recommended by panel manufacturer.
a. Use polymer-coated (alkali-resistant) mesh tape, 2 inch wide at interior applications, [and 3 inch wide at exterior applications.]

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
4. <Insert products>.

2.08 Exterior JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

B. Sealant for Glass-Mat Gypsum Board: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by manufacturers for covering exposed fasteners.
1. Joint Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 10 or 10 by 20 threads/inch (390 by 390 or 390 by 780 threads/m), of type recommended by manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

2.09 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
   1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
   2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Door frame Grout: Equal to USG Durabond 90 Joint Compound, Multi-Purpose.

F. Sealer Gaskets: 5-12 inch x 3/8 inch closed cell foam and adhesive backed peel and stick membrane, equal to Protecto Wrap (800-759-9727) "Triple Guard Energy Sill Sealer." Provide at all exterior metal studs in contact with floor slab.

G. Hanger Wire: ASTM A 641, 9 Gauge galvanized steel wire.

H. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

I. Vapor Retarder: As specified in Division 07 "Vapor Retarders."

2.10 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

B. Non-Aggregate Finish: Pre-mixed, vinyl texture finish for spray application.
   1. Texture: Orange Peel Spatter.

C. Non-Aggregate Finish: Premixed, vinyl texture finish for spray application.

D. Acoustical Finish: Water-based, chemical-setting or drying-type, job-mixed texture finish for spray application.

PART 3 - EXECUTION

3.01 EXAMINATION AND COORDINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Interface and Coordination with Other Work:
   1. Coordinate installation of firestopping at penetrations through fire-resistive rated assemblies.
   2. Coordinate installation of joint sealers specified in Division 7 Section at penetrations of non fire-resistive rated assemblies.
   3. Coordinate support framing and blocking requirements of all construction to be attached to gypsum board assemblies.

4. At partitions indicated to receive thermal or acoustical batts, pack insulation into cavities while framing is being fabricated for stud packs, box headers, and other framing cavities that will be inaccessible upon erection of framing.

D. Coordinate installation with joints in adjacent construction designed to reduce transmission of sound. Do not install gypsum board assemblies in a manner to create an acoustical bridge across such joints and conditions. Conditions include but are not limited to the following:
   1. Floor and slab acoustical isolation and similar construction details.
   2. Acoustical isolation of structural members and components.
   3. Mechanical ductwork acoustical joints and construction.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Panel Installation:
   1. Use wallboard of maximum lengths to minimize joints.
   2. Stagger end joints where they occur.
   3. Stagger vertical joints on opposite sides of partitions, and stagger joints between each layer of panel in multiple layer installations, by at least one framing member.
      a. Exception: Do not bridge panels over expansion joints.
   4. Locate end joints as far as possible from center of wall or ceiling.
   5. Do not place butt ends against tapered or grooved edges. Do not place tapered edges against cut edges or ends.
   6. Support ends and edges of wallboard on framing or furring members.
   7. No wallboard installed over piping, ducts, electric boxes or conduits until they have been installed, run and tested.
   8. Attach wallboard and sheathing with screws spaced 12 inch O.C. and staggered along abutting vertical edges.
   9. Partitions indicated sealed to deck shall be continuous except where interrupted by structure, mechanical or electrical construction.
   10. Fit gypsum panels around ducts, pipes, conduits, and structural members. Cut panels to fit profile of penetrations and apply a bead of sealant 1/4 inch to 3/8 inch wide.
   11. Tape and float only is acceptable behind lockers that have solid backs unless otherwise required for partition fire or acoustical ratings.
   12. Rated partitions shall have wall board continuous both sides above ceiling to deck and fire taped and sealed.
   13. Partitions shown to include sound batt but not to extend to deck shall have wall board continuous to deck above ceiling and taped on one side only.
      a. Exception: Partitions shown to have acoustical insulation placed over ceiling to either side of the partition wall.
   14. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, including floors and deck. Provide 1/4- to 1/2-inch wide spaces at these locations. Trim edges with edge trim where edges of panels will be exposed in the completed work. Seal joints between edges and abutting structural surfaces with acoustical sealant
   15. Form control and expansion joints with space between edges of adjoining panels.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Stagger joints between each layer of panel in multiple layer installations, by at least one framing member. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

J. Curved Surfaces:
   1. Install panels perpendicular to supports and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
   2. For multiple-layer construction, fasten base layer(s) to studs with screws 16 inches.C. Stagger joints between successive layers. Fasten finish layer to studs with screws spaced 12 inches.C.

K. Partitions shown to include sound batt but not to extend to deck shall have wall board continuous to deck above ceiling and taped on one side only.
   1. Exception: Partitions shown to have acoustical insulation placed over ceiling to either side of the partition wall.

L. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Type X: As indicated on Drawings .
   2. Mold-Resistant Type: At Wet Locations.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On Z-shaped furring members, apply base layer horizontally and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.04 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
1. Install tile backer board as substrate for thin set ceramic tile.
2. Space 1/4 inch above fixture lips.
3. Seal ends, cut edges and penetrations of each piece with water resistant compound before installation.
4. Tape & mortar over all joints prior to tile installation.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840, in locations where detailed, and the following, unless otherwise indicated:
1. At changes in backup material.
2. Vertically in partition walls at 30 feet - 0 inch maximum on center.
3. Horizontally in partition walls taller than 16 feet. Confirm elevations of such joints with Architect.
4. In large ceilings 20 feet - 0 inch maximum on center each way.
   a. Also at perimeter of ceilings in Apparatus Bay.
5. At interior side of all exterior door and window frames.
6. At both sides of all interior and exterior door and window frames.

C. Interior Trim: Install over face layer with fasteners spaced 9 inch O.C. where shown and where gypsum surfaces meet dissimilar materials, in the following locations:

1. Cornerbead: Use at outside corners [unless otherwise indicated].
2. Bullnose Bead: Use [at outside corners] [where indicated] <Insert requirements>.
3. J-Bead: Use [at exposed panel edges] <Insert requirements>.
4. L-Bead: Use [where indicated] <Insert requirements>.
5. U-Bead: Use [at exposed panel edges] [where indicated] <Insert requirements>.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use [at exposed panel edges] <Insert requirements>.

3.06 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Joint Treatment Application:
1. Joint treatment compounds and products, as specified under Materials, shall be mixed and applied in accordance with manufacturer's direction to completely conceal all joints and screw depressions and provide a smooth surface to receive finishes as scheduled.

E. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C840, manufacturer's published instructions and GA-214 Finish Levels.:
1. Level Four (4): Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges, and apply skim coat of joint compound over entire surface, and sand smooth. Provide Level Four (4) finish typical, where panels are to receive painted finish unless specifically indicated otherwise.
a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
b. Texture for level four (4) finish: Light sand texture, or other [light] texture as approved by Architect through sample and mockup review.

F. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

H. Wall Identification: Permanently label all fire and/or smoke control rated walls with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.

3.07 INSTALLATION OF TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written instructions.

3.08 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
   1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
   2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
      a. Installation of 80 percent of lighting fixtures, powered for operation.
      b. Installation, insulation, and leak and pressure testing of water piping systems.
      c. Installation of air-duct systems.
      d. Installation of air devices.
      e. Installation of mechanical system control-air tubing.
      f. Installation of ceiling support framing.

3.09 PATCHING AND REPAIR

A. Remove and replace gypsum board panels that become wet, moisture damaged, or exhibit evidence of mold.

3.10 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

3.11 CLEANING

A. Contractor shall completely clean all areas affected by this work and shall leave no excess or scrap materials or bedding compound on the job site.

END OF SECTION 09 29 00

SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Tile/Stone types
      a. Ceramic Tile
      b. Porcelain tile.
   2. Tile backing panels.
   3. Waterproof membrane
   4. Grout Materials
      a. Polymer-Modified Tile Grout
         1) Sanded
         2) Un-Sanded
      b. Epoxy Tile Grout
   5. Metal edge strips.
   6. Interior Setting Methods
      a. Flooring Installation Methods
         1) Concrete Floors
            a) Thin-Set on Concrete
      b. Wall Installation Methods
         1) Wood/Metal Stud Walls
            a) Thin-Set on Cementitious Board
      c. Interioir Bath Room Walls
         1) Thin-Set on Cement Backer Board
      d. Interior Shower/Bath Wall Methods
         1) Thin-Set on Waterproof Sheet Membrane

B. Related Requirements:
   1. Division 03 Section "Cast-in-Place Concrete".
   2. Section 07 92 00 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
   3. Division 08 Section "Access Doors and Panels" for coordination with access doors and panels installation.
   4. Division 09 Section "Gypsum Board" for cementitious backer units[and for coordination of wall flatness required for ceramic sheet tile installation].
   5. Division 09 Section "Flooring" Sections for transition strips other than those specified in this Section.
   6. Division 10 Section "Toilet Accessories", and other sections as applicable, for coordination of recessed items installed in tiled walls.

7. Division 22, for coordination with plumbing fixtures, shower base units, floor drains.

1.03 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. Face Size: Actual tile size, excluding spacer lugs (minor facial dimension as measured per ASTM C 499).

C. Module Size: Actual tile size plus joint width indicated (minor facial dimension as measured per ASTM C 499) .

D. Large and Heavy Tile (LHT) – Any ceramic, porcelain or stone tile with at least one side dimension greater than 15" and/or tile weight over 5 pounds per square foot.

E. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.04 REFERENCE STANDARDS

A. TCA / TCNA: Tile Council of North America, Inc., and the TCNA Handbook for ceramic, glass, and stone tile installations, most current versions.

B. ANSI A108.01, Requirements for movement joints.

C. Marble Institute of America (MIA): Dimension Stone Design Manual for Expansion Joints.

D. ASTM C1242, Standard guide for selection, design, and installation of dimension stone attachment systems.

E. ASTM C1193, Standard guide for the use of joint sealants.

F. ASTM C1472, Standard guide for calculating movement and other effects when establishing sealant joint width.

1.05 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as tested per the DCOF AcuTest (ANSI A137.1):
   1. Level Surfaces: Minimum 0.42.

B. All sealants used in floor or traffic applications shall have a Shore A hardness not less than 35.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
   2. Full-size units of each type of trim and accessory for each color and finish required.
   3. Stone thresholds in 6-inch lengths.
   4. Metal edge strips in 6-inch lengths.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product, signed by product manufacturer stating products are suitable for intended application.

C. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

D. Letter from sealant manufacturer, stating suitability of products for each application indicated.

1.08 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.09 QUALITY ASSURANCE

A. Qualifications of Installers: For cutting, installing and grouting of ceramic tile, use only thoroughly trained and experienced journeyman tile setters who are completely familiar with the requirements of this work, and the recommendations contained in the referenced standards, and who are CTI, CTEF, ACT or TCNA 5-Star TCNA Trowel of Excellence certified.

B. Codes and Standards: In addition to complying with all pertinent codes and regulations, comply with the following:
   1. Grout and mortar setting shall comply with, ANSI A108.4 and ANSI A 108.5.
   2. Manufacture all ceramic tile in accordance with Standard Grade Requirements of ANSI 137.1.
   3. ANSI A118.10, Specifications for waterproof membranes
   4. ANSI A118.12 Specifications for Crack Isolation Membranes
   5. Install all ceramic tile in accordance with the recommendations contained in Handbook for Ceramic Tile Installation of the Tile Council of North America, Inc., (TCNA) latest edition.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

F. Handle and store large ceramic sheet tile in strict compliance with Manufacturer's instructions to minimize possibility of damage to tile sheets.

1.11 WARRANTY

A. Installer's Warranty: 10 year labor and materials warranty against failure of tile products due to installation or workmanship error, including delamination of tiles from substrates.

1.12 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The following requirements apply for product selection:
   1. Basis-of-Design Product: The design for each tile type is based on the product named. Subject to compliance with requirements, provide either the named product or an approved comparable product by another manufacturer.
   2. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
      a. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
   3. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer. Including self-leveling underlayments and waterproofing / anti-fracturing membranes.
      a. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
      b. Obtain waterproof membrane, except for sheet products, from manufacturer of setting and grouting materials.
   4. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
      a. Waterproof membrane.
      b. Cementitious backer units.
      c. Metal edge strips.

2.02 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
   2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.

C. Colors, Textures, and Patterns: Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the specified product:

D. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

E. Warpage: No more than one-tenth the length of the measured span of the tile can exhibit more than 25 percent of total allowable warpage.

F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

2.03 TILE PRODUCTS

A. Available Suppliers whose products may be incorporated into the work include but are not limited to the following:
   1. As scheduled for new tile.

B. Wall Porcelain Tile: Glazed porcelain ceramic tile. Size and type as indicated on drawings.

C. Floor Tile: Porcelain tile. Size and type as indicated on drawings.

D. Trim & Special Tile: Provide necessary caps, stops, coves, returns, trimmers, and other shapes as required for a complete installation. Items to be supplied by the same manufacturer supplying the tile.

E. Cove Base: Porcelain tile. Base to match tile color to be selected for the floor. Size and type as indicated on the drawings.

F. Ceramic Tile: Flat tile as scheduled on drawings.

G. Cap Tile at half-height wall: Provide custom cap tile with rounded edges, to match adjacent glazed tile.

2.04 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Basis of Design Products: Design is based on products indicated. Subject to compliance with requirements; provide one of the named products, or an approved equal substitution.

C. Waterproof Membranes for thin set tile installations on concrete slabs: Flexible load-bearing, self-curing liquid rubber polymer and reinforcing fabric to form a seamless, heavy-duty waterproof membrane below a protective surface. Provide continuously under floor tile and behind wall tile.
   1. Subject to compliance with requirements; provide one of the named products, or an approved equal substitution:
      a. Laticrete; Hydroban.
      b. MAPEI; Mapelastic AquaDefense.
      c. Custom Building Products; Custom 9240
      d. TEC: Hydraflex
   2. Provide reinforcing membranes at floor to vertical surfaces, throughout shower pan and wall lining to the full height of the wall tile, and for other conditions as recommended by Manufacturer for the waterproofing system indicated.
   3. At curbless shower installations, extend membrane 8 inches beyond shower enclosure.

2.05 SETTING MATERIALS

A. Setting Materials Quality, General: Standards and materials specified herein are to set a minimum acceptable quality standard for setting materials. Contractor may, at Contractor's option and without change in price, propose to provide a higher grade of setting materials that may in Contractor's opinion reduce labor costs, reduce setting time, or afford other benefits in installation. Include for Architect's consideration the reasons for any such proposed revisions of setting materials with product submitta**l**.

B. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following, or approved equal:
   1. Custom Building Products.
   2. LATICRETE International Inc.
   3. MAPEI Corporation.

C. Latex-Polymer Modified Portland Cement Mortar (Thin Set) for Wall and Floor: ANSI A118.4, consisting of the following:
   1. Prepackaged dry-mortar mix containing dry, redispersible, ethylene vinyl acetate additive to which only water must be added at Project site. Available products include the following:
      a. MAPEI; Ultraflex 3.
      b. Laticrete; 254 Platinum.
   2. For wall applications, provide mortar that complies with requirements for nonsagging mortar, ISO 13007; C2TE, in addition to the other requirements in ANSI A118.4.

2.06 GROUT MATERIALS

A. Polymer-Modified Tile Grout: ANSI A118.7, in color as selected by Architect.
   1. Polymer Type: Either ethylene vinyl acetate, in dry, re-dispersible form, prepackaged with other dry ingredients, or acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
   2. Use hydraulic cement sanded grouts for joints 1/8 inch and wider. Available Products:
      a. MAPEI; Ultracolor Plus.
      b. Laticrete; Permacolor.
      c. Custom Building Products; Prism Color Consistent Grout.
   3. Use unsanded grout for joints less than 1/8 inch in width. Available Products:
      a. MAPEI; Keracolor U.
      b. Laticrete; 1600 Unsanded Grout.
      c. Custom Building Products; Polyblend Nonsanded.

B. Water-Cleanable Epoxy Grout: ANSI A118.3.
   1. Provide epoxy grout in the following locations: Restroom floors and Shower Floors & Walls.
   2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 degree F, respectively, and certified by manufacturer for intended use.
   3. Available Products:
      a. MAPEI; Kerapoxy CQ.
      b. Custom Building Products; CEG Lite.
      c. Laticrete; Spectralock Pro Premium.
      d. TEC; AccuColor EFX Epoxy Grout

2.07 ELASTOMERIC SEALANTS

A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements in Division 7 Section "Joint Sealants."

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
   1. Where Grout Manufacturer's sealants meet requirements throughout, use Grout Manufacturer's matching color sealants for sealant joints between tiles. Available Products:
      a. MAPEI; Mapesil.
      b. Laticrete; Latasil.
      c. Custom Building Products; Commerical 100 percent Silicone Caulk.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
   1. Available Products:
      a. MAPEI; Mapeflex P1 SL.
      b. Bostik; Chem-Calk 550.
      c. Mameco International, Inc.; Vulkem 245.
      d. Pecora Corporation; NR-200 Urexpan.
      e. Tremco, Inc.; THC-900.

E. Joint Backers: Foam joint backer material to prevent sealant bond and form recommended joint cross sectional shape. Round or rectangular with rounded top, and in sizes as appropriate to joint sizes and conditions.

2.08 CEMENTITIOUS BACKER UNITS

A. Provide 1/2 inch [5/8 inch] cementitious backer units at all walls to receive tile and on top of plywood subfloor/deck to receive waterproofing and tile All walls in wet areas complying with ANSI A118.9 in maximum lengths available to minimize end-to-end butt joints re: Division 09 Section Gypsum Board Assemblies.• •

B. Coordinate locations of studs and furring channels and weight of installed system imposed on studs and furring channels as required for support of exterior large format ceramic sheet tile and for movement joints. Refer to delegated design requirements of Division 05 œœCold Formed Metal Framing• • .

2.09 MISCELLANEOUS MATERIALS

A. Tile Lippage Control System: Tile installation system designed to minimize or eliminate tile lippage in floor and wall installation. Raimondi Lippage System or other system acceptable to large format ceramic tile Manufacturer for eliminating lippage in installation of their tile. Use in the following locations:
   1. At all large format ceramic tiles, both in floor and wall installation applications.

B. Metal Edge Strips: Metal edge strips with flange for embedding in tile setting material. Provide shapes as noted below, in sizes to match tile and setting-bed thickness and adjacent finish materials at transitions. Subject to compliance with requirements, provide metal strips as manufactured by Schluter or other approved equal.
   1. Basis of Design Products include:
      a. Ceramic Tile to Concrete or other lower floor material: "RENO-U" by Schluter. Finish: Clear anodized aluminum.
      b. Top edges of tile (that do not go to ceiling): "JOLLY" by Schluter. Finish: Clear anodized aluminum.
      c. Tile Outside Corners: "QUADEC" by Schluter. Finish: Clear anodized aluminum. Include universal accessory pieces for inside and outside corners, and end caps.
      d. Inside Corners shall be soft tile sealant joints to match grout color.
      e. Square Drains in Tile : Refer to Division 22 and Plumbing Fixture Schedule. Drains shall be commercial grade, with no plastic parts. Use stainless steel grate. No aluminum grates allowed.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout : Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. MAPEI Corporation; Ultracare Penetrating Tile, Stone, and Grout Sealer.
      b. Custom Building Products; Aquamix Penetrating Sealer.
      c. C-Cure; Penetrating Sealer 978.

2.10 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
   2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
      a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Contractor shall apply leveling coat or dry-set mortar over wall and floor surfaces which may vary more than 1-inch in 10 feet. Installation constitutes acceptance of the substrate.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

D. Where existing tile is to be color-matched, preserve as much of the existing original tile installation as possible. Remove only damaged, discolored or mismatched tile, or previous patches of inferior quality

3.02 PREPARATION

A. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

B. Provide concrete substrates for tile floors, installed with adhesives or thin-set mortar that complies with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
1. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
2. Remove protrusions, bumps, and ridges by sanding or grinding.

C. Where indicated, prepare substrates to receive waterproof membrane by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

D. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION OF CERAMIC TILE

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors composed of tiles 8 by 8 inches or larger.
2. Comply with ANSI standards for tolerances except as follows:
   a. Lippage: Lippage at **[floor] [and wall]** tile shall not exceed 1/32" between adjacent tiles.
   b. Unless specifically noted otherwise in Drawings, where tiles of different gage thickness are installed adjacent to each other on the same surface, install with thicker medium set mortar bed at the thinner tile as required to install surfaces of adjacent tiles flush, to within the maximum allowed tile lippage.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

E. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

F. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

G. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

H. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Mosaic Tile: 1/8 inch.
   2. Glazed Wall Tile: 1/8 inch.
   3. Porcelain Tile: 1/8 inch.
   4. Unless otherwise approved by Architect, accurately cut tile to install with joint widths between tile and floor drains, floor sinks, and similar items in floors, to the same joint widths as in the tile field.

I. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints per approved shop drawings, and in compliance with TCNA handbook recommendations where indicated during installation of settings materials, mortar beds, and tile.. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles. Do not allow grout, setting materials, or other hard materials to restrict movement or bridge across at movement joints.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Install sealant materials per manufacturer's installation instructions and industry standards. Clean and prime surfaces as recommended by manufacturer. Do not exceed temperature limitations, including where required shading of joints until after cured where joints are exposed to direct sunlight.
   3. Locate joints at inside corners, in tile surfaces directly above joints in concrete substrates, and per reference standards.
   4. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."
   5. Install movement joints with appropriate joint backer material.

6. Install movement joints per details in TCNA EJ171, except where pre-fabricated joint profiles are indicated.
7. Sealant profile shall be slightly concave.
8. In general, movement joints are recommended at 25 each direction at interior spaces. Tile work exposed to direct sunlight, heat or moisture should place movement joints at 12 maximum each direction.

K. Grout tile to comply with requirements of the following tile installation standards:
1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.
2. For chemical-resistant epoxy grouts, comply with ANSI A108.6.

L. Where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated. Coordinate with Division 09 section on Gypsum Wall Board.

M. Metal Edge Strips: Install [at locations indicated] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile] [where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated].

N. Floor Sealer: Apply floor sealer to cementitious grout joints in tile floors according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.04 INSTALLATION OF TILE BACKING PANEL

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.[Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.]

3.05 INSTALLATION OF WATERPROOF MEMBRANE

A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Install water proofing membrane under and behind floor tile and turned up 9 inch vertical behind wall tile at restrooms, shower / locker rooms, and other locations as indicated in Drawings. Also install waterproofing at floor drains, and over other concrete floor substrates where indicated in Drawings.
1. At showers, install waterproofing system throughout the shower including behind wall tile, and extend waterproofing system behind adjacent tile at least 9 inch beyond the shower on all sides.

C. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.06 INTERIOR FLOOR TILE INSTALLATION

A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCNA installation methods and ANSI A108 Series of tile installation standards.,
1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
a. Tile floors composed of tiles 8 by 8 inches or larger.

B. Tile Pattern: As indicated in Drawings .

C. Metal Edge Strips: Provide at locations other than restrooms where exposed edge of tile flooring meets carpet, wood, vinyl composition tile, or other flooring that finishes flush with top of tile. Install with setting flanges embedded in the tile setting material.
   1. Use full length pieces to the extent possible in order to minimize the number of joints.
   2. Unless otherwise noted, install edge strips flush with faces of tile to within maximum lippage tolerances as specified for tile.
   3. Backfill edge strips solidly with tile setting mortar behind cove bases, stair edges, ramp transitions, and similar metal tile trim accessories that have void spaces.

D. Top Sealers: Apply top sealers to tiles and grout according to sealer Manufacturer's written instructions. Wipe to remove excess sealer within time limits indicated by Manufacturer to avoid films or residues.
   1. Apply top sealer to tile surface prior to grouting in the following locations as indicated:
      a. Also seal cementitious grout after grouting using grout sealer product.

E. Grout Sealers: Apply grout sealer to cementitious grout joints <at: insert locations if not all cement based tile grout is to be sealed> according to grout-sealer Manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer that has gotten on tile faces by wiping with soft cloth.

3.07 WALL TILE INSTALLATION

A. Install types of tile designated for wall installations to comply with requirements in the Wall Tile Installation Schedule, including those referencing TCNA installation methods and ANSI setting-bed standards.

B. Joint Widths: Install tile on walls with the following joint widths:
   1. Ceramic Tile: 1/8 inch.

C. Tile Pattern: As indicated in Drawings .

D. Metal Trim Strips: Install at all locations indicated or as required to conceal exposed edge of tile:
   1. Use full length pieces to the extent possible in order to minimize the number of joints.
   2. Unless otherwise noted, install edge strips flush with faces of tile to within maximum lippage tolerances as specified for tile.
   3. Install all strips and transitions set in mortar beneath tile, and per manufacturer's instructions.
   4. At top of tile wainscots and other exposed edges of wall tile, install caulk joint between metal trim and wall. Do not grout to wall. Coordinate color with Architect and adjacent finishes.
   5. Metal Trim at Showers: Install according to Manufacturer's instructions and as follows:
      a. Unless otherwise detailed in Drawings, the open side of handicap accessible showers should be installed with metal trim edge creating a sloped lip 1/4 inch (minimum) to 1/2 inch (maximum) in total height, and compliant with ADA and Texas Accessibility Standards (TAS). Install trim at open side of shower flush with floor tile, and the low side of the trim flush with sloping tile inside the shower pan.
      b. Install adjustable rake trim at rake sides of shower, with face of trim flush with wall tile above.
      c. Install trim at low, slot drain side of shower with the top of trim aligned with the adjacent rake trim pieces.

E. Sealant Joints, General: Install to TCNA standards, including sealant joints at inside corners, and where tile abuts other materials/finishes.

3.08 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.09 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

1. Exclusively published and distributed by Deltek, Inc. for the AIA

SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS

PART 2 - GENERAL

2.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

2.02 SUMMARY

A. Section Includes:
   1. Acoustical tiles for interior ceilings.
   2. Metal Suspension Systems.
      a. BOD Lay-In Suspension System

B. Related Requirements:
   1. Division 05 Section - Metal Fabrications
   2. Division 09 Section - Non-Structural Metal Framing.
   3. Division 21 through 28 Mechanical and Electrical Sections, for coordination with devices installed in grid ceilings.

C. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

2.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product specifications and installation instructions for each acoustical ceiling material required, and for each suspension system, including certified laboratory test reports and other data as required to show compliance with these specifications.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Samples for Verification: For each component indicated and for each exposed finish required, provide three sets of samples of sizes indicated below:
   1. Acoustical Tiles: Set of 4 inch x 4 inch square samples for each acoustical unit required, showing full range of exposed color and texture to be expected in completed work.
   2. Concealed Suspension-System Members: [6-inch-] <Insert dimension> long Sample of each type.
   3. Exposed Moldings and Trim: Set of [6-inch-] <Insert dimension> long Samples of each type and color.
   4. Seismic Clips: Full size.

2.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

2.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials[, from the same product run,] that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Units: Full-size tiles equal to 2 percent of quantity installed, (minimum of one box).

2.06 QUALITY ASSURANCE

A. Contractor shall coordinate connection of lighting and electrical devices to grid. Where lighting fixtures are provided with integral clips, install lighting fixture with the clip attachments and not with screws through grid tees.

2.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical tiles, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical tiles, permit them to reach room temperature and a stabilized moisture content.

2.08 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
   1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 3 - PRODUCTS

3.01 MANUFACTURERS

A. Source Limitations:
   1. Suspended Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile and its suspension system from single source from single manufacturer.
   2. Directly Attached Acoustical Tile Ceilings: Obtain each type of acoustical ceiling tile from single source from single manufacturer.

3.02 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Class A according to ASTM E 1264.
   2. Smoke-Developed Index: 50 or less.

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL or from the listings of another qualified testing agency.

3.03 ACOUSTICAL TILES (AC1)

A. Basis of Design Systems:
   1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings Insert manufacturer's name; product name or designation or comparable product by one of the following:
      a. Armstrong World Industries, Inc.
      b. CertainTeed Corporation.
      c. United States Gypsum Company.
   2. Type AC1: 24 inch x 24 inch x 5/8 inch mineral fiber tile made for a lay-in grid suspension system. Panel design is Armstrong #1774 "Dune", with Angled Tegular edge profile, Color: White.
      a. Use with Grid Type 1.

3.04 METAL SUSPENSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

B. Basis of Design Lay-In Suspension Systems:
   1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
      a. Armstrong World Industries, Inc.
      b. Chicago Metalic, a Rockfon North America Company
      c. CertainTeed Corporation.
      d. United States Gypsum Company.
      e. <Insert manufacturer's name>.
   2. Lay-in suspension system: Exposed steel members made for use with panel types specified. System supplied with all main runner tees, cross tees, wall angles, clips, connectors, fastening and hangar wires. Provide named product, or equal .
      a. Grid Type 1: Grid to be 24 inch x 24 inch pattern with white finish. Armstrong's "Suprafine ML" 9/16 inch exposed tee, or approved equal.

3.05 METAL EDGE MOLDINGS AND TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Armstrong World Industries, Inc.
   2. CertainTeed Corporation.
   3. Chicago Metallic Corporation.
   4. United States Gypsum Company.

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard Shadow Moulding trim for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for of suspension-system runners.
   1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
   2. Finish: Painted in color as selected from manufacturer's full range.

PART 4 - EXECUTION

4.01 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

4.02 PREPARATION

A. Testing Substrates: Before adhesively bonding tiles to wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.

B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

C. Layout openings for penetrations centered on the penetrating items.

4.03 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Directly Attached Ceilings: Install bottom surface of tiles to a tolerance of 1/8 inch in 12 feet and not exceeding 1/4 inch cumulatively.

C. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

4.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections of completed installations of acoustical tile ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no tiles have been installed. Do not proceed with installations of acoustical tile ceiling hangers for the next area until test results for previously completed installations of acoustical tile ceiling hangers show compliance with requirements.
   1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
   2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

B. See Section 01 40 00 "Quality Requirements" for retesting and reinspecting requirements and Section 01 73 00 "Execution" for requirements for correcting the Work.

C. Acoustical tile ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

4.05 ADJUSTING

A. Clean exposed surfaces of acoustical tile ceilings, including trim and edge moldings. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace tiles and other ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 23

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation

1.02 SUMMARY

A. Section Includes:
   1. Vinyl base.

B. Related Sections: Related work specified elsewhere includes but may not be limited to:
   1. Division 09 Section: Resilient Tile Flooring

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

D. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Wall Base: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.
   2. Delivery, Storage and Protection: Comply with Owner's requirements for delivery, storage and protection of extra materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Materials delivered to job site in manufacturer's unopened containers with labels intact.

B. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degree F or more than 90 degree F.

C. Store materials at minimum temperature of 70°F in all areas for at least 48 hours prior to installation

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degree F or more than 95 degree F, in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degree F or more than 95 degree F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 VINYL BASE (RB)

A. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
   1. Style and Location:
      a. Style A, Straight: .

B. Height: 4 inches As indicated on Drawings.

C. Outside Corners: Job formed.

D. Inside Corners: Job formed.

E. Colors and Patterns: As indicated on Drawings.

2.02 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections. Verify substrate conditions are acceptable for installing product in accordance with manufacturer's instructions and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
   2. Any defects found during inspection must be corrected prior to installation; this includes any sanding, leveling, or surface repairs required.

B. Material Inspection: In accordance with manufacturer's installing requirements, visually inspect materials prior to installing. Material with visual defects shall not be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
   1. Base with puckers, bird months, or other visible delaminations from substrates or other imperfections are not acceptable.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: [Provide manufacturer's standard preformed corner units unless conditions do not allow.]
   1. Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 8 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 8 inches in length.
      a. Miter or cope corners to minimize open joints.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.

2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 65 66 - RESILIENT ATHLETIC FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:Materials and installation of indoor resilient sport flooring as follows:
   1. Rubber floor tile.
      a. BOD Rubber Floor Tile

B. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete"
   2. Division 09 Section "Wood Athletic Flooring" for resilient wood flooring.
   3. Division 09 Section "Resilient Base and Accessories" for wall base and accessories installed with flooring.
   4. Division 09 Section "Fluid-Applied Athletic Flooring" for liquid polyurethane flooring applied directly to substrates or pads.

1.03 REFERENCES

A. American Society for Testing & Materials (ASTM)
   1. ASTM D2240: Standard Test Method for Rubber Property (Durometer Hardness).
   2. ASTM F970: Standard Test Method for Static Load Limit.
   3. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as measured by the James Machine.
   4. ASTM G21: Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
   5. ASTM F925: Standard Test Method for Resistance to Chemicals of Resilient Flooring.
   6. ASTM E648: Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.
   7. ASTM E662: Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
   8. ASTM F1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   9. ASTM F2170: Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
   10. ASTM E1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
   11. ASTM F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

B. GREENGUARD Environmental Institute
   1. GREENGUARD Indoor Air Quality Certified®.

C. National Fire Protection Association
   1. NFPA 101: Life Safety Code®.

D. International Organization for Standardization (ISO)
   1. ISO 9001: Requirements for Quality Management Systems.
   2. ISO 14001: Requirements with Guidance for Use for Environmental Management Systems.

1.04 ACTION SUBMITTALS

A. Product Data: Manufacturer's current printed data sheets on specified products (surfacing product, adhesives, seaming methods, accessories, etc.) including current installation guidelines for each type of product indicated.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

C. Samples for Verification: For each type, color, and pattern of flooring indicated, 6-inch-square Samples of same thickness and material indicated for the Work.
   1. Provide three samples, 6 inches x 6 inches, for verification of such characteristics as color, texture and finish for each specified rubber athletic flooring product.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified flooring Installer.

B. Provide current subfloor preparation guidelines, as published by the Manufacturer.

C. Provide current installation guidelines, as published by the Manufacturer.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For flooring to include in maintenance manuals.

B. Provide current standard warranty, as published by the Manufacturer.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish no fewer than 1 box for each 50 boxes or fraction thereof, of each type, color, pattern, and size of floor tile installed.

1.08 QUALITY ASSURANCE

A. Installer to be recognized and approved by the rubber athletic flooring Manufacturer and have performed installations of the same scale in the last three (3) years.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.

B. Store materials according to the manufacturer's recommendations and to prevent deterioration. Store tiles on a raised flat surfaces providing ventilation below.

C. Take care in handling to not damage materials (i.e. edge chipping, excessive warping, etc.).

1.10 FIELD CONDITIONS

A. The General Contractor or Construction Manager shall be responsible for ensuring all site conditions meet the requirements of the rubber athletic flooring Manufacturer, as referenced herein at sections 3.2 and 3.3.

B. Adhesively Applied Products:
   1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 degree F or more than 95 degree F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
   2. After postinstallation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 degree F or more than 95 degree F.
   3. Close spaces to traffic during flooring installation.
   4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.

C. Installation to be carried out no sooner than the specified curing time of concrete subfloor (normal density concrete curing time is approximately 28 days for development of design strength).

D. Moisture vapor emission content of the concrete slab must not exceed the tolerance of the adhesive used, when tested using the anhydrous calcium chloride test as per ASTM F1869 and/or using the in-situ probes test as per ASTM F2170.

E. Installation of athletic flooring is not to commence unless all other trades in the building are completed. It is the General Contractor or Construction Manager's responsibility to maintain a secure and clean working area before, during and after the installation of rubber athletic flooring.

1.11 COORDINATION

A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

1.12 WARRANTY

A. Provide current standard warranty, as published by the Manufacturer.

PART 2 - PRODUCTS

2.01 BOD RUBBER FLOOR TILE RF

A. Description: Athletic flooring consisting of modular rubber tiles with smooth edges for adhered application.

B. Basis of Design Product - Roppe Tuflex Spartus is prefabricated rubber athletic flooring, calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation, as manufactured by Roppe or approved equal.
   1. Thickness: 0.394 inch (10mm).
   2. Colors: As shown on Drawings.
   3. Manufactured in two layers which are vulcanized together. The shore hardness of the top layer will be greater than that of the bottom layer; shore hardness of layers to be recommended by the Manufacturer and the limits specified.
   4. Tile Size:: : 27 inch x 27 inch .

5. Warranty: The rubber athletic flooring to be warranted to be free from manufacturing defects for a minimum period of three (3) years from the date of shipment from the Manufacturer.

2.02 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. It is the responsibility of the general contractor/construction manager to ensure that project/site conditions are acceptable for the installation of the indoor resilient athletic flooring.

B. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Concrete subfloors to be placed a minimum of twenty-eight (28) days prior to the installation of rubber athletic flooring.
   2. Concrete subfloors on or below grade are installed over a suitable moisture retardant membrane. Water vapor membrane complies with specification in ASTM E1745.
   3. No concrete sealers or curing compounds are applied or mixed with the subfloors (refer to Section 03 05 00 - Common Work Results for Concrete of Division 3).
   4. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   5. Alkalinity Testing: Perform pH testing according to ASTM F 710. Proceed with installation only if pH readings are not less than 7.0 and not greater than 8.5.
   6. Moisture Testing:
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
         1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
      b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.

C. Wood Subflooring: APA (Engineered Wood Association) Exterior grade plywood or CANPLY Exterior Certified plywood (Group 1, CC type). Verify and comply with flooring manufacturer recommendations.

D. Smooth, dense finish, highly compacted with a tolerance of 1/8'' in a 10 ft radius (3.2 mm in 3.05 m radius). Floor Flatness (FF) and Floor Levelness (FL) numbers are not recognized.

E. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.

F. Use trowelable leveling and patching compound to fill cracks, holes, and depressions in substrates.

G. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
   1. Do not install flooring until they are same temperature as space where they are to be installed.

H. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.

I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 FLOORING INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions.

B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use nonpermanent, nonstaining marking device.

3.04 FLOOR TILE INSTALLATION

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.

B. Discard broken, cracked, chipped, or deformed tiles.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged if so numbered.

D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.05 FIELD-APPLIED FINISHES

A. Apply finish after game-line and marker paint is fully cured.

B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.

C. Do not cover flooring after finishing until finish reaches full cure.

3.06 CLEANING AND PROTECTING

A. Initial cleaning should only be performed 72 hours after the rubber athletic surface has been completely installed.

B. Remove all unused materials, tools, and equipment and dispose of any debris properly. Clean the indoor resilient athletic surfacing in accordance with the manufacturer’s instructions.

C. Perform the following operations after completing flooring installation:
   1. Remove adhesive and other blemishes from flooring surfaces.
   2. Sweep and vacuum flooring thoroughly.
   3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.

D. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
   1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION

SECTION 09 81 00 - ACOUSTICAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Provide sound insulation as shown on the drawings and as herein specified.
      a. Fiberglass Acoustical Insulation

B. Related Sections include the following:
   1. Division 07 Section "Thermal Insulation."

1.03 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency
   1. Batt Insulation: flame spread and smoke developed of 0. NFPA 101 Class A.
   2. Other insulation types: As indicated.

B. Low VOC: All batt insulation products shall be made with binder containing no added urea formaldehyde.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original packages, clearly marked with brand name, type and R-Value.

B. Store materials in area protected from weather, moisture and damage, remove any damaged materials from the site.

1.05 SUBMITTALS

A. Samples of materials and complete product and technical description submitted for approval to the Architect prior to ordering materials.

PART 2 - PRODUCTS

2.01 Materials

A. Sound Insulation Blankets: BOD product “” Sound Attenuation Batt by Owens Corning, without membrane facing, produced fiberglass strands.
   1. STC-Rated Acoustical Assemblies: Comply with acoustical rating assembly requirements of partition, see drawing.
   2. Fire-Resistance-Rated Assemblies: Non-combustible unfaced batts 10/10 when tested according to ASTM E84.

3. Provide resilient channels when indicated or required to meet required STC level.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas receiving insulation work to insure work of preceding trades is completed. Check surfaces to see that they are uniform in place, free from mortar droppings, grease, oil or other debris which would affect proper insulation. Application constitutes acceptance of substrate conditions.

3.02 INSTALLATION

A. Insulation installed in accordance with current printed recommendations of insulation manufacturer.

B. Install sound batts tightly to studs and to all penetrations. Install tightly fitted and continuously behind and around conduit, boxes, pipe, and other obstructions. Install in full length pieces in each stud cavity to the extent possible to minimize the number of joints at cut ends. Fit cut ends pressed together to ensure a continuous acoustical barrier. Where the stud depth is greater than the nominal batt thickness, cut ends in mats shall be overlapped at least two inches.

END OF SECTION 09 81 00

SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Provide complete surface preparation, priming, field painting and sealing of exposed exterior and interior items and surfaces.
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
   2. Examine specifications for various other trades and their provisions regarding their painting. Surfaces that are left unfinished by other sections of specifications shall be painted or finished as a part of this section.
   3. Basis of Design Products
      a. Sherwin Williams
   4. Exterior Paint Applications
      a. Ferrous Metal
      b. Zinc-Coated Metal
      c. Concrete
      d. Cement Fiber Board
   5. Interior Paint Applications
      a. Concrete Unit Masonry (CMU)
      b. Gypsum Board
      c. Ferrous Metal
      d. Zinc-Coated Metal
      e. DryFall Metal Deck Surfaces
      f. Concrete Floors
   6. Miscellaneous Products
      a. Concrete Floor Sealer
      b. Interior CMU Epoxy Coating

B. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.
   1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron supports, and surfaces of mechanical and electrical equipment that do not have a factory-applied final finish.

C. Do not paint prefinished items and finished metal surfaces except where otherwise noted in Drawings or specifications. Do not paint concealed surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:

a. Architectural woodwork.
b. Finished mechanical and electrical equipment.
c. Light fixtures.
d. Prefinished wall, roof & soffit panels

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Furred areas.
   b. Ceiling plenums.
   c. Pipe spaces.
   d. Duct shafts.
3. Finished metal surfaces include the following:
   a. Anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper and copper alloys.
   e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

D. Related Sections include the following:
1. Division 04 Section "Unit Masonry"
2. Division 05 Section "Structural Steel" for shop priming structural steel.
3. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
4. Division 06 Section "Architectural Woodwork" for shop priming interior architectural woodwork.
5. Division 07 Section "Joint Sealers ".
6. Division 08 Section "Steel Doors and Frames" for factory priming steel doors and frames.
7. Division 09 Section "Gypsum Board" for surface preparation of gypsum board.
8. Division 32 Section "Pavement Accessories" for traffic-marking paint.

1.03 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 523 apply to this Section.
1. Gloss Level One (1) (Flat), refers to a lusterless or matte finish with a gloss range below 5 when measured at an 60-degree meter and below 10 at 85 degrees.
2. Gloss Level Two (2) (Velvet): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level Three (3) (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level Four (4) (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level Five (5) (Semi-gloss): 35 to 70 units at 60 degrees.
6. Gloss Level Six (6) (Gloss): 70 to 85 units at 60 degrees.
7. Gloss Level Seven (7) (High-Gloss): More than 85 units at 60 degrees.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated. Include block fillers and primers.

1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Submit Manufacturer's Product Safety Data Sheets for each product.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

C. Materials shall be manufacturer's best grade of respective paint types.

D. Gloss levels for paints required are as per the National Paint and Coatings Association.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at an ambient temperature between 45 and 95 degree F. Maintain storage containers in a clean condition, free of foreign materials and residue.
1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

1.07 PROJECT CONDITIONS

A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 degree F.

B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 degree F.

C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degree F above the dew point; or to damp or wet surfaces.
   1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

D. Provide adequate ventilation of spaces while applying primer and finish coats.

E. All application of coatings shall be done under adequate illumination.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.
   1. Quantity: Furnish Owner with an additional 3 percent, but not less than 1 gal. or one (1) case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Basis of Design Products: Products listed are basis of design products to establish a level of quality and performance. Subject to compliance with requirements, provide the named products or products of equal quality by one of the following Manufacturers. Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part Two (2) articles. The architect will be sole judge of paint quality and acceptability as equal to named products.
   1. Benjamin Moore & Co. (Benjamin Moore).
   2. Coronado Paint Company (Coronado).
   3. Kelly-Moore Paint Co. (Kelly-Moore).
   4. PPG Paints (PPG)/ (PPGPMC).
   5. Sherwin-Williams Co. (Sherwin-Williams).

2.02 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
   1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: As scheduled on the drawings.

2.03 CONCRETE UNIT MASONRY BLOCK FILLERS

A. Concrete Unit Masonry Block Filler: Factory-formulated high-performance latex block fillers.
   1. PPGPMC; AMERLOCK 400BF Low VOC Two-component, Epoxy Masonry Block Filler: Applied at a dry film thickness of not less than 10.0 - 20.0 mils.
   2. Sherwin-Williams; PrepRite Interior/Exterior Block Filler B25W25: Applied at a dry film thickness of not less than 8.0 mils.

2.04 EXTERIOR PRIMERS

A. Exterior Ferrous-Metal Primer: Factory-formulated rust-inhibitive metal primer for exterior application.
   1. PPGPMC; MULTIPRIME 4160 One-component, multi-purpose tank and structural primer: Applied at a dry film thickness of not less than 2.0 -2.5 mils.
   2. Sherwin-Williams; Pro-Cryl Universal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.

B. Exterior Galvanized Metal Primer: Factory-formulated galvanized metal primer for exterior application.
   1. PPG; Pitt-Tech Plus 4020PF Interior/Exterior Primer/Finish: Applied at a dry film thickness of not less than 3.0 mils.
   2. PPGPMC; MULTIPRIME 4160 One-component, multi-purpose tank and structural primer: Applied at a dry film thickness of not less than 2.0 - 2.5 mils.
   3. Sherwin-Williams; Pro-Cryl Universal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.

C. Exterior Primer for Concrete and Fiber Cement Siding (Hardi Board): Loxon Concrete & Masonry Primer B24W8300: Applied at a dry film thickness of not less than 3.0 mils.

D. Exterior Primer for Drywall: Sherwin-Williams B51- 450 Interior/Exterior Multi-Purpose Latex "Adhesion Primer", or approved equal. Applied at a dry film thickness of 1.4 mils.

E. Exterior Architectural PVC, Plastic, or Fiberglass: Sherwin-Williams B51- 450 Interior/Exterior Multi-Purpose Latex "Adhesion Primer", or approved equal. Applied at a dry film thickness of 1.4 mils.

2.05 INTERIOR PRIMERS

A. Interior Concrete Primer: Factory-formulated alkali-resistant acrylic-latex interior primer for interior application.
   1. Sherwin-Williams; Loxon Concrete & Masonry Primer B24W8300: Applied at a dry film thickness of not less than 3.0 mils.

B. Interior Masonry Primer: 100 percent acrylic-emulsion conditioner for interior application only, to bond light chalk to the surface of existing brick & CMU.
   1. Sherwin-Williams; Loxon Conditioner Masonry Primer A24-1100 Series: Applied at a dry film thickness per manufacturer's recommendation.
   2. No substitutions.

C. Interior Gypsum Board Primer: Factory-formulated latex-based primer for interior application.
   1. Sherwin-Williams; ProMar 200 Zero VOC Latex Wall Primer B28W2600 Series: Applied at a dry film thickness of not less than 1.5 mils.

D. Interior Ferrous-Metal Primer: Factory-formulated quick-drying rust-inhibitive alkyd-based metal primer.
   1. PPGPMC; MULTIPRIME 4160 One-component, multi-purpose tank and structural primer: Applied at a dry film thickness of not less than 2.0 - 2.5 mils.
   2. Sherwin-Williams; Pro-Cryl Universal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.

E. Interior Zinc-Coated Metal Primer: Factory-formulated galvanized metal primer.
   1. PPGPMC; MULTIPRIME 4160 One-component, multi-purpose tank and structural primer: Applied at a dry film thickness of not less than 2.0 - 2.5 mils.
   2. Sherwin-Williams; Pro-Cryl Universal Primer B66-310 Series: Applied at a dry film thickness of not less than 3.0 mils.

2.06 EXTERIOR FINISH COATS

A. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals (Lintels, Trim, Partitions, and wainscot): Factory-formulated full-gloss waterborne acrylic-latex enamel for exterior application.
   1. Sherwin-Williams; Pro Industrial Acrylic Gloss B66-600 Series: Applied at a dry film thickness of not less than 2.5 mils.

B. Exterior Semi-Gloss Acrylic Enamel for Ferrous and Other Metals: (Lintels, Trim, Partitions, and wainscot): Factory-formulated semi-gloss waterborne acrylic-latex enamel for exterior application.
   1. Benjamin Moore; Moore's Ultra Spec HP D.T.M. Acrylic Semi-Gloss Enamel: Applied at a dry film thickness of not less than 2.0 mils.
   2. Sherwin-Williams; Pro Industrial Acrylic Semi-Gloss B66-650 Series: Applied at a dry film thickness of not less than 2.5 mils.
   3. PPG; 90-1610 PITT-TECH PLUS EP DTM Acrylic Sem-Gloss: Applied at a dry film thickness of not less than 2.0 - 4.0 mils.

C. Exterior Zinc-Coated Ferrous Metal
   1. Sherwin-Williams; Pro Industrial Acrylic Gloss, B66-600 Series: Applied at a dry film thickness of not less than 2.5 mils.
   2. PPG; 90-1510 PITT-TECH PLUS EP DTM Acrylic Gloss: Applied at a dry film thickness of not less than 2.0 - 4.0 mils.

D. Exterior Wood, Cement, or Brick Flat Finish: Sherwin-Williams A-100 Exterior Latex Flat, A6-100 Series. Applied at a dry film thickness of not less than 1.2 mils.

E. Exterior Wood, Cement, or Brick Satin Finish: Sherwin-Williams A-100 Exterior Latex Satin, A82-100 Series. Applied at a dry film thickness of not less than 1.5 mils.

F. Exterior Textured Coating: Sherwin-Williams Ultra Crete Medium Textured Coating, A44W811. Applied at 50-80 sq. ft/gal.

G. Exterior Metal Canopy Semi-Gloss Sherwin-Williams SprayLastic Exterior Semi-Gloss Waterborne Dryfall, B42W17/B42T17. Applied at a dry film thickness of not less than 2.0 mils.

H. Exterior Stained Wood Semi-Transparent: Sherwin-Williams WoodScapes Exterior Polyurethane Semi-Transparent Stain, A15T5.

2.07 INTERIOR FINISH COATS

A. Interior Flat Acrylic Paint: Factory-formulated flat acrylic-emulsion latex paint for interior application:
   1. Sherwin-Williams ProMar 200 Zero VOC Interior Latex Flat: Applied to a dry film thickness of not less than 1.6 mils.
   2. PPG; 6-5110 Speedhide ZERO Interior Flat: Applied at a dry film thickness not less than 1.2 mils.

B. Interior Low-Luster Acrylic Enamel: Factory-formulated Eggshell/Satin acrylic-latex interior enamel:
   1. Sherwin-Williams Promar 200 Zero VOC Interior Eg-Shel: Applied to a dry film thickness of not less than 1.7 mils.
   2. PPG; 6-5310 Speedhide ZERO Interior Eggshell: Applied at a dry film thickness not less than 1.5 mils.

C. Interior Semi-Gloss Acrylic Enamel: Factory-formulated semigloss acrylic-latex enamel for interior application.
   1. Sherwin-Williams; ProMar 200 Zero VOC Interior Latex Semi-Gloss Enamel B31-2600 Series: Applied at a dry film thickness of not less than 1.6 mils.

D. Interior Full-Gloss Acrylic Enamel: Factory-formulated full-gloss acrylic-latex interior enamel.
   1. Sherwin-Williams; Solo 100 percent Acrylic Interior/Exterior Gloss: Applied at a dry film thickness of not less than 1.6 mils.

E. Interior Full-Gloss Alkyd Enamel for Wood and Metal Surfaces: Factory-formulated full-gloss alkyd interior enamel.
   1. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35-200 Series: Applied at a dry film thickness of not less than 1.5 mils.

F. Interior Full Gloss Epoxy:
   1. Sherwin-Williams; Tile-Clad High Solids Epoxy B62Z series: Applied at a dry film thickness of not less than 2.5 mils.

G. Interior Precatalyzed Water-Based Epoxy:
   1. Sherwin-Williams; Pro Industrial Pre-Catalyzed Water-based Epoxy K45-150 Series (Egg-shell): Applied at a dry film thickness of not less than 1.5 mils.
   2. PPG; 16-310 Series: Pitt GlazeWB1 Interior Eggshell Pre-Catalyzed Water-Borne: Applied at a dry film thickness not less than 1.5 mils.
   3. To be installed at (previously painted) interior existing brick and CMU surfaces; and interior plaster surfaces of exterior walls.

H. Interior DryFall, Water Based Flat, for Galvanized Steel Decking: Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall B42W81.

2.08 MISCELLANEOUS PAINT PRODUCTS

A. Other materials such as linseed oil, turpentine and shellacs shall be pure and of highest quality.

B. Concrete Floor Sealer: Exposed concrete floor slabs with smooth troweled finish: One coat flood-applied, hardener/densifier. Chemical reactive silicate / siliconate formulation that enhances sheen level of troweled concrete and is designed to maintain or increase sheen level over time with normal wear. Provide one of the following or approved equal product by another Manufacturer:
   1. Euclid Chemical Company; "Euco Diamond Hard", www.euclidchemical.com.
   2. CureCrete Chemical Company; "Ashford Formula", www.ashfordformula.com.
   3. Dayton Superior; "Sure-Hard Densifier J17", www.daytonchemical.com.
   4. L&M Construction Chemicals: "Seal Hard", www.lmmc.com.
   5. PPGPMC Flooring: Contact Dwayne Thomas, dwaynethomas@ppg.com, Flooring BDM South Central/ Gulf.

C. Water based Epoxy: Catalyzed epoxy meeting requirements of ASTM D3730, equal to Sherwin Williams B67 Series.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
   1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
   1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.02 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
   1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
   1. Provide barrier coats over incompatible primers, or remove and re-prime.
   2. Cementitious and Masonry Materials: Prepare brick, concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.

3. Wood: Clean new or existing surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view down to consistent substrate for intended finish. Ensure smooth surface remains and remove all residual dust.
   a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
   b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, trim, rails, doors, frames and windows.
   c. If transparent finish is required, backprime with spar varnish.
   d. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
   a. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
   b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

E. Concrete floor surfaces to remain exposed shall be cleaned and properly acid etched per floor sealer manufacturer's instructions. Fill and patch holes, crevices, cracks, etc. Remove any paint, soil, loose material and dust. Remove oil or grease with a hot TSP solution and rinse thoroughly. Floor to be completely dry prior to etching with muriatic acid and water solution.

3.03 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.

4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
2. Omit primer over metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping.
2. Uninsulated plastic piping.
3. Pipe hangers and supports.

4. Tanks that do not have factory-applied final finishes.
5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
8. New rooftop gas piping.
9. All existing and new exterior conduit, gas, water and similar piping at face of exterior walls.

G. Electrical items to be painted include, but are not limited to, the following:
1. Switchgear.
2. Panelboards.
3. Electrical equipment that is indicated to have a factory-primed finish for field painting.

H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.

I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats.

L. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

M. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.04 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.05 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.

1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces prior to final inspection. Comply with procedures specified in PDCA-P1.

3.06 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
   1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a rust-inhibitive primer.
      a. Primer: Exterior ferrous-metal primer (SW Pro-Cryl Universal Primer, B66-310 Series).
      b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals (SW Pro Industrial Acrylic Gloss, B66-600 Series).
   2. Refer also to Division 09, Section "High Performance Coatings", for surfaces that receive high performance coatings rather than coatings specified in this Section.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated metal surfaces:
   1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a galvanized metal primer.
      a. Primer: Exterior universal metal primer (SW Pro-Cryl Universal Primer, B66-310 Series).
      b. Finish Coats: Exterior full-gloss acrylic enamel for ferrous and other metals (SW Pro Industrial Acrylic Gloss, B66-600 Series).
   2. Refer also to Division 09, Section "High Performance Coatings• • , for surfaces that receive high performance coatings rather than coatings specified in this Section.

C. Exterior concrete rubbed or parged concrete bases at light poles and similar conditions calling for paint finish on concrete: Provide the following finish systems over architectural concrete surfaces schedule for paint application:
   1. Exterior Satin Latex Finish: Two finish coats over concrete and masonry primer.
      a. Primer: Concrete and Masonry latex primer (SW A24W8300, Loxon Concrete and Masonry Primer).
      b. Finish Coats: Exterior Satin Latex (SW A82-100 Series, A-100 Exterior Latex Satin).

D. Cement Fiber Board: Provide the following paint finish systems over cement fiber board surfaces:
   1. Latex Satin Finish: Two finish coats over primer.
      a. Primer: Concrete and Masonry latex primer (SW A24W8300, Loxon Concrete and Masonry Primer).
         1) At fiber cement material, prime only cut surfaces, etc. that do not already have factory applied primer.
      b. Finish Coats: latex satin finish (Sherwin-Williams A-100 Exterior Latex Satin, A82-100 Series).

3.07 INTERIOR PAINT SCHEDULE

A. New Concrete Unit Masonry: Provide the following finish systems over new interior concrete masonry:
   1. Semigloss Acrylic-Enamel Finish: Two finish coats over a block filler.
      a. Block Filler: Concrete unit masonry block filler.(SW PrepRite, B25W25).
      b. Finish Coats: Pre-catalyzed water-based Semi-gloss epoxy (SW Waterbased Catalyzed Epoxy Gloss, B73-300).

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Eggshell Latex Finish: (Typical where not otherwise noted) Two finish coats over a primer.
    a. Primer: Interior gypsum board primer (SW ProMar Zero VOC Interior Latex Primer, B28W2600).
    b. Finish Coats: Interior eggshell latex (SW ProMar 200 Zero VOC Interior Latex Eg-Shel, B20-2600 Series).
2. Eggshell Epoxy Finish: (Provide epoxy finish at Kitchen, Food Prep, Dry Storage, receiving, and serving areas, at locker rooms, shower rooms, and restrooms, and other wet locations, and any other additional locations as indicated in Drawings): Two finish coats over primer.
    a. Primer: Interior gypsum board primer (SW ProMar Zero VOC Interior Latex Primer, B28W2600).
    b. Finish Coats: Interior epoxy (SW Pro-Industrial Pre-Catalyzed Waterbased Epoxy)

C. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.
    a. Primer: Interior zinc-coated metal primer.(SW Pro-Cryl Universal Primer, B66-310 Series).
    b. Finish Coats: Interior full-gloss acrylic enamel.(SW Pro Industrial Acrylic Semi-Gloss, B66-650 Series)
2. Refer also to Division 09, Section "High Performance Coatings", for surfaces that receive high performance coatings rather than coatings specified in this Section.

D. Zinc-Coated Metal: Provide the following finish systems over interior zinc-coated metal surfaces:
1. Full-Gloss Acrylic-Enamel Finish: Two finish coats over a primer.
    a. Primer: Universal metal primer (SW Pro-Cryl Universal Primer, B66-310 Series).
    b. Finish Coats: Interior / Exterior Gloss Acrylic Enamel (SW Pro Industrial Acrylic Gloss, B66-600 Series).
2. Refer also to Division 09, Section "High Performance Coatings", for surfaces that receive high performance coatings rather than coatings specified in this Section.

E. Dryfall Paint at areas of painted exposed to deck structure: Paint structure, deck, mechanical, plumbing, and other exposed metal items below structure as appropriate: 1 or 2 finish coats as required for complete coverage and consistent appearance, over 1 coat primer:
1. Primer: Alkyd or Acrylic primer as recommended by Manufacturer for metal substrate types.
2. Finish Coats: Dryfall Paint (Sherwin-Williams Pro Industrial Waterborne Acrylic Dryfall B42W81).

F. Interior Concrete Floors: Provide the following:
1. 1st coat - Sealer / Reducer (400 SF/gal.)
2. 2nd coat - Sealer / Reducer (600 SF/gal.)
    a. Exposed Concrete Finished Floors.

END OF SECTION

SECTION 10 14 16 - PLAQUES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes all labor, materials, equipment and services necessary to furnish and install all plaques as shown on the Drawings and as herein specified:
   1. Metal plaques.
      a. Cast plaque.
         1) Baked-Enamel or Powder-Coat Finish.

B. Related Requirements:
   1. Section 10 14 23 "Panel Signage" and Section 10 14 23.16 "Room-Identification Panel Signage" for plaques or signs similar to metal plaques, with or without frames, except that they are made of materials other than solid metal.
   2. Division 10 - Section "Dimensional Letter Signage".
   3. Division 10 - Section "Panel Signage".
   4. Division 10 - Section "Room-Identification Panel Signage".
   5. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for labels, tags, and nameplates for plumbing systems and equipment.
   6. Section 23 05 53 "Identification for HVAC Piping and Equipment" for labels, tags, and nameplates for HVAC systems and equipment.
   7. Section 26 05 53 "Identification for Electrical Systems" for labels, tags, and nameplates for electrical equipment.

1.03 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For plaques.
   1. Include fabrication and installation details and attachments to other work.
   2. Show plaque mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each plaque at least half size.
   4. Prepare shop drawings and schedule production of dedication plaque with adequate time for review, approval, and fabrication to ensure the plaque will be installed at substatial completion, or other date as may be required for dedication ceremony.

a. Where Owner is responsible for providing initial direction for design and layout, provide written notification to Owner not less than 4 months prior to scheduled substantial completion date that their direction is required, and copy Architect.
b. Submit initial shop drawings no later than 2 months, plus fabrication time, prior to scheduled substantial completion date, to ensure adequate time for Owner review and approval of dedication plaque(s).

C. Samples for Initial Selection: For each type of plaque, exposed component, and exposed finish.
1. Include representative Samples of available typestyles and graphic symbols.
2. Color and Finish Selections: Submit samples of all colors and finishes for selection or approval by Architect prior to fabrication. All samples shall be actual materials proposed or otherwise indicating accurate color, gloss and appearance of finished products. Websites and photocopy / printed materials are not accurate color renditions and are not acceptable.
3. Building Dedication Plaques: Owner will provide list of names, graphics and other information to be included on dedication plaques. Architect will suggest an arrangement of information on the plaque. Submit graphic layout of each plaque for review, in form of electronic files, until designs are approved by Owner.

1.05 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Maintenance Data: For plaques to include in maintenance manuals.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: [**Manufacturer of products**] [**An entity that employs installers and supervisors who are trained and approved by manufacturer**].

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of plaques that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Deterioration of finishes beyond normal weathering.
b. Deterioration of embedded graphic image.
2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design".

2.02 METAL PLAQUES

A. Cast Plaque : Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following
a. A.R.K. Ramos.

b. Original Metal Sign Company.
c. <Insert manufacturer's name>.

2. Plaque Material: Cast bronze.
3. Plaque Thickness: 0.25 inch.
4. Finishes:
   a. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color as selected by Architect from manufacturer's full range.
5. Background Texture: As selected by Architect from manufacturer's full range.
6. Integrally Cast Border Style: As indicated on Drawings .
7. Applied Frame Material, Style, and Finish: As indicated on Drawings.
8. Mounting: Concealed studs.
9. Text and Typeface: Typeface as selected by Architect from manufacturer's full range.
10. Owner shall provide layout, graphics and copy requirements for each sign. Fabricator is responsible to convert any non-vector graphics provided by Owner to vector graphic images as may be required. Architect and Construction Manager will provide image files of their respective logos in appropriate resolution as me be required for incorporation into plaques.
11. Architect and Owner shall approve rubbing prior to casting.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   3. Exposed Metal-Fastener Components, General:
      a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
   4. Plaque Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of plaque, screwed into back of plaque, or screwed into tapped lugs cast integrally into back of plaque unless otherwise indicated.
      b. Through Fasteners: Exposed metal fasteners matching plaque finish, with type of head indicated, installed in predrilled holes.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.04 FABRICATION

A. General: Provide manufacturer's standard plaques according to requirements indicated.
   1. Preassemble plaques in the shop to greatest extent possible. Disassemble plaques only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.

5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match plaque finish.
6. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Surface-Engraved Graphics: Machine-engrave characters and other graphic devices into indicated plaque surface to produce precisely formed copy, incised to uniform depth.
1. Engraved Metal: Fill engraved graphics with manufacturer's standard baked enamel.

C. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted plaques to suit plaque construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
1. Stainless Steel Brackets: Factory finish brackets to match plaque background finish unless otherwise indicated.

2.05 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that plaque-support surfaces are within tolerances to accommodate plaques without gaps or irregularities between backs of plaques and support surfaces unless otherwise indicated.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF METAL PLAQUES

A. General: Install plaques using mounting methods indicated and according to manufacturer's written instructions.
1. Install plaques level, plumb, true to line, and at locations and heights indicated, with plaque surfaces free of distortion and other defects in appearance.
2. Install plaques so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that plaque surfaces are clean and free of materials or debris that would impair installation.

4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:
   1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of plaque. Remove loose debris from hole and substrate surface.
      a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place plaque in position and push until flush to surface, embedding studs in holes. Temporarily support plaque in position until adhesive fully sets.
      b. Thin or Hollow Surfaces: Place plaque in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
   2. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
   3. Brackets: Remove loose debris from substrate surface and install bracket supports in position, so that plaque is correctly located and aligned.
   4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of plaque and of suitable quantity to support weight of plaque after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as plaque is applied and to prevent visibility of cured adhesive at plaque edges. Place plaque in position, and push to engage adhesive. Temporarily support plaque in position until adhesive fully sets.
   5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of plaque and of suitable quantity to support weight of plaque without slippage. Keep strips away from edges to prevent visibility at plaque edges. Place plaque in position, and push to engage tape adhesive.
   6. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach plaques to plate using method specified above.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed plaques and plaques that do not comply with specified requirements. Replace plaques with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as plaques are installed.

C. On completion of installation, clean exposed surfaces of plaques according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain plaques in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 16

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation..

1.02 SUMMARY

A. Section Includes all labor, materials, equipment and services necessary to furnish and install all signage as shown on the Drawings and as herein specified:
   1. Cast dimensional characters.

B. Related Requirements:
   1. Division 01 - for Project Identification Signage.
   2. Division 06 - Section "Rough Carpentry ", for blocking in walls.
   3. Division 09 - Section "Gypsum Board Assemblies".
   4. Division 10 - Section "Directories".
   5. Division 10 - Section "Plaques".
   6. Division 10 - Section "Panel Signage".
   7. Division 10 - Section "Room-Identification Panel Signage".
   8. Division 26 - Section "Low-Voltage Electrical Power Conductors and Cables", for electrical service and connections for internally illuminated signs.

1.03 DEFINITIONS

A. Illuminated: Illuminated by lighting source integrally constructed as part of the sign unit.

1.04 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.
   1. Include fabrication and installation details and attachments to other work.
   2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
   3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.
   4. Show locations of electrical service connections.
   5. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
   1. Include representative Samples of available typestyles and graphic symbols.

D. Product Schedule: For dimensional letter signs. Use same designations indicated on Drawings or specified.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.09 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Deterioration of finishes beyond normal weathering.
      b. Separation or delamination of sheet materials and components.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.02 DIMENSIONAL CHARACTERS

A. Cast Characters : Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A.R.K. Ramos.
      b. ASI Sign Systems, Inc.
      c. APCO Graphics, Inc.
   2. Character Material: Cast aluminum.
   3. Character Height: As indicated on Drawings.
   4. Thickness: As indicated on Drawings .
   5. Finishes:

a. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.

6. Mounting: Concealed studs.
7. Typeface: As indicated on Drawings.

2.03 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. Use concealed fasteners and anchors unless indicated to be exposed.
   2. For exterior exposure, furnish stainless steel devices unless otherwise indicated.
   3. Sign Mounting Fasteners:
      a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      b. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
      c. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

2.04 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
   1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
   2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
   3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
   4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
   5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
   6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
   7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
   1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish to match sign-background color color unless otherwise indicated.

2. Stainless Steel Brackets: Factory finish brackets [**to match sign background**] [**to match Architect's sample**] [**with No. 4**] <**Insert finish**> finish unless otherwise indicated.

2.05 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.06 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.

B. Color Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that electrical service is correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
   1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
   3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.03 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
1. Fully Recessed fire extinguisher cabinets.
2. Semi-Recessed fire extinguisher cabinets.
3. Fire extinguisher brackets.
4. Cabinet Identification.
5. Fire Department Key Vault for Building access.

B. Related Requirements:
1. Division 04 - Section "Unit Masonry Assemblies", for coordination of block-outs in masonry walls.
2. Division 06 - Section "Rough Carpentry", for coordination of blocking in walls.
3. Division 07 - Section "Joint Sealants".
4. Division 09 - Section "Gypsum Board Assemblies".
5. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets
6. Division 21, for coordination with fire sprinkler system design.
7. Division 26, for coordination of pathway for Knox Box security system connection.
8. Division 28, for coordination of security system connection to Knox Box tamper switch.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.
1. Include plans, elevations, sections, details, and attachments to other work.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.03 FIRE-PROTECTION CABINET <Insert drawing designation>

A. Cabinet Type: Suitable for fire extinguisher.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Babcock-Davis.
      b. Guardian Fire Equipment, Inc.
      c. J.L. Industries, Inc. a division of Activar Construction Products
      d. Larsen's Manufacturing Company
      e. Potter Roemer LLC.

B. Cabinet Construction: Nonrated**.**
   1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.
   1. Shelf: Same metal and finish as cabinet.

D. Recessed Cabinet: One-piece steel cabinet sized for extinguisher specified, with stainless steel finish. Top of rough opening for unit shall be at 54 inch above finished floor surface, unless otherwise dictated by governing authority. Cabinets shall be J.L. Industries Cosmopolitan series. Acceptable manufacturer's that may produce similar equal products include but not limited to Larsen's Architectural series.
   1. Fully Recessed at typical double stud wall and 6" stud walls.
   2. Trim:
      a. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box, to act as drywall bead.
      b. Trimless with Hidden Flange: Flange of same metal and finish as box overlaps surrounding wall finish and is concealed from view by an overlapping door.
      c. Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   3. Finish: Enamel coated steel.
   4. Door Style: Vertical Duo.
   5. Glazing: Clear Acrylic.

6. Fire Rating: Provide cabinet in rated walls equal to rating for that wall. Rated cabinets shall have double walls with fire-barrier material. Provide factory-drilled mounting holes.

E. Semi-Recessed Cabinet: One-piece steel cabinet with stainless steel finish with rolled-edge trim. Semi-recessed cabinets shall not project more than 4 inch from face of wall, and overall depth sized to fit specified fire extinguishers. Provide recessed handle where 4 inch projection of the cabinet is required. Top of rough opening for unit shall be at 54 inch above finished floor surface, unless otherwise dictated by governing authority. Cabinets shall be J.L. Industries Cosmopolitan series. Acceptable manufacturer's that may produce similar equal products include but not limited to Larsen's Architectural series.
   1. Semi-recessed at typical stud construction.: Designed to recess into 3-5/8 inch stud wall construction (nominal 4 inch recessed).
   2. Door Style: Vertical Duo tall, narrow light.
   3. Glazing: Clear Acrylic .
   4. Fire Rating: Provide cabinet in rated walls equal to rating for that wall. Rated cabinets shall have double walls with fire-barrier material. Provide factory-drilled mounting holes.

F. Fire Extinguisher Brackets: At [Kitchenettes], [Break Rooms], [Lawn Storage], and [other Type K extinguishers as well as CMU walls, provide brackets according to Section 10 44 16 "FIRE EXTINGUISHERS".

G. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.
   1. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

H. Fire Department Key Vault for Building access: Provide equal to Knox Knox-Vault 4400 Series single lock model, recessed mount with recessed mounting kit. Provide all hardware and accessories as required for complete, secure mounting and installation at wall construction indicated.
   1. Finish: Black.
   2. Provide with tamper alarm switch.

2.04 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.
   4. Prepare doors and frames to receive locks.
   5. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Fabricate door frames of one-piece construction with edges flanged.
   3. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.05 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare recesses for recessed and semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
   1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb to comply with manufacturer's instructions.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.

C. Fire Department Key Vault: At key vaults located on exterior building walls, wire tamper switch to building security system as shown in Drawings or specified elsewhere. Or where security system is not part of project scope or not indicated for key vault to be wired to security system, provide empty conduit with pull wire to above nearest accessible ceiling for future security system connection.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes the following types of portable fire extinguisher products:
   1. Multi-Purpose Class ABC Fire Extinguishers
   2. Class K Kitchen Fire Extinguishers
   3. Fire Extinguisher brackets

B. Related Requirements:
   1. Section 10 44 13 "Fire Protection Cabinets."
   2. Section 23 38 13 "Commercial-Kitchen Hoods" for fire-extinguishing systems provided as part of commercial-kitchen exhaust hoods.
   3. Division 21, for coordination with fire sprinkler system design.
   4. Division 26, for coordination of pathway for Knox Box security system connection.
   5. Division 28, for coordination of security system connection to Knox Box tamper switch.

1.03 ACTION SUBMITTALS

A. Product Data: Manufacturer's product literature, both pictorial and written, for each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.06 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
      b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: UL Listed products, labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.02 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each indicated.
   1. Manufacturers: Basis of Design products listed. Subject to compliance with requirements, provide products by one of the following:
      a. JL Industries Inc.; A division of the Activar Construection Products Group
      b. Larsens Manufacturing Company
   2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
   3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multi-purpose Class ABC Fire Extinguishers: Provide all extinguisher cabinets with ABC type extinguishers unless otherwise noted. ABC Fire extinguishers shall be a multi-purpose dry chemical type, enameled metal containers with pressure indicating gauges, rated for Class A, B, and C fires.
   1. At Fire Extinguisher Cabinets, provide 10 lb extinguishers, 4A-80BC rated, equal to the following:
      a. J. L. Industries Model Cosmic 10E, with MB846A bracket at bracket mounted locations.
      b. Larsen's Model MP10 with nozzle, with B-2 bracket at bracket mounted locations.
   2. Where locations for specified extinguishers are not indicated in Drawings, confirm exact locations with Architect.

C. Class K, Kitchen Fire Extinguishers: Provide (1) extinguisher on bracket mount at each kitchen area equal to J.L. Industries Saturn 15, or Larsen's WC 6L, wall-mounted, wet chemical type, K class rated, 1.8 gallon capacity fire extinguishers.
   1. Bracket: J.L. Industries MB810C, or equal.

2.03 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standardsteel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish. (at CMU walls and other locations where cannot be recessed or semi-recessed in cabinet)
   1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. Babcock-Davis.
      b. Guardian Fire Equipment, Inc.

c. JL Industries, Inc.; a division of the Activar Construction Products Group.
d. Larsens Manufacturing Company.
e. Potter Roemer LLC.

2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
a. Orientation: Vertical.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 10 51 56 - TURNOUT GEAR LOCKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Provide and install turnout gear lockers units as shown on the drawings and as herein specified.

B. Related Sections include the following:
   1. Division 4, Section "Unit Masonry Assemblies".
   2. Division 06 Section "Rough Carpentry"

1.03 PRODUCT DELIVERY AND STORAGE

A. Deliver all products to job site in manufacturer’s original, standard containers with seals unbroken and labels intact. Store in clean, dry area. Handle and protect materials and finishes to prevent damage.

1.04 SUBMITTALS

A. Product Data: Submit manufacturers product literature for all products specified.

B. Shop Drawings: Submit shop drawings for each run of lockers. Indicate attachments to substrates and coordination with project dimensions and conditions.

C. Samples: Submit manufacturer's standard color samples for color selections.

1.05 WARRANTY

A. Manufacturer's standard limited warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Turnout Gear Lockers: Provide storage units equal to "Geargrid Wall Mount Lockers" as manufactured by Gear Grid, (888) 643-6694, www.geargrid.com.
   1. Lockers: Open Faced Wall-mounted and Mobile rack locker units on casters**,** as indicated on the drawings.
      a. Width: 20 inch nominal
      b. Depth 20 inch nominal
      c. Height 74 inch nominal (wall mounted), 83 inch nominal (mobile / floor mounted).
      d. Frame: High strength ASTM A513 1-1/4 inch diameter x 16 gauge steel tubing
      e. Panel Construction: Sides and backs of high strength ASTM A510 cold drawn 1/4 inch diameter wire resistance welded in 3 inch square pattern.

1) Two full width shelves per unit, located at top and bottom, constructed of high strength 1/4 inch wire.
2) Number / Name Plates on top shelf: 20 gauge steel, to accept printed tags.

f. Accessories:
1) Apparel Hooks: (3) .25 inch diameter wire hooks per locker.
2) Rod and Hangers: Provide each locker unit with one full width hanging rod with the following hangers:
a) Three heavy duty hangers.
b) One Heavy Duty Gear Dryer hanger, designed to hold gear jackets open to allow faster drying.
c) One Gloves hanger, designed to hold one pair of gloves and to allow faster drying.
3) Top-side Storage: Provide top shelf over lockers matching panel construction, at all locker units.

g. Mounting Brackets: 11 gauge steel

B. Finish: All components excluding assembly and mounting hardware and stainless steel components to receive high grade durable powder coat enamel finish.
1. Gear Lockers Color: Red.

PART 3 - EXECUTION

3.01 INSPECTION AND ADJUSTMENTS

A. Examine units for damage. Do not install damaged units.

B. Examine all surfaces receiving gear storage units for any defects that would impair installation and if any are found, make such corrections as necessary.

3.02 INSTALLATION

A. Assemble and install units using manufacturer's standard recommended methods. Use manufacturer's standard hardware for assembly and mount units securely to substrated indicated using hardware recommended by Manufacturer.

B. Ensure lockers are installed above top of resilient base, unless noted otherwise.

3.03 PROTECTION AND CLEANING

A. Clean exposed surfaces.

B. Protection: Installer shall advise General Contractor of final protection and maintenance conditions necessary to ensure that work will be without damage at time of acceptance.

END OF SECTION

SECTION 10 75 16 - GROUND-SET FLAGPOLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section includes ground-set flagpoles, including all standard fittings as specified herein. Actual location of flagpoles as shown on Drawings or directed by Architect.
   1. Metal Type:
      a. Basis of Design Aluminum Flagpoles
         1) External Halyard System

B. Related Sections include the following:
   1. Division 3 Section: Concrete.
   2. Division 26, Electrical, for grounding requirements and lighting installed at top of pole.

1.03 ACTION SUBMITTALS

A. Shop Drawings: For each flagpole.
   1. Include the following
      a. Plans, elevations, and attachment details. Show general arrangement, jointing, fittings, accessories, grounding, anchoring, and support.
      b. Section, and details of foundation system.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Flagpole assemblies, including anchorages and supports, to withstand design loads indicated within limits and under conditions indicated.

1. Wind Loads: Determine according to NAAMM FP 1001-07, “Guide Specifications for Design of Metal Flagpoles”, or to specified wind speed indicated on the drawings, whichever is more stringent
2. Base flagpole design on nylon or cotton flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2.03 BASIS OF DESIGN ALUMINUM FLAGPOLES

A. Manufacturers: Flagpole specifications are based upon flag poles and manufactured by Concord Industries, Inc., 4150A Kellway Circle, Addision TX 75001, 800-527-3902, www.concordindustries.com. Subject to compliance with requirements, provide the named products or comparable products by another manufacturer.
   1. Substitutions: Permitted.

B. Equal to the following specifications for Concord Industries "Continental", with the following standards and options:
   1. Flag Poles: Commercial ground set, one piece, cone tapered aluminum (6063-T6) flagpole.
      a. Number of poles: As indicated in Drawings.
      b. Exposed height: 30 feet - 0 inch.
      c. Outside Butt Diameter: 6 inch
      d. Wall Thickness: .188 inch
      e. Finish: Flagpole finish, deep luster, highly polished.
   2. Base, spun aluminum flash collar.
      a. Equal to Concord #FC11.
   3. Flag Arrangement:
      a. Single flag of size[s] indicated.

b. Two flags per pole of sizes indicated.Flags: Provide the following flags, with rip stop nylon furnished with two non-corrosive grommets:

1) American flag with embroidered stars and sewn stripes: 4 feet x 6 feet.
2) Texas State Flag: 4 feet x 6 feet.

   4. Halyards and Truck Assembly: External halyards, two sets of #10 white water-proof polypropylene, each equipped with 2 chrome swivel snaps.
      a. Cleats ““ Two 9 inch aluminum. Tamperproof stainless head bolts.
      b. Truck - Cast aluminum with stainless steel ball bearings and 2 sheaves.
      c. Cleat Cover and Halyard Boxes: Key operated cylinder lock box of finish to match pole.
   5. Foundation sleeve - #16 gauge galvanized steel, with steel base plate and as detailed on the drawings.
   6. Finial: #14 gauge aluminum ball with a flush seam and gold anodized finish.
      a. Manufacturer's standard flush seam ball in size to match pole butt diameter.

2.04 MISCELLANEOUS MATERIALS

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M.

B. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.

C. Sand: ASTM C33/C33M, fine aggregate.

D. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate installation of lighting and electrical work with other trade as required.

B. Coordinate adjacent new paving/surfacing installation to slope away from the base of the light pole(s).

3.02 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms to prevent displacement during concreting.

D. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.

E. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.

F. Anchor Bolts: Locate and secure anchor bolts in forms with templates and by tying to reinforcement.

G. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.

H. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.03 FLAGPOLE INSTALLATION

A. Prior to installation, verify that pole equipment may all be installed in accordance with the manufacturer's recommendation; notify the Architect of any areas of discrepancy before proceeding with the installation.

B. General: Install foundations and flagpoles where indicated and according to[**Shop Drawings and**] manufacturer's written instructions.

C. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

D. Baseplate: Cast anchor bolts in concrete foundation. Install baseplate on washers placed over leveling nuts on anchor bolts and adjust until flagpole is plumb. After flagpole is plumb, tighten retaining nuts and fill space under baseplate solidly with nonshrink, nonmetallic grout. Finish exposed grout surfaces smooth and slope 45 degrees away from edges of baseplate.

END OF SECTION 10 75 16

SECTION 12 36 61.19 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. General Coordination Procedures, (Reference Specification Section 01 31 00) General Contractor shall coordinate construction operations included in different Sections of the

C. Specifications to ensure efficient and orderly installation of each part of the Work that depend on each other for proper installation, connection, and operation.

1.02 SUMMARY

A. Section Includes:
   1. Quartz agglomerate countertops.
   2. Quartz agglomerate backsplashes.
   3. Quartz agglomerate end splashes.
   4. Quartz window sills.
   5. Countertop joints

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
   2. Section 06 41 16 "Plastic Laminate Clad Architectural Cabinets"
   3. Division 22 Sections for plumbing fixtures and fittings.
   4. Division 26 Sections for electrical devices installed in architectural woodwork.

1.03 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:
   1. Countertop material; Provide 3 - 6 inches square samples for review and approval..

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator and installer**.**

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.08 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.01 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
   2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings :
   3. Colors and Patterns: As indicated by manufacturer's designations.

B. Wood Underlayment Material:
   1. Core Material at countertops: Exterior-grade MDO plywood.
   2. Use fire retardant treated material at fire retardant treated cabinets.

2.02 QUARTZ WINDOW SILLS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings and matching Quartz Countertops finish.

B. Thickness: 1cm thickness at window sills.

2.03 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
   1. Grade: Custom.
   2. Units fabricated and designed to with-stand a 200 lb. per sq. ft. loading condition without the use of vertical supports. Fabricator shall indicate on shop drawings any special locations for stud supports as required for attachment of countertops.
   3. Provide welded steel tube support frames to support countertops at wide spans between base cabinets, walls, or other countertop supports. Conceal steel tubes in adjacent wall, countertop, and cabinet construction to maximum extent possible unless specifically detailed otherwise. Refer to Division 5, Section - Metal Fabrications for general requirements. Provide steel supports as follows:
      a. Where specifically detailed in Drawings.
      b. Where required to achieve loading criteria specified.

4. Junction between countertops and non-integral splashes caulked with clear silicone sealant providing a tight sanitary joint. Junction between splash, countertop or any casework and wall shall be caulked with silicone sealant of color to match wall or adjacent construction.

B. Configuration:
   1. Backsplash: Straight, slightly eased at corner.
   2. End Splash: Matching backsplash.

C. Countertops: 3/4-inch- thick, quartz agglomerate.

D. Backsplashes: 3/4-inch- thick, quartz agglomerate.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
   1. Fabricate with loose backsplashes for field assembly.

F. Joints: To the greatest extent possible fabricate countertops without joints.
   1. Joints: Fabricate countertops in sections for joining in field.
   2. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
   3. Joint Type: Bonded, 1/32 inch or less in width.
   4. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints[where indicated]. Make width of cuts slightly more than thickness of splines to provide snug fit.[Provide at least three splines in each joint.]

G. Cutouts and Holes:
   1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
      a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
   2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
   3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.04 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into corner blocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
   1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
   2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

I. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61.19

SECTION 21 00 00 - FIRE PROTECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, hose connections, and equipment covered by this Section, with all appurtenances, ready for owner's use.

1.03 RELATED WORK

A Section 21 02 01 - Coordination Drawings

B Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

C Section 21 13 13 - Wet Pipe Sprinkler System

D Section 21 13 16 - Dry Pipe Sprinkler Systems

E Section 213113

F Section 221200

1.04 REFERENCES

A ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

B ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe

C ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

D FM Global Fire Protection Standards

E NFPA 13 - Standard for the Installation of Sprinkler Systems

F NFPA 14 - Standard for the Installation of Standpipe and Hose Systems

G UL - Underwriters Laboratories

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D Domestic Manufacture: All valves, pipe, fittings, hose connections, and equipment shall be by a domestic manufacturer.

1.06 SUBMITTALS

A Submit shop drawings in accordance with Section 22 02 00 and as described below.

B Submit shop drawings of entire water-based building fire protection system with all standpipe, hose valve, and hose connection locations, including the accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

C Submit complete product data for 213113 concurrently with the submittal for this Section, for all systems served by such equipment.

D Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

E Submit product data to include pipe materials, pipe fittings, valves, hose connections, waterflow and alarm devices, and other appurtenances. Provide manufacturer’s catalog information, product certifications, and **country of origin**. Indicate valve data and ratings.

1.07 REGULATORY REQUIREMENTS

A Work in accordance with:

1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems
3. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances
4. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
5. Local codes that have jurisdiction.

B Products in accordance with:

1. UL (Underwriters Laboratories) listed.
2. FM (Factory Mutual) approved.
3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.08 CERTIFICATE OF TESTING

A Furnish Owner with test certificate certifying the system approved by:

1. Fire Marshal.

2. Insurance Services Officials.

PART 2 - PRODUCTS

2.01 GENERAL

A Work included:

1. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, hose connections, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.

2. Coordinate work and installation with electrical and fire alarm contractors accordingly to interface system with the building fire and smoke alarm systems.

B Requirements:

1. Materials and installation to meet or exceed the requirements of NFPA 13 and 14, (prevailing editions) and the local authority having jurisdiction (AHJ).

2. All components of the system shall be UL listed for the intended service.

3. Provide components with minimum pressure ratings as suited for system working pressure(s).

4. All hose connections shall be provided with approved threads, caps, and chains.

2.02 FIRE HOSE VALVES, CONNECTIONS, AND EQUIPMENT

A General requirements: All hose valves shall be listed. All hose connections shall be provided complete with connections, caps and chains conforming to local Fire Department requirements.

B Acceptable Manufacturers:

1. Potter-Roemer

2. Dixon

3. Elkhart Brass

4. Croker

C FIRE DEPARTMENT CONNECTIONS: No less than 4” and two-way type, with additional connections and in larger size in accordance with system demand per NFPA. Polished chrome plated brass with lettering consistent with system type and service. Back, top, or bottom outlet as required for placement and wall construction for building mounted variations. Provide complete with accessibly located, listed check valve with approved automatic drip valve. Potter-Roemer Model 5751 (building mounted), Model 5761 (free-standing) or similar model with features as required and as described above.

PART 3 - EXECUTION

3.01 DESIGN

A The Contractor shall conform to the requirements of NFPA 14 for standpipe and hose system design and installation. It shall be the Contractor's responsibility to determine if any deficiency or deviations exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

3.02 INSTALLATION

A Install all items in accordance with applicable codes.

B Piping shall be protected accordingly where subject to mechanical damage and/or fire damage.

C Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D Piping (mains and standpipes) shall be protected accordingly from freezing temperature with the use of supervised and listed heat tracing with insulation and jacketing.

E In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

F Piping in finished spaces shall be routed concealed. This shall not include areas such as mechanical spaces, parking garages, and stairways. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G All standpipes shall be provided with a means of draining and shall be arranged to discharge water at an approved location.

H Identify all locations requiring coordination with the electrical and fire alarm contractors accordingly to ensure connectivity with the building fire and smoke alarm systems. This shall include, but is not necessarily limited to, the following: water flow switches, alarm bells, and tamper/supervisory switches at control valves.

I At building expansion joints provide approved system expansion joint fittings/assemblies accordingly and per manufacturer's recommendations and NFPA 13 requirements. Victaulic Style 155 carbon steel expansion joint for sizes up to and including 12" pipe.

3.03 PAINTING AND PIPE IDENTIFICATION

A Painting of fire protection piping and appurtenances shall be provided as follows:

1. Surfaces to be painted shall be cleaned as necessary to ensure they are free from dirt and oils.

2. Unless directed otherwise by Architect, heat and water resistant, air-cured, high performance one-part epoxy paint shall be provided. Coating shall be high-gloss, lead-free, suited for indoor and outdoor use, and USDA approved. Armor-Poxy or similar.

3. Fire sprinkler risers and associated alarm valves and related piping exposed in occupied spaces shall be painted red.

4. Fire protection and sprinkler piping exposed in occupied spaces shall be painted as directed by Architect.

5. Fire protection and sprinkler piping exposed in unoccupied accessory areas such as stairways shall be painted red unless directed otherwise by Architect.

B Identification of fire protection piping shall be provided as follows:

1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.

2. All exterior visible piping shall be provided with pipe markers.

3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.

4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.

    a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.

    b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.

    c. Markers shall indicate the pipe service, include flow directional arrows, and meet ANSI/ASME A13.1-2015.

5. Acceptable manufacturers:

    a. Seton Setmark Pipe Markers

    b. Brimar Industries Pipemarker System 1 Pipe Markers

    c. Brady Corporation

6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer's installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.

7. Markers shall be provided in accordance with ANSI/ASME A13.1-2015 requirements. **Specific items indicated below are not intended as a substitute for this complete standard**. Markers shall be provided:

   a. On both sides of each floor or wall penetration.

   b. On each side of each tee.

   c. On each side of each valve and/or valve group.

   d. On each side of each piece of equipment.

   e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.

   f. In congested areas, on each pipe at the point it enters and exits the area.

   g. At the point of connection to each piece of equipment and automatic control valve.

   h. Where they are readily visible to personnel from the point of normal approach.

   i. With letter height and length of color field according to the size of the pipe served.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White

3.04 REPLACEMENT

A Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.05 TESTING

A Upon completion of the installation, test the system and obtain approval of the local fire insurance rating organization having jurisdiction.

3.06 TRAINING

A Owner's people shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B Routine maintenance, yearly maintenance, winterization, and spring start-up shall be fully discussed and documented.

C Names of those instructed and dates, as well as a list of information handed over to the owner, shall be included in the final report.

END OF SECTION 21 00 00

SECTION 21 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.02 COORDINATION DRAWINGS

A The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.

C Submitting the contract drawings as coordination drawings will not be acceptable.

D The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4” scale drawings for review.

G The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

    a. Wall and type locations.

    b. Clearances for installing and maintaining insulation.

    c. Locations of light fixtures and sprinkler heads.

    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

    e. Equipment connections and support details.

    f. Exterior wall and foundation penetrations.

g. Routing of storm and sanitary sewer piping.

h. Fire-rated wall and floor penetrations.

i. Sizes and location of required concrete pads and bases.

j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.

H Sequence of Coordination

1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated.

a. Structural and Architectural model

b. Miscellaneous steel

c. Perform preliminary space allocation

d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)

e. Main and medium pressure ducts from the shaft out

f. Main graded plumbing lines and vents

g. Sprinkler mains and branches

h. Cold and hot water mains and branches

i. Lighting fixtures and plumbing fixtures

j. Smaller sized ducts and flex ducts

k. Smaller size cold water and hot water piping, flex ducts, etc.

I The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION 21 02 01

SECTION 21 05 29 - HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A Pipe hangers, supports, and associated appurtenances.

B Sleeves and seals.

1.02 RELATED WORK

A Section 21 00 00 - Fire Protection

B Section 21 13 13 - Wet Pipe Sprinkler System

C Section 21 13 16 - Dry Pipe Sprinkler Systems

D Section 213113

1.03 REFERENCES

A ASME B31.1 - Power Piping.

B NFPA 13 - Standard for the Installation of Sprinkler Systems.

C NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.

1.04 QUALITY ASSURANCE

A Supports for Sprinkler Piping: In conformance with NFPA 13.

B Supports for Standpipes: In conformance with NFPA 14.

1.05 SUBMITTALS

A Submit shop drawings and product data under provisions of Division One.

B Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A Hangers for Pipe Sizes up through 2 Inch: Carbon steel, adjustable swivel ring type with rounded edge design, UL listed and FM approved. Anvil International Figure 69.

B Hangers for Pipe Sizes 2-1/2 Inch and larger:

1. Carbon steel, adjustable clevis type, UL listed and FM approved. Anvil International Figure 260.

2. Carbon steel, adjustable swivel ring type, UL listed and FM approved. Anvil International Figure 69.

3. Carbon steel, UL listed straps & hangers with beveled edge design and/or plastic coating for abrasion protection of and intended for use with CPVC piping (only where such pipe material is specified). Anvil International.

C Building structure attachments for hangers: Ductile iron, universal C-type clamps, UL listed and FM approved. Anvil International Figure 92, 93, 94.

D Vertical Piping Supports: Carbon steel riser clamp. Anvil International Figure 40.

E Floor Supports for pipe headers and similar horizontal runs of pipe: Steel pipe stand assembly.

1. Cylindrical pipe stanchion assembly complete with malleable iron flange or welded steel flange base plate secured to the floor by an approved method with listed anchors.

2. Each base plate shall be attached to the floor with a minimum of four (4) anchors no smaller than 1/2" diameter, per NFPA 13.

3. Provide pipe saddle support with steel U-bolt yoke and nuts to attach piping to each stand.

4. Anvil International Figure 63, Type P with Figure 259 saddle support.

F Equivalent UL listed, FM approved hanger and support products by Eaton B-Line shall also be acceptable.

G For installation of protective shields refer to Article 3.3.

2.02 HANGER RODS

A Galvanized or cadmium plated carbon steel hanger rods: Threaded both ends, threaded one end, or continuous threaded. Provide rod couplings in matching finish.

2.03 INSERTS/FASTENERS

A Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

B Fasteners: For wood construction and for metal purlin and metal deck applications only, the use of appropriate self-drilling fasteners (UL listed, FM approved, manufactured in USA) provided in accordance with manufacturer's recommendations shall be acceptable. ITW Buildex "Sammys" products or pre-approved equal.

2.04 SLEEVES

A All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.

B Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:

1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.

2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.

3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.

C Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

D Caulk: Paintable 25-year acrylic sealant.

E Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.05 FABRICATION

A Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B Design hangers without disengagement of supported pipe.

2.06 FINISH

A Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A Support horizontal piping with maximum distance between hangers and minimum hanger rod diameters as follows:

Pipe Size	Max. Hanger Spacing	Min. Rod Diameter
(Steel Pipe)		
1 to 1-1/4 inch	10'-0"	3/8"
1-1/2 to 3 inch	12'-0"	3/8"
4 to 6 inch	12'-0"	1/2"
8 to 10 inch	12'-0"	5/8"
12 to 14 inch	12'-0"	3/4"
(CPVC Pipe, only where specified)		
3/4 to 1 inch	4'-0"	3/8"
1-1/4 to 1-1/2 inch	4'-0"	3/8"
2 to 3 inch	6'-0"	3/8"

B Where a listed CPVC pipe manufacturer's maximum hanger spacing is more stringent than the spacing above, it shall be followed.

C Spacing of hangers for unbroken lengths of CPVC pipe shall be permitted to be increased to a maximum of 5'-6" for 3/4" piping and 6'-0" for 1" through 1-1/2" piping.

D Ensure to adequately secure sprinkler piping to restrict the movement of piping upon sprinkler operation. Where listed CPVC pipe is specified, supports must be provided as required in accordance with the pipe manufacturer's recommendations.

E Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

F Place a hanger within 12 inches of each horizontal elbow and at the vertical to horizontal transition.

G Use hangers with 1-1/2 inch minimum vertical adjustment.

H Ensure that hanger rods are only loaded axially (along the rod). Provide additional hangers or restraints as necessary to minimize non-axial loads

I Threaded sections of rod shall not be formed or bent, neither prior to nor as a result of installation.

J Support vertical piping at every floor. Distances between supports for risers shall not exceed 25 feet.

K In multi-story buildings (in addition to at every floor) riser supports shall be provided at the lowest level, above and below offsets, and at the top of the riser.

L Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

M Support riser piping independently of connected horizontal piping.

N Install hangers with a nut at the base and above the hanger; tighten upper nut to hanger after final installation adjustments.

O Where piping is subject to seismic activity, ensure to provide protection measures in accordance with NFPA 13 requirements.

3.03 INSULATED PIPING

A Comply with the following installation requirements.

B Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

C Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation.

D Shields: Install protective shields MSS Type 40 on cold and chilled water piping that has vapor barrier. Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Length	Thickness
1/4 through 3-1/2 inch	12 inch	0.048 inch
4 inch	12 inch	0.060 inch
5 through 6 inch	18 inch	0.060 inch
8 through 14 inch	24 inch	0.075 inch
16 through 24 inch	24 inch	0.105 inch

E Piping 2” and larger provide galvanized sheet metal shields with calcium silicate at hangers/supports.

F Insert material shall be at least as long as the protective shield.

G Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A Provide equipment bases of concrete.

B Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C Construct support of steel members. Brace and fasten with flanges bolted to structure.

3.05 SEALS

A Provide flexible watertight sealant where piping penetrates waterproofed walls, floors, and roofs.

B Where dry sprinklers are connected to wet pipe sprinkler systems protecting areas subject to freezing temperatures (such as, but not necessarily limited to, insulated freezer structures) ensure that the clearance space around the sprinkler barrel is completely sealed in accordance with the manufacturer's recommendations.

3.06 SLEEVES

A Set sleeves in position in formwork. Provide reinforcing around sleeves.

B Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.

C Where piping penetrates a floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

D Fire protection sleeves may be flush with floor of stairways.

END OF SECTION 21 05 29

SECTION 21 13 13 - WET PIPE SPRINKLER SYSTEM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

C Refer to Section 21 00 00 for integral requirements.

1.02 SCOPE

A Scope of the work shall include the furnishing and complete installation of the fire protection piping, valves, sprinkler heads, and equipment covered by this Section, with all appurtenances, ready for owner's use.

B The scope of work shall include the painting and pipe marking of fire sprinkler system piping as described in Section 21 00 00.

C The scope of work shall include providing UL listed, FM approved factory-assembled automatic release air vents on sprinkler branch lines for the reduction of trapped air in the sprinkler system. Provide each complete with isolation valve, union or quick connect, wye strainer with valve, and drain line to drain in accordance with manufacturer’s recommendations and local requirements.

D The provision of air vents shall be coordinated with any other systems or treatment for general corrosion or MIC (Microbiologically Influenced Corrosion) that may be specified.

1.03 RELATED WORK

A Section 21 00 00 - Fire Protection

B Section 21 02 01 - Coordination Drawings

C Section 21 05 29 - Hangers and Supports for Fire Suppression Piping and Equipment

D Section 211350

E Section 21 13 16 - Dry Pipe Sprinkler Systems

F Section 211317

G Section 213113

1.04 REFERENCES

A ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

B ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.

C ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.

D ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

E AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

F NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; 2024.

H NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

I NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2023.

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and **country of origin**.

D Domestic Manufacture: All valves, pipe, fittings, sprinkler heads, and equipment shall be by a domestic manufacturer.

E Welding Procedures and Performance:

1. Meet or exceed the requirements of AWS B2.1/B2.1M “Welding and Brazing Qualifications”; as well as any local AHJ requirements.

2. Maintain and be able to produce complete certified records, including, but not necessarily limited to, the following: Welding Procedure Specifications (WPS’s), Procedure Qualification Records (PQR’s), and welder qualification records.

1.06 SUBMITTALS

A Submit shop drawings in accordance with Section 22 02 00 and as described below.

B Submit product data with manufacturer’s catalog information, product certifications, and **country of origin** identified. Indicate valve data and ratings. Product data to be submitted shall include, but not necessarily be limited to, the following:

1. Pipe material
2. Pipe fittings and couplings
3. Sprinkler heads and guards
4. Valves, air release vents, and backflow preventers
5. Waterflow, supervisory and alarm devices
6. Fire-stopping sealant and pipe marker products
7. Spare sprinkler head box, signage, and other accessories
8. Include a schedule of wall sleeves to be provided

C Product data for hangers and and supports *may* be submitted under this section, although these items are specified under Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

D Submit shop drawings of entire sprinkler system with all head locations and including accompanying hydraulic calculations to the Architect/Engineer for review. **A current and fully documented fire hydrant flow test must be included.**

E Submit complete product data for 213000 **concurrently** with the submittal for this Section, for all systems served by such equipment.

F Provide Architect with six complete sets of final approved shop drawings before starting the installation. Include details of the sprinkler system showing sections, light fixtures, ducts, and a plan indicating fire department connections, location of all exposed structures within twenty feet of this structure, and other equipment to be used. Drawings shall bear the stamp of review of the local fire insurance rating organization having jurisdiction.

G Service Utility Diagram: Furnish Architect with an accurately marked print showing location of underground pipes and valves as installed upon completion of underground work.

H Where a project is required to comply with FM Global requirements, ensure to submit a set of drawings, hydraulic calculations, and other required documentation to a designated representative of FM Global for review and acceptance prior to the start of any system installation.

1.07 REGULATORY REQUIREMENTS

A Work in accordance with:

1. NFPA 13
2. NFPA 14
3. NFPA 24
4. NFPA 25
5. Requirements of the local Authority Having Jurisdiction (AHJ).

6. FM Global Datasheet 2-0.

B Products in accordance with:

1. UL listed.

2. FM (Factory Mutual) approved.

3. Requirements of the local Authority Having Jurisdiction (AHJ).

1.08 CERTIFICATE OF TESTING

A Furnish the Owner with test certificate certifying the system approved by:

1. Fire Marshal

2. Insurance Services Officials

PART 2 - PRODUCTS

2.01 GENERAL

A Work included:

1. Design, coordination, furnishing, and installation of inside and outside piping, valves, sprinkler heads, hangers, supports, and sleeves.

2. The sprinkler system is an automatic wet pipe type system and shall be designed to provide coverage for the entire building unless specifically indicated otherwise.

   a. The Contract Drawings indicate the general extent and arrangement.

   b. The Contract Drawings identify rooms and spaces, which may aid in the determination of the various occupancy hazard classifications.

   c. Sprinkler heads are not shown.

3. The Drawings provide a preliminary layout with locations of water service entry/water supply, control valves, riser assembly/zone valves, and fire department connection(s). These are a guide for the subsequent preparation of the Licensed Fire Sprinkler Contractor's detailed working drawings.

4. Coordinate work and installation with electrical and fire alarm contractors accordingly. Ensure that power is provided at required locations. Ensure that system is interfaced with the building fire and smoke alarm systems. This shall include, but not necessarily be limited to:

   a. Flow and tamper switches - including any remote locations such as backflow preventer vaults, water supply post indicating valves, etc.

   b. Waterflow signals ensure the immediate shut down of associated HVLS fans per NFPA 13, 11.1.7.

B Requirements:

1. Materials and installation to meet or exceed the requirements of NFPA 13, prevailing edition and the local Authority Having Jurisdiction (AHJ).

2. All components of the system shall be UL listed for the intended service.

3. Provide components with minimum pressure ratings as suited for system working pressure(s).

2.02 VALVES

A General requirements:

1. Valves shall be rated for no less than 175 psi.

2. All valves controlling connections to water supplies and to supply pipes to sprinklers shall be listed indicating valves.

3. Drain and test valves shall be approved.

4. All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal identification signs.

5. Provide as indicated on the Drawings and configured in accordance with the requirements of the local Authority Having Jurisdiction.

6. A listed relief valve not less than 1/2" in size shall be provided on each wet pipe system, in accordance with NFPA 13 requirements. Provide a piped drain line to the outdoors for each such valve.

B Alarm Valves

1. Riser alarm valves shall be UL listed, FM approved alarm check valve type complete with pressure actuated switch or riser check valve type with a listed vane type waterflow alarm switch.

   a. Approved pressure gauges shall be provided on both the supply and system sides of the valve.

   b. Valve body shall include a removable cover for check clapper access.

2. Local waterflow alarm devices shall be a listed water-motor operated device or an electrified bell type for outdoor installation. Additionally, provide an electrified bell for indoor installation. System Sensor, Potter, or Reliable.

3. Provide connectivity to the building fire alarm system.

4. Acceptable valve manufacturers:

   a. Reliable

   b. Viking

   c. Tyco-Grinnell

d. Victaulic (acceptable for alarm check valve variations only)

C Control Valves (Gate)

1. Control valves shall be UL listed, FM approved bronze trimmed resilient wedge gate type.

2. Provide bronze bodied, rising stem, inside screw type for sizes 2" and smaller. Provide ductile iron bodied, rising stem, outside screw and yoke type for sizes 2-1/2" and larger.

3. Acceptable manufacturers:

a. Mueller Company

b. Kennedy Valve

c. Victaulic

d. Nibco

D Control Valves (Butterfly)

1. Control valves shall be UL listed, FM approved ductile iron bodied, gear operated with flag, butterfly type.

2. Acceptable manufacturers:

a. Reliable

b. Kennedy Valve

c. Tyco-Grinnell

d. Victaulic

e. Nibco

E Check Valves

1. Check valves shall be UL listed, FM approved ductile or cast iron bodied, bronze fitted, non-slam type, suited for horizontal or vertical installation.

2. Acceptable manufacturers:

a. Mueller Company

b. Kennedy Valve

c. Victaulic

d. Nibco

e. Tyco-Grinnell

F Test and Drain Valve Assemblies shall be UL listed, FM approved bronze bodied ball valve type complete with tamper resistant test orifice and sight glasses. AGF Manufacturing, Inc.

G Automatic air release valve and vent assemblies shall be UL listed, FM approved and provided complete with brass or bronze bodied ball valves, stainless steel mesh strainers, and float operated air release valves. Acceptable manufacturers:

1. Engineered Corrosion Solutions PAV-W.
2. Tyco TAV-W.
3. Potter PAAR-B.

H Backflow Preventers: Provide as indicated on the Drawings and in accordance with the requirements of the water supplier and public health authority having jurisdiction. All such devices shall be listed for fire protection service.

2.03 PIPE AND FITTINGS

A Underground service entry shall be: UL listed, FM approved, NFPA 24 compliant, type 304 stainless steel, pre-fabricated in-building riser. Acceptable manufacturers:

1. Ames Fire & Waterworks
2. Zurn Wilkins

B All sprinkler system piping above grade shall be (refer to 21 00 00 for **standpipe** system piping):

1. ASTM A135/A135M / ASTM A53/A53M schedule 10 black steel pipe with roll-grooved ends, joined with mechanical couplings and with manufactured carbon steel grooved fittings with matching mechanical couplings for pipe 2-1/2" and larger. Fittings shall be fully metallically formed type with an independent gasket and coupling at each pipe connection. All coupling assembly points shall have bolts and nuts.
2. ASTM A135/A135M / ASTM A795/A795M schedule 40 black steel threaded pipe and cast iron or malleable iron fittings for pipe 2" and smaller.
3. For gridded systems, the use of an approved grooved mechanical coupling shall be acceptable at one end of each branch line to facilitate the connection of such branch lines to a system main.
4. Welding shall be acceptable only for providing ASTM A53/A53M shop welded, branch outlet fittings, UL Listed and FM Approved for use in fire sprinkler systems, in accordance with NFPA 13 and local AHJ requirements.
    a. Merit Manufacturing Corporation or pre-approved equal.
    b. In no case shall butt-welding of pipe ends be allowed.

C Acceptable manufacturers:

1. Wheatland Tube Company
2. Bull Moose Tube Company

3. Tex-Tube

4. Allied Tube

D Acceptable mechanical coupling manufacturers:

1. Victaulic

2. Tyco-Grinnell

3. Anvil Gruvlok

E **Regardless of manufacturer, the use of pipe hole-cut, gasketed bolt-on branch outlets shall not be permitted. This prohibition includes, but is not necessarily limited to, the following: clamp-T, mechanical-T, outlet-T, strap-T, and U-bolt-T outlet connectors.**

F In all locations subject to corrosive conditions, ensure to provide a suitable epoxy (spray) coating to all exposed surfaces of pipe and fittings. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens. All job-applied protective coatings shall be provided as approved and only after verification that the proper piping has been installed, per the markings along the length of the pipe.

2.04 SPRINKLER HEADS

A Suspended Ceiling Type: Standard concealed pendent type with white cover plate.

B Exposed Area Type: Standard upright type with brass finish.

C Sidewall Type: Chrome plated finish with matching escutcheon.

D Where maximum ceiling temperatures exceed 100 degrees F, sprinklers with temperature ratings in accordance with maximum ceiling temperatures as tabulated in NFPA 13 shall be provided. Sprinkler heads within a given compartment must all be of the same temperature rating. Ambient ceiling temperatures expected in the vicinity of the sprinklers must be considered accordingly. Possible high ambient temperature areas may include, but are not necessarily limited to, the following: electrical equipment rooms, kiln rooms, sauna rooms, and manufacturing/process spaces.

E Sprinkler heads of the “O”-ring seal type are not acceptable.

F In all locations subject to corrosive conditions provide heads entirely constructed of stainless steel or heads with polyester coated finish and dipped in wax. Such locations shall include, but not necessarily be limited to, the following: natatoriums, pool equipment rooms, chemical and metal process areas, and animal pens.

G In all locations subject to occupant abuse or vandalism provide institutional type sprinkler heads with tamper-resistant construction and suitable “break-away” weight test documentation from the manufacturer. Such locations shall include, but not necessarily be limited to, the following: patient areas of institutional mental health occupancies, prisoner areas (cells, etc.) of correctional facilities – jails, prisons, juvenile detention facilities.

H **Flexible type sprinkler head connections are not acceptable.**

I Acceptable manufacturers:

1. Tyco-Grinnell
2. Viking
3. Victaulic
4. Reliable
5. Globe Fire Sprinkler Corporation

2.05 FIRE DEPARTMENT CONNECTIONS

A Refer to Section 21 00 00 for all such requirements.

2.06 INSULATION

A All piping and valves exposed to the weather or within building and exposed to the weather shall be insulated with phenolic foam with ASJ and all joints sealed. Insulation density shall not be less than 1.5 pounds per cubic foot, and conductivity (K) not higher than 0.25 and 75 degrees F mean temperature difference, with factory applied all weather vapor barrier jacket.

B All insulated pipe and valves subject to damage shall be protected with an aluminum jacket with sealed joints.

C Refer to Section 22 07 19 for detailed specifications.

PART 3 - EXECUTION

3.01 GENERAL

A All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items as required by NFPA 13 and installed as per manufacturer's recommendations.

C For any area requiring sprinkler protection and where the piping will be subject to freezing, the expectation is that a dry pipe system will be provided. This shall apply whether or not such an area has been identified on the Drawings and whether or not such a system has been specified under a separate Section.

3.02 DESIGN

A Design spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the occupancy hazard.

B Uniform discharge density design shall be based on hydraulic calculations utilizing the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C Friction losses in pipe will be based on a value of "C" =120 in the Hazen - Williams formula for steel pipe and "C" =150 for listed CPVC pipe (only if specified).

D Design and install the system so that no part will interfere with doors, windows, heating, plumbing, or electrical equipment. Do not locate sprinkler heads within 6 inches of lighting fixtures, HVAC diffusers and other obstructions. Sprinkler piping cannot penetrate ductwork, structural members, or lighting fixtures.

E The Contractor shall conform to NFPA 13, prevailing edition. Special attention shall be given to the Chapters on Plans and Calculations and on Systems Acceptance. It shall be the Licensed Fire Sprinkler Contractor's responsibility to determine if any deficiencies exist, such as an inadequate water supply, or any other item which would materially affect the acceptability of the system.

F Design sprinkler system piping accordingly and provide hose connections complete with valves, hoses, and cabinets where and as required by code. Adhere to the acceptable manufacturers listed in Section 21 00 00. Locations shall include, but are not necessarily limited to, the following: theatrical stages greater than 1,000 square feet.

G Reference the latest architectural reflected ceiling plans. Extend branch lines accordingly to provide sprinklers both above and below "cloud" ceilings, where present and as required.

H Ensure to provide sprinklers under fixed obstructions (such as ductwork) over 48 inches wide.

3.03 INSTALLATION - GENERAL

A Install all items in accordance with applicable codes.

B Install piping so that mains and branches are not located directly underneath HVAC equipment or other items needing access.

C Do not install risers or mains in MDF/IDF/Data closets or electrical rooms. Where sprinkler protection is provided, only the associated branch lines and sprinkler heads shall be allowed in such spaces.

D Furnish additional heads which may be required for coordinated ceiling patterns without added cost, even though number of heads may exceed minimum code requirements.

E All sprinkler heads shall be located as near the center of ceiling tiles as is practical (±1/2"). Location shall present a uniform pattern with all heads aligned when completely installed.

F Run piping concealed above furred ceilings and in joist space to minimize obstructions. Expose only heads. Exact routing of piping shall be approved by Architect or relocated as required at no additional cost to Owner.

G Provide wire guards on all non-concealed pendent and upright sprinklers heads subject to damage, including, but not necessarily limited to, the following locations: mechanical rooms, gymnasiums, athletic areas, wood and metal shops.

H Locate outside alarms on wall of building adjacent to sprinkler riser room.

I Provide on wall near the sprinkler valve(s): a clearly labeled and suitably sized cabinet containing (a minimum of 5% but no less than four) spare sprinkler heads of each type and a wrench suitable for each head type.

J Provide one case of spare escutcheons for each type of sprinkler head.

K Provide 1 inch diameter nipple and 1 inch x 1/2 inch reducing fitting for each upright head.

3.04 INSTALLATION - DRAINAGE

A All sprinkler pipe and fittings shall be installed so that the system can be drained.

B Unless not practicable, all piping shall be arranged to drain to the main drain valve for each sprinkler system. Make provisions accordingly for any trapped piping and provide auxiliary drains as necessary, complete with signage, and in accordance with NFPA 13 requirements.

C Unless noted otherwise on the Drawings or in conflict with Owner requirements, all drains shall discharge to the outdoors at locations free from the possibility of causing water damage. Each such drain shall be provided with a chrome wall escutcheon and 45 degree galvanized ell turned down.

3.05 INSTALLATION - AIR VENTS

A Each system shall be provided with at least one (1) automatic air vent, however more than one (1) may be required on a given system in order to exhaust the trapped air.

B Each air vent shall be located near a high point in the system it serves. Provide each such vent where it will be most effective and locate it off the top of the horizontal piping in an accessible location and a level position.

3.06 SYSTEM IDENTIFICATION

A Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction sheet shall be laminated or protected by a transparent plastic cover.

B Provide laminated zone map(s) at the riser location(s) clearly indicating the geographical area protected by each zone valve/floor control assembly. Floor plan shall include the locations of all valves (marked and labeled).

C Provide an additional laminated map as described above at the fire alarm control panel.

D All hydraulic calculation plates must be engraved.

E Each system valve (indoor and outdoor) must be permanently labeled with the system information.

F Signage:

1. Each riser room door must have a 2'-0" x 3'-0" sign provided on the outside with the wording "SPRINKLER RISER ROOM."

2. Each fire department connection shall have a sign with the street address on it.

3. Signage provided shall comply with NFPA and local AHJ requirements.

3.07 PAINTING AND PIPE IDENTIFICATION

A Refer to Section 21 00 00 for all such requirements.

3.08 REPLACEMENT

A Upon receipt of written notice of failure of any part of the guaranteed equipment during the guaranteed period, the Contractor will replace the affected part or parts promptly at no additional cost.

3.09 TESTING

A Prior to testing, the entire sprinkler system shall be thoroughly flushed clean.

B Upon completion of the installation and flushing, test the system and obtain approval of the local fire insurance rating organization having jurisdiction. Particular attention is called to the acceptance requirements of NFPA 13.

C Testing and acceptance must be provided for underground and aboveground piping per NFPA 13 and local AHJ requirements. Documentation of such shall be provided to the Owner.

3.10 TRAINING

A The Owner's maintenance staff shall be fully briefed in the normal start-up of the system, operation, normal and emergency shutdown, and maintenance of the system.

B Routine maintenance, yearly maintenance, and any seasonal requirements or considerations shall be fully discussed and documented.

C Names of those instructed and dates, as well as a list of information provided to the Owner shall be included in the final report.

END OF SECTION 21 13 13

SECTION 22 02 00 - BASIC MATERIALS AND METHODS FOR PLUMBING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departure and the reasons therefore shall be submitted to the Architect/Engineer for approval as soon as reasonably practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is equal to that specified.

1.02 SCOPE OF WORK

A The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent Drawings, including those of other contracts, prior to commencement of Work.

B This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings, or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to: materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C The approximate locations of Plumbing and Fire Protection items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details with regards to locations of piping, appurtenances, etc. Exact locations are to be determined by actual measurements at the building/job-site, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F It is the intention of this Section of the specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified elsewhere, or necessary for complete and functioning plumbing systems shall be considered a part of the overall "Scope".

H The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I The Contractor shall participate in the Commissioning process as required; including, but not necessarily limited to: meeting attendance, completion of checklists, and participation in functional testing.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed Shop Drawings.

B The piping, fixture, and equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit Shop Drawings for review.

C All transitions, offsets and relocations as required by actual field conditions shall be provided by the Contractor at no additional cost to the owner.

D Additional coordination with Electrical Subcontractor may be required to allow adequate clearances of electrical equipment, fixtures, and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts, or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

A Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the piping, fixtures and equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

A Finish painting is specified elsewhere. Prime and protective painting is included in the work of this Division.

B Owner and General Contractor furnished equipment shall be properly connected to plumbing systems.

C Furnishing and installing all required plumbing equipment, control relays and electrical interlock devices, conduit, wire and junction boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

A Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF FINAL ACCEPTANCE

A The date of final acceptance shall be the date of Owner occupancy, or the date all punch list items have been completed, or the date final payment has been received. Refer to Division 01 for additional requirements.

B The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

A Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B Deliver products to the project at such times as the project is ready to receive the fixtures, equipment, pipe, valves, etc. - properly protected from incidental damage and weather damage.

C Damaged fixtures, equipment, valves, pipe, or appurtenances shall be promptly removed from the site and new, undamaged items shall be provided in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

A The plumbing systems and the component parts thereof shall be guaranteed to operate without objectionable noise, water hammering, and vibration.

B Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C Carefully fabricate pipe and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect/Engineer, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

E Above ceiling piping and valves shall not be installed in direct contact with the work of other trades, including, but not limited to, suspended ceiling hanger wire.

1.10 APPLICABLE CODES

A Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B Arrange with the serving utility companies for the connection, relocation, and upgrade of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards.

D Such codes and standards shall include, but not necessarily be limited to:

1. American Standards Association, ASA.
2. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
3. American Society of Mechanical Engineers, ASME.
4. American Society of Plumbing Engineers, ASPE.
5. American Society of Testing Materials, ASTM.
6. American Water Works Association, AWWA.
7. National Bureau of Standards, NBS.

8. National Fire Protection Association, NFPA.

9. UL, LLC (formerly Underwriters Laboratories).

10. FM Global.

11. International Energy Conservation Code, IECC.

12. International Fire Code.

13. International Fuel Gas Code.

14. International Plumbing Code.

E Where differences exist between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Architect/Engineer in writing of all differences.

F When directed in writing by the Architect/Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards. Correct the deficiencies and complete the work at no additional cost to the Owner.

1.11 DEFINITIONS AND SYMBOLS

A General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver new to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I Installer: Entity (person or firm) engaged by the Contractor or its Subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 2009 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.12 DRAWINGS AND SPECIFICATIONS

A These Specifications are intended to supplement the Drawings. It will not be the province of the Specifications to address any part of the work which the Drawings can fully convey in every particular and such omission shall not to relieve the Contractor from carrying out portions of work indicated on the Drawings only.

B Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least seven (7) working days prior to bid opening date for issuance of an addendum.

C The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is equal to the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturers' standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equal capacity, construction, and performance. However, under no circumstances shall any substitution by made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing at least ten (10) days prior to the bid date without fail.

F Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G Wherever a definite material or manufacturer's product is specified and the Specification indicates that products of similar design and equal construction from the list of acceptable manufacturers may be used, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H Wherever a definite product, material or method is specified and there is a statement that "OR EQUAL" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUAL" product, material or method may be used if it complies with the specifications and is submitted for review to the Engineer as outlined herein.

I Where equipment other than that used in the design as specified or shown on the Drawings is provided (either from an acceptable manufacturer list or by submittal review), it shall be the responsibility of the Contractor to coordinate space requirements, building provisions and connection requirements with all trades bear any additional costs.

J Where permission to use a substitution product, material, or method is granted by the Owner or Engineer in writing, the Contractor shall bear full responsibility for the implementation of that substitution. Specific responsibilities shall include, but shall not be limited to, the following:

1. Verifying that the substituted item will fit in the space available. This shall include allowances for all code required clearances and manufacturer's maintenance and service clearances.

2. The coordination and provision of all necessary supports, hangers, and appurtenances. Hanger spacing shall be adjusted accordingly and any additional hangers or supports required shall be provided.

3. The coordination and provision of all necessary insulation, firestopping provisions, etc.

4. Adherence to manufacturer's published installation recommendations.

5. Adherence to requirements of the Authority Having Jurisdiction (AHJ) and provision of a code compliant installation.

6. Changes to architectural, structural, electrical, mechanical, and plumbing requirements as a result of the substitution.

7. Bearing any additional costs and time impact and providing any necessary redesign. The Owner will bear no such cost and make no time allowances.

8. Coordination of plumbing and electrical requirements and utility provisions with the Mechanical and Plumbing Design Documents and all other trades, including Division 26.

K If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with above and if accepted, will issue a written acceptance allowing the substitutions.

1.13 SUBMITTALS

A Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of Shop Drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty (30) day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive Shop Drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all Shop Drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.

2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.

6. Identification of each item of material or equipment matching that indicated on the Drawings.

7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.

8. Additional information as required in other Sections of this Division.

9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B Refer to Division 00 and Division 01 for additional information on Shop Drawings and submittals.

C Equipment and materials submittals and Shop Drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of Shop Drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D Where Shop Drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E Shop Drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The Contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous Shop Drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all Shop Drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F Materials and equipment which are purchased or installed without Shop Drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H Submittals are required for, but not necessarily limited to, the following items:

1. Basic Materials.

2. Plumbing Fixtures and Valves.

3. Supports and Carriers.

4. Floor Drains, Roof Drains, and Cleanouts.

5. Interceptors/Traps (All Types).

6. Water Heaters and Boilers.

7. Expansion Tanks.

8. Water Softeners.
9. Water Treatment Equipment.
10. Water Filters.
11. Domestic Water Booster Pumps.
12. Fire Pumps and Jockey Pumps.
13. Storm, Sanitary, and Wastewater Pumps and Ejectors.
14. Fire Pump and Jockey Pump Controllers.
15. Domestic Water and Fire Protection Break Tanks.
16. Backflow Preventers.
17. Plumbing Piping.
18. Piping, Vessel, and Equipment Insulation.
19. Air Compressors and Air Dryers.
20. Expansion Fittings and Devices.
21. Variable Frequency Drives.
22. Noise and Vibration Controls.
23. Pipe and Equipment Hangers and Supports.
24. Plumbing Specialties.
25. Test, Adjust and Balance Reports.
26. Testing, Adjusting and Balancing Contractor Qualifications.
27. Coordination Drawings.

I Refer to other Division 22 sections for additional Shop Drawing and submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.14 COORDINATION DRAWINGS

A Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, equipment, and other materials. Include the following:

a. Wall locations and types.

b. Clearances for installing and maintaining insulation.

c. Locations of light fixtures and sprinkler heads.

d. Clearances for servicing and maintaining equipment, including tube removal and space for equipment disassembly required for periodic maintenance.

e. Equipment connections and support details.

f. Exterior wall and foundation penetrations.

g. Routing of storm, sanitary sewer piping and plumbing piping.

h. Fire-rated wall and floor penetrations.

i. Sizes and location of required concrete pads and bases.

j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

B This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C By submitting Shop Drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DOCUMENTS

A Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 22.

B The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work; precise locations of all concealed pipe; locations of all valves, controls and operable devices; and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Mains and branches of piping systems, with valves and control devices located and numbered, unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion fittings, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.

2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

4. Contract Modifications, actual equipment and materials installed.

E Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F If the Contractor does not keep an accurate set of Record Documents, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G Upon completion of the Work, the Contractor shall submit three (3) full size sets of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled dates for each test. This detailed completion and test schedule shall be submittal at least ninety (90) days before the projected Project completion date.

B Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C Submit four (4) copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D Certifications and test reports to be submitted shall include, but not be limited to those items outlined in other Sections of Division 22.

1.17 OPERATIONS AND MAINTENANCE MANUALS

A Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 22. In addition to the requirements of other Sections, this shall include operational, trouble-shooting, and routine maintenance information for fixtures, specialties, and equipment.

1. Identifying names, name tags designations and locations for all equipment.
2. Valve tag lists with valve number, type, color coding, location and function.
3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.
4. Fabrication drawings.
5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
8. Servicing instructions and lubrication charts and schedules.
9. Equipment and motor name plate data.
10. Wiring diagrams.
11. Exploded parts views and parts lists for all equipment and devices.

12. Color coding charts for all painted equipment and conduit.

13. Location and listing of all spare parts and special keys and tools furnished to the Owner.

14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow 1/4” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Plumbing Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 22 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.18 OPERATOR TRAINING

A The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel.

B The Owner's operator training shall include a minimum of 12 hours of on- site training in three (3) shifts of four (4) hours each.

C Before proceeding with the instruction of Owner's Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he or she has a proper understanding of the operation and maintenance of the systems and then resubmit the signed outlines.

D Refer to other Sections of Division 22 for additional Operator Training requirements.

1.19 FINAL COMPLETION

A At the completion of the work, all equipment, operable appurtenances, and systems shall be tested. All faulty equipment and material shall be repaired or replaced. Refer to other Sections of Division 22 for additional requirements.

B Clean and adjust all fixtures, flushometers, valves and operable devices. Replace faulty or otherwise damaged parts immediately prior to final acceptance.

C Touch up and/or refinish any scratched equipment and devices immediately prior to final acceptance. This shall be acceptable only for minor superficial scratches, the determination of which rests solely on the judgment of the Architect or Engineer.

1.20 CONTRACTOR'S GUARANTEE

A Use of the Plumbing systems to provide temporary service during the construction period shall not be allowed without written permission from the Owner, and, if granted, shall not be cause for the warranty period to start, except as defined below.

B Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one (1) year after its completion and final acceptance, and shall furnish free of additional cost to the Owner all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of issue of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D All air compressors shall have parts and labor guarantees for a period of not less than five (5) years beyond the date of final acceptance.

E Refer to other Sections of Division 22 for additional guarantee or warranty requirements.

1.21 TRANSFER OF ELECTRONIC FILES

A Project documents are not intended or represented to be suitable for re-use by Architect/Owner or others on extensions of this project or on any other project. Any such re-use or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D Any re-use or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks unless indicated otherwise.

C All access panels located in wet areas such as toilet rooms, locker rooms, shower rooms, natatoriums, kitchens, and any other wet areas shall be constructed of stainless steel.

D Access doors shall be as follows:

1. Plastic Surfaces: Milcor Style K.

2. Ceramic Tile Surfaces: Milcor Style M.

3. Drywall Surfaces: Milcor Style DW.

4. Install panels only in locations approved by the Architect.

2.02 EQUIPMENT PADS

A Provide four (4) inch high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

B Provide six (6) inch high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of six (6) inches beyond the equipment. Provide a four (4) foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bull-nosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.01 ROUGH-IN

A Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B Refer to equipment specifications in other Divisions (10, 11, 12, 13, 21, 22, etc.) for additional rough-in requirements as necessary and provide accordingly.

3.02 PLUMBING INSTALLATIONS

A General: Sequence, coordinate, and integrate the various elements of plumbing and fire systems, materials, and equipment. Comply with the following requirements:

1. Coordinate plumbing and fire protection systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, leave-outs, and other openings in building components during progress of construction to allow for plumbing installations.

4. Coordinate the installation of required supporting devices, sleeves, and pathways to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of plumbing and fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.

11. Install access panels or doors where valves, operable devices, and equipment are concealed behind finished surfaces. Refer to Article 2.1 of this Section and to Architectural documents for specifications and locations.

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curb to match roof slope. Refer to architectural drawings and details.

14. The equipment to be furnished under this Specification shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.

15. The architectural and structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.

16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.

17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, valves, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.

18. Identification of Plumbing Equipment:

    a. Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Shop Drawings shall include dimensions and lettering format for approval. Attachments shall be with escutcheon pins, self-tapping screws, or machine screws.

    b. Tags shall be attached to all valves, including control valves, with nonferrous chains. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the Record Drawings.

3.03 CUTTING AND PATCHING

A Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B Perform cutting, removal, patching, replacement/repair as required to:

1. Uncover Work to provide for installation of ill-timed Work.

2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.

5. Install fixtures, equipment, piping, and appurtenances in existing structures.

6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.

7. Patch and replace/repair existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Article 1.11 DEFINITIONS AND SYMBOLS for definition of "Installer."

C Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, equipment, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and the Architect/Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems will have to be maintained in service within the occupied spaces of the existing building.

B Start-up for major plumbing and fire protection equipment shall be performed by a factory authorized technician. Such equipment shall include, but not necessarily be limited to, the following: domestic water boilers and packaged water heating systems, water softeners, ultra-pure water equipment systems, domestic water booster pumps, fire pumps, and break tank level alarm systems. Refer to other Sections of Divisions 21 and 22 for additional requirements.

3.05 DEMOLITION AND WORK WITHIN EXISTING BUILDINGS

A In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing piping, utilities, equipment and other apparatus related to this phase of the work. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by this Contractor, who shall produce drawings that shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

B All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

C All equipment and/or systems noted on the Drawings "To Be Removed" shall be removed including, associated pipe, supports, and hangers. Where pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

D Ensure existing piping and equipment to remain that is adjacent to and impacted by the scope of Work is properly supported, fastened, and secure.

E During the construction and remodeling, portions of the Project shall remain in service. Construction equipment, material tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

F Certain work during the demolition phase of construction may require overtime, night time, or weekend shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

G Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and disposed of lawfully.

H Equipment, piping or other potential hazards to the working occupants of the building or the general public shall not be left overnight outside of the designated working or construction area.

I Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage that occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

J Include in the contract price all rerouting of existing pipe, utilities, etc., and the reconnecting of the existing equipment and plumbing fixtures as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Provide all temporary pipe, utilities, controls, etc., as required to maintain heating, cooling, ventilation and plumbing services for the existing areas with a minimum of interruption.

K All existing plumbing fixtures, pipe, utilities, materials, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

L Pipe, utilities, equipment and controls serving mechanical, plumbing and owner's equipment, etc., which is to remain but which is served by pipe, utilities, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

M No portion of the fire protection systems shall be turned off, modified or changed in any way without the express knowledge and written permission of the Owner’s representative in order to protect systems that shall remain in service.

N It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

O Refer to Architectural Demolition and/or Alteration plans for actual locations of walls, ceiling, etc., being removed and/or remodeled.

END OF SECTION 22 02 00

SECTION 22 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.02 COORDINATION DRAWINGS

A The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Contractor will be provided with the REVIT model that was used to generate the contract documents and this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT and may use any 3-D software in generating and combining the coordination model.

C Submitting the contract drawings as coordination drawings will not be acceptable.

D The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

    a. Wall and type locations.

    b. Clearances for installing and maintaining insulation.

    c. Locations of light fixtures and sprinkler heads.

    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

    e. Equipment connections and support details.

    f. Exterior wall and foundation penetrations.

g. Routing of storm and sanitary sewer piping.

h. Fire-rated wall and floor penetrations.

i. Sizes and location of required concrete pads and bases.

j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling mounted items.

H Sequence of Coordination

Below is hierarchy of model elements and the sequencing by which the models will be coordinated.

1. Structural and Architectural model

2. Miscellaneous steel

3. Perform preliminary space allocation

4. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)

5. Main and medium pressure ducts from the shaft out

6. Main graded plumbing lines and vents

7. Sprinkler mains and branches

8. Cold and hot water mains and branches

9. Lighting fixtures and plumbing fixtures

10. Smaller sized ducts and flex ducts

11. Smaller size cold water and hot water piping, flex ducts, etc.

I The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J The Contractor shall be responsible for coordination of all items that will affect the installation of the Work. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K By submitting shop drawings on the project, the Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all trades.

END OF SECTION 22 02 01

SECTION 22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use. Provide electric motors, control panels, control and safety devices, and control wiring when specified or as required for proper operation of electrical systems associated with plumbing equipment and appurtenances.

B WORK SPECIFIED ELSEWHERE:

1. Painting.

2. Power control wiring to motors and equipment.

1.03 WARRANTY

A Warrant the Work specified herein for one year and motors for five years beginning on the date of substantial completion against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

1.04 SUBMITTALS

A SHOP DRAWINGS: Indicate size material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures variations, and accessories.

C MOTOR NAMEPLATE INFORMATION: Manufacturer's name, address, utility and operating data.

D Refer to Division One for additional information.

1.05 DELIVERY AND STORAGE

A DELIVERY: Deliver clearly labeled, undamaged materials in the manufacturers' unopened containers.

B TIME AND COORDINATION: Deliver materials to allow for minimum storage time at the project site. Coordinate delivery with the scheduled time of installation.

C STORAGE: Store materials in a clean, dry location, protected from weather and abuse.

PART 2 - PRODUCTS

2.01 ELECTRIC MOTORS

A APPROVED MANUFACTURERS: Provide motors by a single manufacturer as much as possible.

1. Baldor
2. Marathon
3. Leeson-Lincoln Electric
4. General Electric
5. Westinghouse

B TEMPERATURE RATING: Provide insulation as follows:

1. CLASS B: 40 degrees C maximum.
2. CLASS F:
   a. Between 40 degrees C and 65 degrees C maximum.
   b. Totally enclosed motors.

C STARTING CAPABILITY: As required for service indicated five starts minimum per hour.

D PHASES AND CURRENT: Verify electrical service compatibility with motors to be used.

1. UP TO 3/4 HP: Provide electronically commutated brushless DC single phase motors with built-in inverter and microprocessor-based control.
2. 1 HP AND LARGER: Provide squirrel-cage AC induction polyphase motors.
3. Name plate voltage shall be the same as the circuit's normal voltage, serving the motor.

E SERVICE FACTOR: 1.15 for polyphase; 1.35 for single phase.

F FRAMES: U-frames 1.5 hp. and larger.

G BEARINGS: Provide sealed re-greasable ball bearings; with top mounted zerc lubrication fittings and bottom side drains minimum average life 100,000 hours typically, and others as follows:

1. Design for thrust where applicable.
2. PERMANENTLY SEALED: Where not accessible for greasing.
3. SLEEVE-TYPE WITH OIL CUPS: Light duty fractional horsepower motors or polyphase requiring minimum noise level.

H ENCLOSURE TYPE: Provide enclosures per applications as follows:

1. CONCEALED INDOOR: Open drip-proof (ODP).
2. EXPOSED INDOOR: Splash-proof.
3. OUTDOOR TYPICAL: Type III, totally enclosed fan-cooled (TEFC).
4. OUTDOOR WEATHER PROTECTED: Weather protected II (WPII).
5. HAZARDOUS LOCATIONS: Explosion-proof.

I OVERLOAD PROTECTION: Built-in sensing device for stopping motor in all phase legs and signaling where indicated for fractional horse power motors.

J NOISE RATING: "Quiet" except where otherwise indicated.

K EFFICIENCY: Minimum full load efficiency listed in the following table, when tested in accordance with IEEE Test Procedure 112A, Method B, including stray load loss measure.

NEMA Efficiency - 1800 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	91.0
10	F	91.7
15 - 20	E	93.0
25 - 30	E	93.6
40	D	94.1
50	C	94.5
60	C	95.0
75	C	95.0
100 - 125	B	95.4
150 - 200	B	95.8
NEMA Efficiency - 1200 RPM Synchronous Speed		
Motor Horsepower	Index Letter	Minimum Efficiency %
3 - 5	G	89.5
7.5	G	90.2
10	F	91.7
15	F	91.7
20	E	92.4
25 - 30	E	93.6
40 - 50	D	94.1
60	D	94.5
75	C	94.5
100 - 125	C	95.0
150 - 200	B	95.4

2.02 MOTOR CONTROLLERS (STARTERS)

A All motor controllers (for equipment furnished under Division 22) shall be furnished under Division 22 and installed under Division 26 unless otherwise noted on the plans.

1. Starters shall be provided for 3 phase motors 1 horsepower and greater.

B Motor starters shall be furnished as follows.

1. GENERAL: Motor starters shall be Square D Company Class 8536 across-the-line magnetic type, full-voltage, non-reversing (FAVOR) starter. All starters shall be constructed and tested in accordance with the latest NEMA standards, sizes and horsepower. ICE sizes are not acceptable. Starters shall be mounted in a general purpose dead front, painted steel enclosure and surface-mounted. Provide size and number of poles as shown and required by equipment served. Provide two speed, two winding or two speed, single winding motor starter as required for two speed motors.

2. CONTACTS: Magnetic starter contacts shall be double break solid silver alloy. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter shall have straight-through wiring.

3. OPERATING COILS: Operating coils shall be 120 volts and shall be of molded construction. When the coil fails, the starter shall open and shall not lock in the closed position.

4. OVERLOAD RELAYS: Provide manual reset, trip-free Class 20 overload relays in each phase conductor in of all starters. Overload relays shall be melting alloy type with visual trip indication. All 3 phase and single phase starters shall have one overload relay in each underground conductor. Relay shall not be field adjustable from manual to automatic reset. Provide 6 overload relays for two speed motor starters.

5. PILOT LIGHTS: Provide a red running pilot light for all motor starters. Pilot lights shall be mounted in the starter enclosure cover. Pilot lights shall be operated from an interlock on the motor starter and shall not be wired across the operating coil.

6. CONTROLS: Provide starters with HAND-OFF-AUTOMATIC switches. Coordinate additional motor starter controls with the requirements of Division 22. Motor starter controls shall be mounted in the starter enclosure cover.

7. CONTROL POWER TRANSFORMER: Provide a single-phase 480 volt control power transformer with each starter for 120 volt control power. Connect the primary side to the line side of the motor starter. The primary side shall be protected by a fuse for each conductor. The secondary side shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals will not be located above the transformer.

8. AUXILIARY CONTACTS: Each starter shall have one normally open and one normally closed convertible auxiliary contact in addition to the number of contacts required for the "holding interlock", remote monitoring, and control wiring. In addition, it shall be possible to field-install three more additional auxiliary contacts without removing existing wiring or removing the starter from its enclosure.

9. UNIT WIRING: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for line and load power wiring and HVAC control wiring.

10. ENCLOSURES: All motor starter enclosures shall be NEMA 1, general purpose enclosures or NEMA-3R if mounted exposed to high moisture conditions. Provide NEMA 4X when located by cooling towers, fountains, or similar locations.

11. POWER MONITOR: Provide a square "D" 8430 MPS phase failure and under-voltage relay, base and wiring required for starters serving all 3 phase motors. Set the under-voltage setting according to minimum voltage required for the motor to operate within its range.

C APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.

1. Siemens.

2. Square D.

3. General Electric.

4. Eaton.

2.03 COMBINATION MOTOR STARTERS

A GENERAL: Combination motor starters shall consist of a magnetic starter and a fusible or non-fusible disconnect switch in a dead front, painted steel NEMA 1 enclosure unless otherwise noted and shall be surface-mounted. Size and number of poles shall as shown and required by equipment served. Combination motor starters shall be as specified for motor starters in Paragraph 2.1/B, except as modified herein.

B DISCONNECT SWITCH: Disconnect switches shall be as specified in Division 26.

C APPROVED MANUFACTURERS: Controller numbers are based on first named manufacturer. Provide one of the following manufacturers.

1. Siemens.

2. Square D.

3. General Electric.

PART 3 - EXECUTION

3.01 INSTALLATION

A All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractors' price shall include all items required as per manufacturer's requirements.

C Install in a professional manner. Any part or parts not meeting this requirement shall be replaced or rebuilt without extra expense to Owner.

D Install rotating equipment in static and dynamic balance.

E Provide foundations, supports, and isolators properly adjusted to allow minimum vibration transmission within the building.

F Correct objectionable noise or vibration transmission in order to operate equipment satisfactorily as determined by the Engineer.

END OF SECTION 22 05 13

SECTION 22 05 16 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the fittings and items covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Expansion joints and compensators.

2. Pipe loops, offsets, and swing joints.

1.03 RELATED WORK

A Section 22 02 00 - Basic Materials and Methods for Plumbing

B Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C Section 22 10 00 - Plumbing Piping

1.04 REFERENCES

A IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.05 PERFORMANCE REQUIREMENTS

A Provide structural work and equipment required to control expansion and contraction of piping. Verify that anchors, guides, and expansion joints provided, adequately protect system.

B Expansion Calculations:

1. Installation Temperature: 50 degrees F (10 degrees C).

2. Domestic Hot Water: 140 degrees F (60 degrees C).

3. Safety Factor: 30 percent.

C Pipe sizes indicated are to establish a minimum quality of compensator. Refer to manufacturer's literature for model series for different pipe sizes.

1.06 SUBMITTALS

A Submit shop drawings under provisions of Division One.

B Product Data:

1. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

2. Pipe loops, offsets, and swing joints: Indicate temperature rise, developed lengths, pipe size, material expansion coefficient-allowable stress-modulus of elasticity, and final calculated amount of expansion. Indicate bend, loop, offset & return dimensions coinciding with the calculated expansion.

C Design Data: Indicate selection calculations.

D Manufacturer's Installation Instructions: Indicate special procedures, and external controls.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of expansion joints, fittings, anchors, and guides.

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Maintenance Data: Include adjustment instructions.

1.09 QUALIFICATIONS

A Manufacturer: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

B Design expansion compensation system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the state where the project is located.

1.10 DELIVERY, STORAGE, AND HANDLING

A Deliver, store, project and handle products to site under provisions of Division One.

B Accept expansion joints on site in factory packing with shipping bars and positioning devices intact. Inspect for damage.

C Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

1.11 WARRANTY

A Provide five year warranty under provisions of Division One.

B Warranty: Include coverage for leak free performance of packed expansion joints.

1.12 EXTRA MATERIALS

A Furnish under provisions of Division One.

PART 2 - PRODUCTS

2.01 EXPANSION JOINTS

A Bellows Type (Based on 4" Pipe):

1. Manufacturers:
    a. VMC Group, Style EB
    b. Triplex, Model Resistoflex R6905
    c. Mercer Rubber Company, Style 803 or 805 (Mason Industries)
    d. Metraflex
2. Body: Monel wire reinforced molded TFE teflon bellows, multiple arch.
3. Pressure Rating: 70 psig WSP and 250 degrees F (66 degrees C).
4. Maximum Compression: 1 inch.
5. Maximum Extension: 1 inch.
6. Maximum Offset: 1/2 inch.
7. Joint: ASA standard ductile iron flanges, integral molded gasket.
8. Size: Use pipe sized units.
9. Accessories: Control rod limit bolts.
10. Application: Steel piping 8 inch and under.

B Pre-manufactured Loop Type:

1. Manufacturers:
    a. Flexicraft Industries
    b. Metraflex MLS-UPC-80 series
2. Materials of construction: Copper custom 180 degrees bend (or 90 degree elbows with spool), copper 90 degree elbows for connections to piping, bronze hose and braid.
3. Certifications: NSF 61 lead-free compliant, IAPMO (UPC) approved.
4. Working Pressure: No less than 200 psi at 250 degrees F.
5. Allowable Movement: +/- 4 inches.
6. Labeled from the manufacturer and provided complete with attached support bracket and drain plug.

7. Size: Same as piping being served.

8. Installation: In strict accordance with manufacturer's recommendations, including support.

9. Application: Copper piping 4 inch and under.

2.02 ACCESSORIES

A Pipe Alignment Guides to Direct Axial Movement:

1. Manufacturers:

   a. Triplex, Model Flexonics

   b. Metraflex

2. Welded steel construction bolt together two piece design, frame with four mounting holes, shop painted, spider type guide, exact style/model as necessary for bare or insulated pipe to match size and thickness as appropriate, 4 inch movement standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Provide miscellaneous metals to rigidly anchor pipe to building structure. Provide pipe guides so that movement takes place along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

C Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. This shall include where piping crosses expansion joints in the building.

3.02 MANUFACTURER'S FIELD SERVICES

A Prepare and start systems under provisions of Division One.

B Provide inspection services by manufacturer's representative for final installing and to certify the installation is in accordance with manufacturer's recommendations and expansion joints and accessories are performing satisfactorily.

END OF SECTION 22 05 16

SECTION 22 05 29 - HANGERS AND SUPPORT FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Pipe, and equipment hangers, supports, and associated anchors.

B Sleeves and seals.

C Flashing and sealing equipment and pipe stacks.

1.03 RELATED WORK

A Section 22 02 00 - Basic Materials and Methods for Plumbing

B Section 22 07 19 - Plumbing Piping Insulation

C Section 22 10 00 - Plumbing Piping

D Section 22 11 21 - Natural Gas Piping Systems

1.04 REFERENCES

A ASME B31.1 - Power Piping; 2022.

B ASME B31.9 - Building Services Piping; 2020.

C MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.05 QUALITY ASSURANCE

A Hangers and Supports for Plumbing Piping: In conformance with ASME B31.1 and ASME B31.9.

B Hangers and Supports for Plumbing Piping: In conformance with MSS SP-58.

1.06 SUBMITTALS

A Submit shop drawings and product data under provisions of Division One.

B Indicate hanger and support framing and attachment methods.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A Hangers for Pipe Sizes 1/2 to 1-1/2 Inch Malleable iron, adjustable swivel, split ring.

B Hangers for Pipe Sizes 2 to 4 Inches Carbon steel, adjustable, clevis.

C Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

D Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for pipe sizes 6 inches and over.

E Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F Wall Support for Pipe Sizes 4 Inches and Over: adjustable steel yoke and cast iron roller.

G Vertical Support: Steel riser clamp.

H Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.

J Roof Pipe Supports and Hangers: Free-standing manufactured pipe support system with hot dip galvanized steel components and hardware with UV-inhibited injection molded high density/high impact black polypropylene base material. Portable Pipe Hangers, Inc. or approved equal.

For pipes 2-1/2” and smaller	Type PP10-R, with pipe roller support
For pipes 3” through 8”	Type PS-1-2, with pipe roller support
For multiple pipes	Type PSE - Custom

K Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L For installation of protective shields also reference Section 22 07 19.

M Shields for Vertical Copper Pipe Risers: Sheet lead.

N Pipe Rough-In Supports in Walls/Chases: Provide pre-formed plastic pipe supports, Sioux Chief “Pipe Titan”, Hold Rite or equal.

2.02 HANGER RODS

A Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

A Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A Metal Flashing: 20 gage galvanized steel.

B Lead Flashing: 4 lb./sq. ft. sheet lead for waterproofing.

C Caps: Steel, 20 gauge minimum; 16 gage at fire resistant elements.

D Coordinate with roofing contractor/architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

A Fabricate curbs of hot dipped galvanized steel.

2.06 ROOFTOP PIPE SUPPORTS

A All roof-mounted piping shall be supported with engineered pre-fabricated piping support systems specifically designed to be installed on the roof without roof penetrations, flashing, or damage to the roofing material.

1. Bases shall be made of UV protected HDPE.
2. Frames shall be made of hot dipped galvanized strucutral steel.
3. Nuts, threads, and washers shall be hot dipped galvanized steel.
4. System shall be specifically designed to fit the piping and the actual conditions of service.
5. Wood supports are not acceptable.
6. Portable Pipe Hanger (PHP) system or pre-approved equal, installed per manufacturer's instructions.

2.07 SLEEVES

A All pipe penetrations through walls, floors, floor-ceiling assemblies, etc. shall be sleeved to ensure no direct contact between the pipe and that which it passes through. All installations shall be provided consistent with the fire and smoke safeguards required by the building code per the fire-resistance rating as indicated on the architectural drawings and shall be provided consistent with the assemblies/methods indicated on the architectural drawings.

B Unless required otherwise (the most stringent requirement shall govern), sleeves for pipes:

1. Through nonfire-resistance-rated floors shall be formed with 18 gage galvanized steel, tack welded to form a uniform sleeve.
2. Through nonfire-resistance-rated walls, through grade beams and foundation walls, and through potentially wet floors shall be formed with schedule 40 steel pipe, galvanized.

3. Through assemblies including but not limited to fire-resistance-rated walls-barriers-partitions, smoke barriers-partitions, etc. shall be schedule 40 steel pipe securely fastened to the rated assembly. All annular spaces shall be firestopped with an approved penetration firestop system (UL listed) compatible with the pipe material and installed per the manufacturer's recommendations.

C Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

D Caulk: Paintable 25-year acrylic sealant.

E Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.08 FABRICATION

A Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B Design hangers without disengagement of supported pipe.

C Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.09 FINISH

A Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with structural engineer for placement of inserts.

B Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with structural engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A Support horizontal piping as follows:

PIPE SIZE	MAX/ HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"

1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"
(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B Sagging of horizontal pipe is unacceptable.

C Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D Place a hanger within 12 inches of each horizontal elbow and at the vertical horizontal transition.

E Use hangers with 1-1/2 inch minimum vertical adjustment.

F Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers. Also reference specific requirements for cast iron piping installation in Section 22 10 00, Part 3 Execution.

G Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

H For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners and hardware, braces, unistrut, structural steel members, etc. to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

I Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

J Support riser piping independently of connected horizontal piping.

K Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

3.03 INSULATED PIPING

A Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C Shields: Install protective shields MSS Type 40 on insulated piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D Galvanized sheet metal shields shall span an arc of 180 degrees and shall have dimensions not less than the following:

Nominal Pipe Size	Shield Length	Gauge Thickness
1/4 through 3-1/2 inch	12 inch	18
4 inch	12 inch	16
5 through 6 inch	18 inch	16
8 through 14 inch	24 inch	14
16 through 24 inch	24 inch	12

E Ensure to provide an insert of high density insulation (calcium silicate) at each hanger/support to prevent the weight of the pipe from otherwise crushing the insulation. This insert material shall be at least as long as the associated protective shield.

F Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A Provide equipment bases of concrete.

B Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C Construct support of steel members. Brace and fasten with flanges bolted to structure.

D Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

A Provide flexible flashing and metal counter flashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B Flash vent and soil pipes projecting 8 inches minimum above finished roof surface with lead worked one inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter flash and seal.

C Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inch sheet size. Fasten flashing to drain clamp device.

D Seal floor shower mop sink and all other drains watertight to adjacent materials.

E Provide curbs for mechanical roof installations 8 inches minimum high above roofing surface. Contact architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

A Set sleeves in position in formwork. Provide reinforcing around sleeves.

B Extend sleeves through floors minimum one inch above finished floor level. Caulk sleeves full depth with fire rated thermafiber and 3M caulking and provide floor plate.

C Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with UL listed fire stopping insulation and caulk seal air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION 22 05 29

SECTION 22 05 48 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of vibration & sound control products and seismic controls covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Vibration and shock mounting.
2. Flexible pipe connectors.
3. Seismic restraints.

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 10 00 - Plumbing Piping

C Section 22 30 00 - Plumbing Equipment

1.04 REFERENCES

A ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B NFPA 99 - Health Care Facilities Code; 2024, with Errata.

C NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

1.05 QUALITY ASSURANCE

A Manufacturer’s Qualifications: Firms regularly engaged in manufacture of vibration control and seismic products, of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria (NC) curves for all equipment at full load conditions.

C Unless indicated otherwise, sound and vibration control products and seismic products shall be provided by a single manufacturer.

1.06 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A VMC Group

B Mason Industries, Inc.

C Kinetics Noise Control, Inc.

D Vibration Eliminator Co., Inc.

E Unisource Manufacturing (as specifically noted below)

2.02 GENERAL

A Provide vibration isolation supports for equipment, piping and appurtenances to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B Provide seismic restraints, supports, and attachments suitable for the applicable seismic loads in seismic design category areas as required by the ICC (IBC) and local code requirements.

C Where Basis of Design manufacturer and model numbers are indicated, the products of the other listed manufacturers above will be acceptable provided they comply with all of the requirements of this specification.

2.03 BASE MOUNTED PUMPS

A Provide VMC Group model SP-NR, style E, elastomeric isolation pads consisting of two layers of 3/8'' thick alternate ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate.

B Pads shall be sized for approximately 40 psi loading and 1/8'' deflection.

C Provide inertia bases for all base mounted pump applications in which the pumps are to be installed on any floor level other than the ground floor or grade level. Inertia bases shall also be provided for base mounted pump applications in which the associated room where they are housed is in a noise sensitive location, regardless of floor level.

2.04 FLOOR MOUNTED AIR COMPRESSORS, VACUUM PUMPS, AND SIMILAR EQUIPMENT

A Provide VMC Group model CAL-2 aluminum housed isolators sized for 2” static deflection. Cast iron or steel housings may be used provided they are hot-dip galvanized after fabrication.

B If floor mounted equipment is furnished with an internal vibration isolation option, provide VMC Group model SP-NRC, style E, consisting of two layers of 1" thick ribbed elastomeric pad bonded to a 16 gauge galvanized steel separator plate to address high frequency breakout and afford additional unit elevation for required drains. Ribbed elastomeric pads shall be located in accordance with the equipment manufacturer’s recommendations.

2.05 PIPING

A Provide line size stainless steel flexible connectors at connections to air compressors, domestic boosters, and other pumps (excluding submersible pumps and small circulators).

1. Type 321 SS annular corrugated interior hose.
2. Type 304 SS single braid exterior hose.
3. End connection type(s) as suited for the application and the equipment and piping being served, but in no case welded or soldered ends.
4. Ensure NSF 61 compliance for all potable water applications.
5. When applied with dissimilar pipe materials, dielectric connections must be provided at both ends.

B For medical gas applications (or similar), flexible connectors at intake and outlet of medical air compressors and vacuum pumps shall be specifically produced for such use:

1. They shall be documented, purged, and brazed to NFPA 99 standards.
2. They shall be cleaned, capped, and bagged in accordance with CGA (Compressed Gas Association) G-4.1.
3. Bronze hose and braid, copper return elbow, and copper sweat end connections. Sizes 2-1/2" through 4" shall utilize stainless steel hose and braid, stainless steel return elbow, and copper sweat end fittings silver brazed to the assembly.
4. Unisource Manufacturing Series 455 "MedFlex"

2.06 CORROSION PROTECTION

A All vibration isolators shall be designed and treated for resistance to corrosion.

B Steel components: PVC coated or phosphated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.01 INSTALLATION

A All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION 22 05 48

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the items covered by this Section, with all appurtenances, ready for owner's use.

B All plumbing piping shall be appropriately labeled.

C Refer to Architectural Sections for any additional requirements.

1.03 RELATED WORK

A Section 22 10 00 - Plumbing Piping

B Section 22 07 19 - Plumbing Piping Insulation

1.04 REFERENCES

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A Valves:

1. All valves shall be identified with a 1-1/2" diameter brass valve tag with stamped, black or red filled characters. Service designations shall be 1/4" letters and valve numbers shall be 1/2" numbers. Secure tags to valve handles by use of use of copper or Monel wire seals. For any services not identified below, contact Engineer in advance for approval. Service designations:

    a. Domestic cold water: DCW

    b. Domestic hot water: DHW

    c. Domestic hot water return: DHWR

    d. Natural gas: GAS

    e. Compressed air: AIR

2. All valves on the project shall be numbered sequentially, with valves for any one system and/or trade grouped together.

3. Valve tags are not required if the valve is located within 3'-0" of the equipment being served and the service is obvious.

4. Catalog a complete written record of all valves on the project, whether tagged or not. Include manufacturer, model number, size, service, system pressure (if like services with differing pressures are present on the project), location, valve tag data, and a description of the equipment/room/area served. Any valves which must be operated in sequence shall be indicated as such. Prepare a valve chart/schedule with all such information and include this chart/schedule in the project Operating and Maintenance Manual.

5. Mark all valve locations on the record drawings with appropriate identifying symbols or information to align with the above referenced valve chart/schedule. In addition to the O&M submission, provide the Owner with a digital copy (PDF format) of all such information in high-resolution, suitable for printing as full size drawings.

6. Tags and fastenings shall be manufactured by the Seton Nameplate Corporation or approved equal.

7. In addition to tags, all isolation valves serving emergency safety fixtures shall be provided with immediately adjacent clear and permanent signage indicating their purpose so as to avoid accidental shut-off.

B Pipe Marking:

1. All interior visible piping located in accessible spaces shall be provided with pipe markers. Accessible spaces shall include, but not necessarily be limited to, the following: above accessible ceilings, inside equipment rooms and utility spaces, in attic spaces, in crawl spaces, and in chase spaces, etc. viewable via access panels.

2. All exterior visible piping shall be provided with pipe markers.

3. Peel-off, self-adhesive, sticker type labels shall not be acceptable.

4. Pipe markers shall be manufactured with rigid vinyl PVC, printed with UV resistant ink, abrasion and chemical resistant, suited for indoor or outdoor use and for a service temperature of -40 degrees F to 160 degrees F.

   a. For pipes up to 6” provide cylindrically pre-coiled markers that snap into place without the need for tape or adhesives.

   b. For pipes 6” and larger provide flat snap-around markers installed using manufacturer’s heavy-duty nylon ties or stainless steel strapping.

   c. Markers shall indicate the pipe service, include flow directional arrows, and meet ASME A13.1.

5. Acceptable manufacturers:

   a. Seton Setmark Pipe Markers

   b. Brimar Industries Pipemarker System 1 Pipe Markers

c. Brady Corporation

6. Markers shall be provided after final insulating, painting, jacketing, etc. of piping and per manufacturer's installation instructions. Strapping (applies to large diameter markers only) shall be snug but shall not compromise any insulation. All such strapping shall also be cleanly trimmed of excess material.

7. Markers shall be provided in accordance with ASME A13.1 requirements. Specific items indicated below are not intended as a substitute for this complete standard. Markers shall be provided:

   a. On both sides of each floor or wall penetration.

   b. On each side of each tee.

   c. On each side of each valve and/or valve group.

   d. On each side of each piece of equipment.

   e. On straight pipe runs at equally spaced intervals not to exceed 50 feet.

   f. In congested areas, on each pipe at the point it enters and exits the area.

   g. At the point of connection to each piece of equipment and automatic control valve.

   h. Where they are readily visible to personnel from the point of normal approach.

   i. With letter height and length of color field according to the size of the pipe served.

   j. For non-potable water not less than once per room and at equally spaced intervals not to exceed 20 feet.

8. Color scheme of markers shall be as indicated below and otherwise in accordance with ANSI/ASME color recommendations. Legend color indicates color of legend text and flow directional arrow:

SYSTEM	LABEL COLOR	LEGEND	LEGEND COLOR
Sanitary Sewer	Green	Sanitary Sewer	White
	Green	Plumbing Vent	White
Storm Drain	Green	Storm Drain	White
	Green	Overflow	White
Domestic Water	Green	Domestic Cold Water	White
Domestic Hot Water	Green	Domestic Hot Water	White
Domestic Hot Water Return	Green	Domestic Hot Water Return	White
Fire Protection	Red	Fire Protection	White
	Red	Fire Sprinkler	White
Fuel Gas	Yellow	Natural Gas	Black
	Yellow	Propane Gas	Black

Diesel	Yellow	Diesel Oil	Black
Compressed Air	Blue	Compressed Air	White
Nitrogen	Orange	Nitrogen	Black
Carbon Dioxide	Orange	Carbon Dioxide	Black
Non-Potable Water	Yellow	Caution: Non-Potable Water, Do Not Drink	Black
Deionized Water	Green	Deionized Water	White
Reverse Osmosis Water	Green	R.O. Water	White
Acid Waste	Orange	Acid Waste	Black
		Acid Vent	Black

C Pipe Painting:

1. Pipe painting shall be per the color schedule below or as directed by the Architect. Confirm all color selections with Architect prior to installation, in particular for exposed piping in publicly occupiable areas.

2. All exterior piping shall be painted.

3. All piping subject to corrosive conditions shall be painted. This shall include, but not necessarily be limited to: natatoriums, pool equipment rooms, chemical and metal processing areas, and animal pens.

4. All exposed piping shall be painted (including, but not limited to: piping in mechanical rooms, kitchens, and storage rooms).

5. Paint color schedule:

System	Color
Storm Sewer	White
Sanitary Sewer Waste and Vent	Light Gray
Domestic Cold Water	Dark Blue
Domestic Hot Water Supply and Return	Orange
Fuel Gas (except for utility provider installed piping)	Yellow, unless specifically indicated/required otherwise by Architect or AHJ

2.02 EQUIPMENT IDENTIFICATION

A Plumbing equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.01 INSTALLATION REQUIREMENTS

A All labeling equipment shall be installed per manufacturer's printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor’s price shall include all items as required per manufacturers' requirements.

C All piping to be painted shall be cleaned of rust, dirt, grease, oil and all other contaminants prior to painting. Provide primer if and as recommended by the paint manufacturer. Provide a quality polyamine epoxy paint over all surfaces of pipe.

END OF SECTION 22 05 53

SECTION 22 07 16 - PLUMBING EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B Work specified elsewhere.

1. Basic materials and methods.

2. Piping systems.

1.03 REFERENCES

A ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

E UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 WARRANTY

A Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B Defects shall include, but not be limited to, the following:

1. Mildewing.

2. Peeling, cracking, and blistering.

3. Condensation on exterior surfaces.

1.05 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.06 DELIVERY AND STORAGE

A DELIVERY: Deliver undamaged materials in the manufacturer's unopened containers clearly labeled with flame and smoke ratings.

PART 2 - PRODUCTS

2.01 EQUIPMENT INSULATION

A It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

C A sample quantity of each type insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

F All insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

G Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

H All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturers requirements.

END OF SECTION 22 07 16

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B Furnish and install piping insulation to:

1. Interior domestic hot water and hot water return piping.
2. Interior domestic cold water piping.
3. Exterior domestic cold water piping.
4. Drain bodies and associated piping.
5. Condensate drainage piping.
6. All pipes subject to freezing conditions shall be insulated.

C Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D For insulation purposes, piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer wells, unions, pressure reducing stations, and orifice assemblies.

1.03 RELATED SECTIONS

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 05 53 - Identification for Plumbing Piping and Equipment

C Section 22 10 00 - Plumbing Piping

1.04 REFERENCES

A ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

C ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

D ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

E ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

F ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

H ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.05 WARRANTY

A Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.06 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.07 DELIVERY AND STORAGE

A Deliver undamaged materials in the manufacturer's unopened containers. Containers shall be clearly labeled with the insulation's flame and smoke ratings.

B Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 PIPING INSULATION

A It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved prior to installation.

C A sample quantity of each type of insulation and each type application shall be installed and approval secured prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

E All piping insulation shall comply with minimum requirements of International Energy Conservation Code ICC (IECC) and ASHRAE Std 90.1 I-P.

F Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.02 APPROVED MANUFACTURERS

A Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

B Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C Armaflex elastomeric cellular thermal insulation by Armacell.

D Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

E Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products, Inc.

2.03 MATERIALS

A INTERIOR DOMESTIC WATER PIPE: Provide glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket.

B EXTERIOR DOMESTIC WATER PIPE: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "AP Armaflex" with secured aluminum jacketing, or preformed phenolic foam in accordance with ASTM C1126 with secured aluminum jacketing.

C DRAIN BODIES AND DOWNSPOUTS: Insulate underside of roof and overflow drain bodies, associated horizontal piping, including first turn down to vertical conductor. Insulate chilled water waste lines from drinking fountain to junction with main waste stacks. Insulate branch lines including traps and exposed underside of floor drains receiving cooling coil condensate, same as water piping where exposed to building occupant view. When concealed, insulation may be same as specified for external duct wrap.

D CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

E ALUMINUM OR STAINLESS STEEL JACKETING: Utilize strap-on type jacketing, banding, and accessories. Provide pre-formed fitting covers for all elbows and tees.

F ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed, complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.01 GENERAL

A All insulation shall be installed in accordance with the manufacturers' recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C Pipes located outdoors, in tunnels or crawlspaces shall be insulated same as concealed piping; and in addition shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

D All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

E Provide all piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.

1. Low temperature surfaces - Minimum Insulation Thickness

    a. Exposed exterior domestic water pipe: 1-1/2 inch

    b. Interior domestic cold water pipe: 1 inch

    c. Condensate drain lines: 3/4 inch

    d. Drains receiving condensate: 1 inch

    e. Concealed piping from roof drains: 1-1/2 inch blanket wrap

    f. Exposed piping from roof drains: 1 inch thick rigid with all service jacket

2. Domestic Hot Water and Return Piping - Minimum Insulation Thickness

    a. Pipe sizes 1-1/4 inch and smaller with operating temperatures of 140°F or less: 1 inch

    b. Pipe sizes 1-1/2 inch and larger with operating temperatures of 140°F or less: 1-1/2 inch

    c. Pipe sizes 1-1/4 inch and smaller with operating temperatures greater than 140°F: 1-1/2 inch

    d. Pipe sizes 1-1/2 inch and larger with operating temperatures greater than 140°F: 2 inch

3.02 WATER PIPE INSULATION INSTALLATION

A The insulation shall be applied to clean, dry pipes with all joints firmly butted together. Where piping is interrupted by fittings, flanges, valves or hangers and at intervals not to exceed 25 feet on straight runs, a vapor dam shall be formed between the vapor retarder jacket and the bare pipe. The seal shall be by the applications of vapor retarder mastic to the exposed insulation joint faces, carried continuously down to and along 4 inches of pipe and up to and along 2 inches of jacket.

B Pipe fittings and valves shall be insulated with pre-molded or shop fabricated glass fiber covers finished with two brush coats of vapor retarder mastic reinforced with glass fabric.

C All under lap surfaces shall be clean and free of dust, etc. before the SSL is sealed. These laps shall be firmly rubbed to insure a positive seal. A brush coat of vapor retarder shall be applied to all edges of the vapor retarder jacket.

D At hangers and supports, provide a high density foam insulation insert that extends 2" beyond the shield on each side and a protective shield/saddle to prevent compression/damage. Secure shield/saddle to insulation using mastic. Also reference specific requirements in Section 22 05 29, Part 3 Execution.

3.03 FIRE RATED INSULATION

A All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION 22 07 19

SECTION 22 08 00 - COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.02 RELATED SECTIONS

A Section 019100

B Section 23 09 63 - Energy Management and Control System (EMCS)

1.03 SUMMARY

A The commissioning of the plumbing system and associated controls shall be performed by an impartial technical firm hired by the owner. The commissioning provider shall be certified under one or more of the following certifications:

1. CxA - Certified Commissioning Authority - ACG

    a. CBCP - Certified Building Commissioning Professional - AEE

    b. CCP - Certified Commissioning Professional - BCA

    c. CPMP - Certified Process Management Professional - ASHRAE

    d. BSC - Building System Commissioning Certification - NEBB

B The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.04 RESPONSIBILITIES

A Contractor: Responsibilities of the Contractor as related to the Commissioning Process include, but are not limited to the following:

1. Facilitate coordination of Commissioning work by Commissioning authority.

2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.

3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.

4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.

5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.

6. Provide As-built drawings and documentation to facilitate Testing.

7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.

8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.

9. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and Pre-Functional Checklists.

10. Provide data concerning performance, installation, and start-up of systems.

11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.

    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.

    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.

13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.

14. Provide qualified personnel to assist and participate in Commissioning.

15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.

16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.

17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.

18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.

19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.

21. Coordinate and provide training of Owner's personnel.

22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority comments.

23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B Subcontractors and vendors shall prepare and submit to Commissioning authority proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority

1.05 COMMISSIONING PLAN

A Commissioning Process tasks and activities:

1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.

2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.

3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.

4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications. Testing shall include all modes and sequence of operation, including under full-load, part-load and emergency conditions (including all alarms). Controls system shall be tested to document that control devices, components, equipment and systems are calibrated and adjusted and operate in accordance with the plans and specifications. Sequences shall be functionally tested to document they operate in accordance with plans and specifications.

5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.

6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.

7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B Equipment to be tested

1. Energy Management and Control System interface with applicable plumbing system equipment.

2. Service water heating systems (100%).

3. Service water circulation equipment (100%).

4. Domestic water booster pumps (100%).

C Testing functions and conditions

1. Verify shutdown of systems when scheduled.

2. Calibration of sensors

3. Confirm functionality of all specified sequences of operations.

4. Verify the functionality of all alarms.

D Performance criteria

1. Water temperatures shall be within tolerances specified in the contract documents.

2. Water heating system “recovery” rates shall be within specified time frame.

3. Booster pump shall maintain system pressure within specified tolerance.

PART 2 - PRODUCTS

2.01 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.01 GENERAL

A This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.02 WORK PRIOR TO COMMISSIONING

A Complete all phases of the work so the systems can be started, adjusted, balanced, tested, and otherwise tested.

B See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C Assist commissioning authority with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E A minimum of 7 days prior to date of system startup, submit to Commissioning authority for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.03 PARTICIPATION IN COMMISSIONING

A Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.04 WORK TO RESOLVE DEFICIENCIES

A Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor's responsibility.

3.05 PRE-FUNCTIONAL CHECKLISTS (PFC)

A Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.

B Refer to commissioning plan for detailed list of equipment to be commissioned.

3.06 FUNCTIONAL PERFORMANCE TESTING (FPT)

A Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B Refer to commissioning plan for detailed list of equipment to be commissioned.

C Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E Sampling

1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.

2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.

3. A common sampling strategy is the "xx% Sampling - yy% Failure Rule", defined by the following example.

   a. xx = the percent of the group of identical equipment to be included in each sample.

   b. yy = the percent of the sample that if failing, will require another sample to be tested.

   c. The example below describes a 20% Sampling - 10% Failure Rule.

   d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

   e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).

   f. If 10% of the units in the second sample fail, test all remaining units in the whole group.

   g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F Re-Testing And Failure To Remedy Deficiencies

1. Despite Contractor's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.

2. It is Contractor's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.

3. It is Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.

    a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor's control to resolve expeditiously.

    b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)

4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.

    a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G Deferred Testing

1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.

2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.

3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.

4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.

5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.

6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.07 TRAINING

A The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C The training agenda (plan) shall include, at a minimum, the following elements:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

D Commissioning authority shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning authority with training plan two weeks before planned training.

3.08 OPERATIONS & MAINTENANCE MANUALS

A The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B Sub-Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority copy of O&M manuals shall be submitted through Architect.

D Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.09 DOCUMENTATION

A Commissioning authority shall provide documentation of process as follows:

1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.

2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION 22 08 00

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the piping covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Pipe and pipe fittings:
    a. Sanitary drainage piping system.
    b. Storm drainage piping system.
    c. Domestic water piping system.
2. Adapters, Transitions, Unions, Couplings, Flanges, Connectors
3. Valves
4. Excavation, Bedding, and Backfill

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C Section 22 05 53 - Identification for Plumbing Piping and Equipment

D Section 22 07 19 - Plumbing Piping Insulation

E Section 221112

F Section 22 11 19 - Plumbing Specialties

G Section 22 30 00 - Plumbing Equipment

H Section 22 40 00 - Plumbing Fixtures

1.04 REFERENCES

A ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.

C ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts With Pipe Threads; Current Edition.

D ASME B16.15 - Cast Copper Alloy Threaded Fittings: Classes 125 and 250; 2018.

E ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

F ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

G ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

H ASME B16.24 - Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500, and 2500; 2021.

I ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

J ASME B16.39 - Malleable Iron Threaded Pipe Unions: Classes 150, 250, and 300; 2019.

K ASME B16.50 - Wrought Copper and Copper Alloy Braze-Joint Pressure Fittings; 2013.

L ASME B16.51 - Copper and Copper Alloy Press-Connect Pressure Fittings; Current Edition.

M ASME BPVC - Boiler and Pressure Vessel Code; 2023.

N ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

O ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.

P ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2021.

Q ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

R ASTM A312/A312M - Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes; 2022a.

S ASTM A403/A403M - Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings; 2022b.

T ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

U ASTM A582/A582M - Standard Specification for Free-Machining Stainless Steel Bars; 2022.

V ASTM A733 - Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples; 2016 (Reapproved 2022).

W ASTM A865/A865M - Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints; 2023.

X ASTM A888 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

Y ASTM B1 - Standard Specification for Hard-Drawn Copper Wire; 2013 (Reapproved 2018).

Z ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).

AA ASTM B16/B16M - Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines; 2019.

BB ASTM B32 - Standard Specification for Solder Metal; 2020.

CC ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2020.

DD ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

EE ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2020.

FF ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

GG ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

HH ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

II ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

JJ ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).

KK ASTM C1173 - Standard Specification for Flexible Transition Couplings for Underground Piping Systems; 2018.

LL ASTM C1460 - Standard Specification for Shielded Transition Couplings for Use With Dissimilar DWV Pipe and Fittings Above Ground; 2017.

MM ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

NN ASTM C1540 - Standard Specification for Heavy-Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings; 2020.

OO ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2022.

PP ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)); 2012 (Reapproved 2021).

QQ ASTM D1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable; 2016.

RR ASTM D1599 - Standard Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings; 2018.

SS ASTM D1784 - Standard Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds; 2020.

TT ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.

UU ASTM D2122 - Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings; 2022.

VV ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2020.

WW ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2023.

XX ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2020.

YY ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2020.

ZZ ASTM D2774 - Standard Practice for Underground Installation of Thermoplastic Pressure Piping; 2021a.

AAA ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

BBB ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2023.

CCC ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019.

DDD ASTM D3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals; 2007.

EEE ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials; 2021.

FFF ASTM D3311 - Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns; 2017 (Reapproved 2021).

GGG ASTM D4101 - Standard Classification System and Basis for Specification for Polypropylene Injection and Extrusion Materials; 2017, with Editorial Revision (2019).

HHH ASTM D4976 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials; 2012.

III ASTM D5926 - Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems; 2015.

JJJ ASTM D6707/D6707M - Standard Specification for Circular-Knit Geotextile for Use in Subsurface Drainage Applications; 2016.

KKK ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

LLL ASTM E438 - Standard Specification for Glasses in Laboratory Apparatus; 1992 (Reapproved 2018).

MMM ASTM F439 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2019.

NNN ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2023.

OOO ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014 (Reapproved 2021).

PPP ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2022.

QQQ ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings; 2021.

RRR ASTM F1290 - Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings; 2019.

SSS ASTM F1412 - Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems; 2016.

TTT ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

UUU ASTM F1548 - Standard Specification for Performance of Fittings for Use with Gasketed Mechanical Couplings Used in Piping Applications; 2001.

VVV ASTM F1673 - Standard Specification for Polyvinylidene Fluoride (PVDF) Corrosive Waste Drainage Systems; 2010, with Editorial Revision (2021).

WWW ASTM F2618 - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems; 2019.

XXX AWS A5.9/A5.9M - Welding Consumables-Wire Electrodes, Strip Electrodes, Wires, and Rods for Arc Welding of Stainless and Heat Resisting Steels- Classification; 2017.

YYY AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.

ZZZ AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.

AAAA AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

BBBB AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.

CCCC AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings; 2019.

DDDD AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe; 2023.

EEEE AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.

FFFF AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service; 2020.

GGGG AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.

HHHH AWWA C651 - Disinfecting Water Mains; 2023.

IIII AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.

JJJJ CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2021.

KKKK CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2020.

LLLL FM 1680 - Approval Standard for Couplings Used in Hubless Cast Iron Systems for Drain, Waste or Vent, Sewer, Rainwater or Storm Drain Systems Above and Below Ground, Industrial/ Commercial and Residential; 1989.

MMMM NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

NNNN NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2022.

OOOO NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.

PPPP NSF 14 - Plastics Piping System Components and Related Materials; 2019.

QQQQ NSF 372 - Drinking Water System Components - Lead Content; 2022.

RRRR UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; Current Edition, Including All Revisions.

SSSS UL 1285 - Safety Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service; 2016.

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D Foreign pipe, fittings or valves are unacceptable.

E All cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and shall be listed by NSF International.

F Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

G Welders Certification: In accordance with ASME BPVC-IX.

1.06 SUBMITTALS

A Submit under provisions of Division One.

B Submit product data and video inspection report under provisions of Division One.

C Include pipe materials, pipe fittings, valves, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

D Submit dimensioned detailed drawings and material specifications for pipe isolation and protection systems being provided for void form/carton form/void box installations.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of valves.

C Include written report and digital video record of waste piping inspection.

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.09 QUALIFICATIONS

A Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E Provide temporary protective coating on cast iron and steel valves.

F Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A Perform work in accordance with plumbing and building codes having jurisdiction.

B PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

C Provide water pressure regulating valves:

1. At the service entry where incoming water supply pressure is greater than 70 psi.

2. Anywhere else in the distribution system where delivered water pressure is excessive relative to the fixture or equipment it serves, based on the fixture or equipment manufacturer's recommendations. Examples may include dish machines, booster heaters, food waste disposers, etc.

PART 2 - PRODUCTS

2.01 SANITARY SOIL, WASTE AND VENT PIPING, BURIED BEYOND 5 FEET OUTSIDE OF BUILDING

A PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.

2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.02 SANITARY SOIL, WASTE AND VENT PIPING, BURIED WITHIN 5 FEET OF BUILDING

A PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.

2. Joints: solvent weld with ASTM D2564 solvent cement, clear, medium bodied, for sizes 3" and smaller and gray, heavy bodied, for sizes 4" and larger. Mating surfaces shall be prepared with ASTM F656 purple primer immediately prior to cement application.

2.03 GREASE WASTE AND VENT PIPING, WITHIN BUILDING AND BURIED

A This Article applies to piping in the kitchen area(s) within the building and also to the piping outside the building limits which connects to the grease trap inlet.

B CPVC Pipe and Fittings: All system pipe and fittings shall be from a single manufacturer, Schedule 40 CPVC manufactured of material in conformance with ASTM D1784 and produced in accordance with ASTM F2618 from CPVC Type IV, ASTM Cell Classification 23447.

1. All pipe shall meet the dimensional requirements of ASTM F441/F441M and all pipe markings shall be accompanied by a yellow stripe for ease of identification.

2. All fittings shall be drainage pattern meeting the requirements of ASTM D3311 and specialty patterns according to the manufacturer’s specifications.

3. All pipe and fittings shall conform to NSF 14.

4. Joining shall be by solvent cement welding, using “one step” primer-less type CPVC cement specially formulated and manufactured in accordance with ASTM F493. Only cement from the system manufacturer shall be acceptable.

5. Mechanical connections for transition to other system materials shall be as specified by the pipe system manufacturer.

6. All installation shall be in accordance with the manufacturer’s instructions and applicable codes.

7. Acceptable Manufacturer: Spears Manufacturing Company Lab Waste CPVC Drainage System only.

2.04 SANITARY SOIL, WASTE AND VENT PIPING, WITHIN BUILDING, NOT BURIED

A Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.

1. Fittings: Cast iron, CISPI 301 or ASTM A888 drainage pattern.
2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
    a. Tyler Pipe
    b. Charlotte Pipe
    c. AB&I Foundry
3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations. Acceptable manufacturers:
    a. Husky SD 4000
    b. Clamp-All 125

2.05 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A PVC Pipe: ASTM D1785 / ASTM D2665 schedule 40 solid wall; installed per ASTM D2321.

1. Fittings: PVC, ASTM D3311 / ASTM D2665 drainage pattern, with bell and spigot ends. Furnished by the same manufacturer as pipe or approved equal.
2. Joints: solvent weld with ASTM D2564 solvent cement, installed per the requirements of ASTM D2855.

2.06 STORM DRAINAGE PIPING, WITHIN BUILDING, NOT BURIED

A Cast Iron Pipe: CISPI 310 or ASTM A888, hubless.

1. Fittings: Cast iron, CISPI 310 or ASTM A888 drainage pattern.
2. Acceptable manufacturers (all pipe and fittings shall be from a single manufacturer):
    a. Tyler Pipe
    b. Charlotte Pipe
    c. AB&I Foundry
3. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.

4. Joints: No hub heavy-duty, shielded, stainless steel couplings meeting ASTM C1540 and FM 1680 Class 1. Complete with minimum 304 stainless steel bands, tightening devices, and shield (minimum 0.015 shield thickness). ASTM C564 neoprene gasket. Made in the USA. Torque all clamps per manufacturer's recommendations. Acceptable manufacturers:

    a. Husky SD 4000

    b. Clamp-All 125

2.07 DOMESTIC WATER PIPE, BURIED WITHIN 5 FEET OF BUILDING EDGE

A Stainless Steel Pre-Fabricated In-Building Riser (acceptable for sizes 2" through 10")

1. Corrosion resistant Type 304 stainless steel construction single, extended 90 degree fitting.

2. UL listed, FM approved and NFPA 24 compliant.

3. Lead free and NSF 61 / NSF 372 certified.

4. Acceptable manufacturers:

    a. Ames Fire & Waterworks Series IBR (4" through 10") and IBR2 (2", 2-1/2", and 3")

    b. Zurn Wilkins Model WBR (4" through 10")

5. For sizes 3" and smaller, ensure to provide riser with an (inlet) end connection type as appropriate for the site water service pipe material. Provide an adapter fitting at each end of the riser if/as necessary. All such fittings shall be approved for installation with the piping material being installed, code accepted, and NSF 61 compliant.

6. Note: For this application, the inlet joint for larger diameter (4" through 10") piping (which shall not be located below a building slab or foundation) can be rubber gasketed push-on type, ANSI/AWWA C111/A21.11. Installation shall be in accordance with AWWA C600.

7. Provide continuous polyethylene encasement for all piping buried or in contact with concrete in accordance with AWWA C105/A21.5, beginning at no closer than the 5'-0" mark from the building and to a minimum of 6" above the finished floor.

2.08 DOMESTIC WATER PIPING, WITHIN BUILDING, BURIED

A Copper Tubing: ASTM B88, Type K, soft annealed.

1. No joints allowed buried, run tubing continuous.

2. Provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer's installation guidelines, for all piping buried or in contact with concrete, to a minimum of 6" above finished floor. Chase Construction Products Tapecoat H35 or approved equivalent.

3. Applies to installations including services to island sinks and trap primer lines.

2.09 DOMESTIC WATER PIPING, WITHIN BUILDING, NOT BURIED

A Copper Tubing: ASTM B88, Type L, hard drawn.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper alloy solder joint pressure fittings.

2. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.

3. Fittings and joints for pipe sizes 1/2" through 4" may be mechanical press-connect system joints with ASME B16.51 lead-free copper bodied fittings with integral ethylene-propylene diene monomer rubber (EPDM) sealing gaskets. All fittings, couplings, and adapters shall be the product of a single system manufacturer and only that manufacturer's approved press tools, kits, and jaws shall be used.

   a. EPDM o-rings shall be pre-installed and lubricated with NSF 61 listed lubricant.

   b. All installers of copper press-connect fittings shall be trained by the fitting manufacturer's appointed representative and carry such credentials for the duration of the project.

   c. The fitting manufacturer's representative shall conduct periodic inspections of the installation and shall provide written reports of such inspections to the Contractor and Engineer, including any observed deviations from the manufacturer's recommended installation practices.

4. Rolled groove type fittings and joints shall be acceptable for copper pipe sizes 2-1/2 inch and larger, with all tools, couplings, adapters, fittings, and gaskets the product of a single system manufacturer.

   a. Fittings shall be cast bronze using lead-free alloys per ASTM B584 or copper wrought copper constructed to ASTM B75/B75M, compliant with NSF 61 for potable water service applications, and meet ASTM F1548.

   b. Couplings shall be epoxy/enamel (rust-inhibiting) coated ductile iron housings conforming to ASTM A536.

   c. Gaskets shall be EPDM for potable water, meeting ASTM F1476, and NSF 61 / NSF 372 certified for potable water service from 30 degrees to 180 degrees F.

   d. Acceptable system manufacturers: Victaulic, Shurjoint, Anvil Gruvlok.

2.10 DOMESTIC WATER PIPING, WITHIN BUILDING - SPECIAL APPLICATIONS

A For filtered and/or reverse osmosis conditioned water applications such as commercial kitchen, break room, and central drinking water treatment systems, copper water piping shall not be employed for post-system distribution unless specifically noted otherwise.

B For such special applications, provide approved plastic pipe and fittings consistent with the treatment system manufacturer's recommendations, the particular installation setting (buried or not buried, return air plenum or non-plenum space, etc.) and local AHJ requirements.

C For applications, pressures, and temperatures consistent with the piping manufacturer's recommendations, Uponor PEX-A pipe and fittings (straight lengths for sizes 1" and larger, coiled form for sizes 3/4" and smaller), complete with insulation and supports as required, is preferred.

2.11 ADAPTERS, TRANSITIONS, UNIONS, COUPLINGS, FLANGES, CONNECTORS

A (Non-Acid Waste) Drainage Applications:

1. Provide approved listed adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements.

2. **Not buried:** For dissimilar piping not buried, provide stainless steel shielded, molded elastomeric couplings and adapters meeting ASTM C564 and ASTM C1460. Applies to installations including cast iron to PVC transitions immediately adjacent to the building floor where piping below is buried.

    a. Husky 4200 or Cremco

    b. Fernco Proflex

3. **Buried, but NOT below building slab**: For dissimilar buried piping beyond the limits of building or readily accessible buried piping transitions in backwater valve pits, etc. Provide shear resistant .012” thick 300 series stainless steel shielded, **PVC gasketed** flexible couplings and adapters meeting ASTM D5926 and ASTM C1173. For direct-bury applications, provide AWWA C209 cold-applied, integrated primer type, elastomeric adhesive, laminate polymeric tape coating, minimum 35 mil nominal thickness, in accordance with manufacturer’s installation guidelines, to completely wrap the shield, banding, and screws. Chase Construction Products Tapecoat H35 or approved equivalent.

    a. Cremco

    b. Mission Rubber Company, LLC

    c. Fernco, Inc. Strong Back RC 1000 Series

4. Adapters, couplings, bushings for copper DWV pipe shall be cast bronze or wrought copper, ASME B16.23 / ASME B16.29.

B Domestic Water Applications:

1. Provide joints between various materials with approved adapter and transition fittings appropriate to the specific pipe transition and in accordance with code requirements and the manufacturer's instructions.

2. For copper tube and pipe: adapters, bushings, plugs, caps, and couplings shall be wrought copper or cast bronze; flanges (minimum class 150) and unions shall be cast bronze. Provide with solder or threaded connections as necessary and as produced to applicable standards ASME B16.15, ASME B16.18, ASME B16.22, ASME B16.24, ASME B16.50 ASME B16.50, ASME B1.20.1. All such appurtenances shall be for use in above ground potable water systems.

3. Buried to not buried transitions for water service entries:

    a. 100% fusion bonded epoxy coated ASTM A536 cast ductile iron construction coupling with acrylonitrile butadiene rubber (NBR) gaskets and EPDM insulating boot for water service. 5/8 inch high strength stainless steel bolts and nuts. Coupling shall meet AWWA C219. Romac Industries, Inc. IC501 or pre-approved equivalent.

    b. 100% fusion bonded 14 mil epoxy coated coupling with ASTM A536 cast ductile iron rings. Complete with acrylonitrile butadiene rubber (NBR) gaskets and type 304 stainless steel bridge, spacers, nuts, and bolts. Coupling shall meet AWWA C219, NSF 61, and NSF 372. Krausz USA Hymax Grip Coupling Restraint or pre-approved equivalent.

4. Dielectric connections:

    a. For pipe sizes 2 inch and smaller, provide lead-free dielectric unions, rated to 180 F at 250 psi and compliant to ASSE 1079.

    b. For pipe sizes larger than 2 inches, provide lead-free dielectric flanged pipe fittings, rated to 180 F at 175 psi and meeting ASME B16.1.

    c. For grooved copper joining systems, provide grooved end dielectric transition fitting from system manufacturer, with virgin polypropylene internal lining, meeting NSF 61.

C General:

1. Unions for ferrous pipe shall be ASME B16.39 galvanized malleable iron, threaded, minimum pressure class 150.

2. Plugs and bushings for ferrous pipe shall be ASME B16.14 galvanized malleable iron, threaded.

3. Nipples for ferrous pipe shall be schedule 40, galvanized, ASTM A53/A53M welded steel pipe nipples, threaded, meeting ASTM A733.

4. Couplings for ferrous pipe shall be galvanized steel, threaded, manufactured in accordance with ASTM A865/A865M.

5. Flanges for ferrous pipe shall be galvanized forged steel construction, either socket weld or slip-on weld type, minimum pressure class 150, manufactured to ASME B16.5.

6. Bolts, nuts, and gaskets for flanged connections shall be appropriate to the pipe material, fluid type, temperature, and pressure. 1/16" thick pre-formed neoprene, typical.

7. Provide flexible stainless steel connectors at pumps and other such equipment, in accordance with manufacturer's recommendations. Connectors shall have corrugated hose and braided 300 series stainless steel jacketing. Carbon steel flanged or grooved ends as appropriate. NSF 372 lead-free for all potable water applications. Metraflex Company or pre-approved equivalent.

2.12 GATE VALVES (IRON)

A ASTM A126 cast iron bodied, class 125 gate valve with bolted bonnet, non-rising ASTM B16/B16M brass stem and packing gland, solid wedge, cast iron hand-wheel. Bronze wedge for sizes up through 6" and cast iron wedge with bronze bushing and wedge face rings for sizes 8" and larger.

B Basis of design:

1. NIBCO T-619 (threaded) for sizes 2" through 4".

2. NIBCO F-619 (flanged) for sizes 6" and larger.

C Acceptable alternate manufacturers:

1. Apollo

2. Milwaukee

2.13 BALL VALVES

A All bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B Basis of design (bronze valves):

1. NIBCO T-585-66-LF (full port) for all sizes up through 2".

2. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".

C Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

D Acceptable alternate manufacturers:

1. Apollo 77 CLF-A series (full port) for all sizes up through 2".

2. Milwaukee UPBA-400S (full port) for all sizes up through 2".

3. Apollo 77 CLF-A series (full port) for size 2-1/2” and Apollo 70LF-140 series (standard port) for 3”.

4. Milwaukee UPBA-100S (standard port) for sizes 2-1/2” and 3”.

E Applies to domestic water system installations.

F Provide valves complete with extended lever handles as required to accommodate insulation and full valve operation.

G Provide valves complete with memory stop kit where used for balancing applications.

2.14 CHECK VALVES (BRONZE)

A ASTM B62 / ASTM B584 bronze body and disc, minimum 200 psi (cold working pressure) Y-pattern horizontal swing type check valve with removable bronze bonnet, Type 300 series stainless steel nuts and hinge pin, and PTFE disc seat. Threaded connections. Certified lead-free to NSF 61 / NSF 372 and suited to 180 degrees F.

B ASTM A126 cast iron bodied, (minimum) class 125 globe style spring loaded (silent) check valve with ASTM B584 bronze disc and seat. Flanged connections. Certified lead-free to NSF 61 / NSF 372 and suited to 200 degrees F.

C Basis of design:

1. NIBCO T-413-Y-LF (Y-pattern swing type) for sizes up through 2”.

2. NIBCO F-910-B-LF (globe style spring loaded type) for sizes 2-1/2” and larger.

D Acceptable alternate manufacturers:

1. Apollo (for sizes up through 2”)

E Applies to domestic water system installations including associated pump discharge lines. Valves shall be suited for installation in both horizontal lines and vertical lines with upward flow, in accordance with manufacturer’s recommendations.

2.15 BALANCING VALVES

A Self-contained, fully automatic thermally actuated balancing valve shall continuously adjust flow to maintain the desired domestic hot water temperature within the branch line, regardless of system operating pressure. Valve shall modulate between open and closed position within a 10 degrees F range. The valve set-point (closing temperature) shall be the hot water system supply temperature. Valve body and all internal components shall be constructed of stainless steel with major components constructed of Type 303 stainless. Rated for 200 psi maximum working pressure and no less than 250 degrees F maximum working temperature. Lead-free NSF 372 and NSF 61 compliant. Threaded connections.

B Basis of design:

1. ThermOmegaTech Circuit Solver, sizes 1/2" through 2”. Provide a union and ball type shutoff valve on both sides of the balancing valve.

2. ThermOmegaTech Circuit Solver with integrated union (CSU) assembly, sizes 1/2" and 3/4". Balancing valve assembly shall come complete with union body and ball type shutoff valves on both sides.

3. Provide complete with an integral check valve from the manufacturer, positioned after the balancing valve. For balancing valves not available with an integral check valve as part of the manufacturer's assembly, ensure to provide a lead-free swing type check valve on the downstream side of the balancing valve component.

C Applies to circulated domestic hot water system installations including multi-branch parallel piping circuits and single-loop piping circuits.

1. Provide balancing valve at end of each domestic hot water supply line (after last fixture served) just prior to the hot water return line, as indicated on Drawings and in accordance with manufacturer’s installation recommendations.

2. Provide a pipe tee or elbow with bushing as appropriate, 3/4" threaded thermowell, and bi-metal adjustable angle 3 inch dial thermometer upstream of each balancing valve. Thermowell stem length and thermometer temperature probe length to be suited for pipe size, insulation thickness, and to ensure clearance for maintenance access and easy viewing of thermometer. Trerice bimetal/sensor, threaded-stepped shank thermowell (style 76) of lead-free brass (PBF) material. Trerice Model B836 thermometer with 300 stainless steel case and stem, hermetically sealed, double strength glass windowed, aluminum white-faced dial, complete with external reset and 0 to 200 degrees F range. Thermowell and thermometer face to be oriented upright for readability.

PART 3 - EXECUTION

3.01 EXCAVATION, BEDDING AND BACKFILL

A This section shall apply for the excavation, bedding, and backfill of all buried piping unless specifically noted otherwise. All work shall be coordinated with any job site subsurface drainage/dewatering and adjusted accordingly.

B Establish elevations of buried piping outside the building to ensure the following:

1. Not less than 2 feet of cover, or not less than maximum depth of frost penetration, whichever is the greater.

2. For water lines intended for fire protection service, the depth of cover shall be:

a. Not less than 2’-6” in those locations where frost is not a factor.

b. Not less than 1’-0” below the frost line for the locality.

c. Not less than 3’-0” for piping under driveways.

d. Not less than 1’-0” below the bottom of the building foundation/footers.

e. In full compliance with the requirements of NFPA 13 and NFPA 24.

C Excavation:

1. Excavate trenches for underground piping to the required depths.

2. The bottom of the trench or excavation shall be cut to a uniform grade.

3. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp to existing density.

4. Coordinate alignment of pipe trenches to avoid obstructions. Ensure that proposed routing of pipe will not interfere with building foundation before any trenching has begun. Should conflicts occur, contact Architect/Engineer before proceeding.

5. Should any sleeving of the building foundation be required, this shall be provided as directed by the structural engineer of record AND in accordance with the prevailing code, but in no case shall the sleeve be any less than two (2) pipe sizes greater than the pipe it serves.

D Bedding and Backfill:

1. Backfill shall not be placed until the piping has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades indicated on drawings. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe. Provide select fill up to finished surface or grade, unless indicated otherwise by project geotechnical report or specified otherwise in Division 02.

2. Compacting Backfill: Place material in uniform layers of 8 inches maximum, loose measure and compact to not less than 95% of maximum soil density as determined by ASTM D698 Standard Proctor.

3. Restoration: Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks and similar areas, to a condition equal to the adjacent undisturbed earth and restore surface of the area to the condition existing prior to trenching or excavating operation.

4. A clay fill “trench plug” extending 3 feet inside the building line and 5 feet outside the building line shall be placed to completely surround utility lines passing beneath the foundation and grade beam. The materials shall consist of on-site soils with a plasticity index (PI) between 30 and 40 percent compacted to at least 95 percent of the Standard Proctor and maximum dry density as determined by ASTM D698.

E Cement Stabilized Sand:

1. Materials:

   a. Cement shall be Type I Portland cement conforming to ASTM C150/C150M.

   b. Sand shall be clean, durable sand meeting grading requirements for fine aggregates of ASTM C33/C33M and free of organic matter and deleterious substances.

   c. Water shall be potable and free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94/C94M.

2. Mixture:

a. Product shall consist of not less than 1.5 sacks of Portland cement per ton of dry sand.

b. Mixture shall contain sufficient water to hydrate the cement and be thoroughly mixed in a pugmill type mixer.

F For water lines (including In-Building Risers) intended for fire protection service, provide joint restraints by way of concrete thrust blocks in accordance with the requirements of NFPA 13 and NFPA 24.

G Aggressive Soil Conditions: Soil shall be considered aggressive and protection of buried metallic piping shall be provided as specified if any of the following situations exist:

1. Conditions are identified as such by the project geotechnical report or project geotechnical engineer.

2. The soil environment is a landfill area, swamp, marsh, polluted river bottom, cinder bed, or has alkaline soils.

3. A score of ten or higher is tallied when applying the soil assessment tool detailed in Appendix A of AWWA C105/A21.5. An excerpt of this evaluation procedure is provided below for reference but is not intended as a substitute for the complete and latest Standard:

NUMERICAL CORROSIVITY SCALE	
Soil Parameter	**Assigned Points**
Resistivity (ohm-cm)	
< 700	10
700 - 1,000	8
1,000 - 1,200	5
1,200 - 1,500	2
1,500 - 2,000	1
> 2,000	0
pH	
0 - 2	5
2 - 4	3
4 - 6.5	0
6.5 - 7.5	0
7.5 - 8.5	0
> 8.5	3
Redox Potential (mV)	
> 100	0
50 - 100	3.5
0 - 50	4
< 0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Poor drainage continuously wet	2
Fair drainage generally moist	1
Good drainage generally dry	0

H Void Form/Carton Form/Void Box Installations

1. Where piping will be installed in a such a setting, steps shall be taken to isolate and protect the piping from expansive soil conditions. This work shall be fully coordinated with the building slab/floor construction, the project geotechnical report, and the structural Drawings and specifications. The most stringent conditions/recommendations shall govern.

2. All piping below slab shall be supported by an approved suspended system.

3. System structure:

    a. Shall provide a dimensionally stable underground void space that is independent from the overhead structural slab. The subterranean system shall support the weight of suspended lateral pipes and fittings, including all imposed loads, throughout the construction process.

    b. The system shall be designed to have the ability to temporarily position and suspend the lateral pipes and fittings to the required height/depth and slope until permanently anchored to the overhead structural slab via the securing hanger system. The open, underground system will then remain independent from the securing hangers.

    c. The open space of the system beneath the structural slab shall be designed to receive the infill of vertical expansion from the underlying soils. If vertical pressure is applied to the edges of the system in contact with the soil, the uplifting soil pressure will become separate and allow the lateral pipes and fittings to be totally independent from the system.

4. System components:

    a. The system shall have waterproof components related to its intended performance.

    b. The system must maintain its structural integrity in all humid environments.

    c. The system must have industry-proven performance in any and all inclement conditions.

    d. The system shall be able to perform if and when submerged in water.

    e. All independent components not included in the system shall comply with the project specifications in order to achieve the intended results of the designed system.

    f. All vertical all-thread rod must have a component secured toward the top end and be permanently affixed into the concrete slab in order to maintain the required elevations.

    g. All system components, excluding all-thread rod, nuts/washers, shall be furnished by the designed, system manufacturer.

    h. Galvanized steel all thread-rod and hardware shall be provided and these materials shall be coordinated with the system manufacturer’s related components.

    i. The system shall be installed per the manufacturer’s requirements and recommendations.

5. Submittals: The exact system to be provided, complete with dimensioned detailed drawings and material specifications, shall be submitted for review by the Architect, MEP engineer, structural engineer, and project geo-technical engineer.

6. Acceptable System Manufacturers:

a. SuperVoid Systems, LLC

b. Void Form Products, Inc.

c. Other pre-approved system providers.

7. Manufacturer Training: The system manufacturer shall provide on-site training, support, and guidance to the Contractor regarding the recommended installation of their products.

I Pipe Penetrations of Buried Exterior Walls or Foundations

1. Unless specifically indicated otherwise on the Drawings, each pipe penetration shall be provided with a schedule 40 steel pipe sleeve no less than two (2) pipe sizes larger than pipe itself.

2. At each penetration provide GPT Industries (“Thunderline”) Link Seal Modular Seal LS series. The exact model shall be as required for the pipe material, pipe size, and sleeve length for the penetration. Provide complete with EPDM sealing element and model “C” zinc coated carbon steel hardware.

3.02 INSTALLATION

A General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

2. Remove any scale, oil and dirt, on inside and outside, before assembly.

3. Prepare piping connections to equipment with flanges or unions.

4. Confirm pipe placement, depth/elevation, and flow lines prior to any installation.

B General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.

2. Valves shall be line-sized unless specifically noted otherwise.

3. Provide clearance for installation of insulation and access to valves and operable fittings. Valves installed beyond reasonable reach shall be provided with a chain operator.

4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.

5. Gate valves installed buried shall be covered with an adjustable cast iron roadway box extended to grade. Cover shall be cast iron with 'water' cast on top of cover and shall be set flush to finished paving or 2" above finished earthen grade. Box shall be supported from undisturbed soil or concrete base and shall not introduce any stress to piping under all traffic conditions.

C Install all materials in accordance with the manufacturer's published instructions.

D Unburied piping inside the building shall be installed concealed, out of public view wherever possible (above ceilings, inside walls and chases, within casework, etc.). This requirement shall not apply to fixture supplies & stops and chrome plated tubular brass drainage piping.

E All exposed sewer and water pipe in toilet rooms or other finished areas of the building shall be chrome plated.

F Provide non-conducting dielectric connections wherever joining dissimilar metals.

G Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on drawings, and maintain gradients.

H Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

I Group piping whenever practical at common elevations.

J Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L Provide encasement for and support for utility meters in accordance with the requirements of utility companies.

M Prepare pipe, fittings, supports, and accessories not pre-finished, ready for finish painting.

N Maintain uniformity in the installation of piping materials and joining methods. Do not mix material types.

O Where connecting new underground sanitary, storm, or vent piping to existing piping of dissimilar material, provide suitable mechanical transition fittings complete with corrosion protection for metallic elements. Chase Construction Products Tapecoat H35 or approved equivalent and a final coat of coal tar to completely cover the transition.

P Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

Q Waste nipple from wall to tapped tee shall be schedule 40 threaded galvanized steel pipe or brass or copper with threaded adapter.

R General requirements for cast iron piping installation:

1. Install all pipe and fittings in accordance with published recommendations from the manufacturer and the Cast Iron Soil Pipe Institute (CISPI). Specific items referenced below are not intended as a substitute for the complete and latest recommendations.

2. Install bell and spigot type pipe with bell end upstream.

3. Above ground horizontal pipe (suspended) shall:

a. Be supported at no less than at every joint, and within 18” of the hub or coupling.

b. Be maintained in alignment. Sagging or grade reversal shall be unacceptable.

c. Be supported at terminal ends of all runs or branches and at each change of direction or alignment.

d. Have all closet bends, traps, trap arms, and similar branches firmly secured.

e. Be braced to prevent movement or joint separation.

f. Be provided with suitable sway bracing (such as clamps, rods, and hardware) where pipe and fittings are suspended in excess of 18” by means of non-rigid hangers.

4. Above ground vertical pipe shall:

a. Be secured at each stack base.

b. Be secured at each floor and riser clamps shall be provided on no greater than 15’-0” intervals.

c. Be adequately supported to keep the system (pipe and contents) in alignment.

5. Provide seismic restraints in seismically active areas, whether specifically required by the prevailing code or not.

S For all buried non-metallic piping outside the building, provide minimum 14 AWG solid copper tracer wire (ASTM B1, ASTM B3) with high molecular weight polyethylene insulation (HMWPE) per ASTM D1248. Wire shall be suited for direct bury applications to facilitate the detection and tracing of underground piping systems. THHN wire and other such nylon jacketing shall not be allowed. Insulation color shall be provided per the particular utility, in accordance with the American Public Works Association (APWA) uniform color code. Provide corrosion proof wire connectors with twist locking design and protective dielectric sealant. Copperhead Industries, LLC Snakebite or pre-approved equivalent. Tracer wire shall be placed in the same orientation as the installed pipe and laid six inches directly above the piping. One end of the tracer wire shall be brought aboveground at a building wall or riser for easy identification.

T PVC pipe, fittings, or similar un-rated material shall not be installed in a return air plenum unless the entire length of all such piping is encased within a minimum two (2) hour fire rated enclosure.

U Installations of buried thermoplastic piping systems shall be in strict conformity with the manufacturer’s published instructions and the requirements of ASTM D2321 (gravity pipe) and ASTM D2774 (pressure pipe).

V Installation of thermoplastic piping systems which are not buried shall be in accordance with the manufacturer’s recommendations. The specific items indicated below are not intended as a substitute for the complete and latest manufacturer’s recommendations.

1. Hangers and supports shall not compress, distort, cut, or abrade the piping. Nor shall they force the pipe and fittings into position.

2. Piping shall be supported at intervals sufficiently close to maintain pipe alignment and to prevent any sagging or grade reversal. System maximum operating temperature will determine support spacing.

3. Piping shall be supported at all branch ends and at all changes of direction, as close as practical to the fitting to avoid introducing excessive torsional stresses into the system.

4. Directly support (or if need be, immediately adjacent to) concentrated loads in the system, such as valves and other appurtenances.

5. Allowances must be made for thermal expansion and contraction of the piping system where temperature fluctuations can reasonably be expected to produce such movement. Provide and place hangers accordingly so as not to restrict.

6. Plastic piping systems shall not be placed alongside steam or other high temperature pipe lines or other high temperature objects.

7. Drainage piping shall be supported at trap arms as close as possible to the trap and all closet bends shall be supported and braced.

W Installation of solvent cement joints for PVC and CPVC piping shall be in strict conformity with the requirements of ASTM D2855 and manufacturer's published instructions.

X Provide approved heavy duty transition coupling at each transition from cast iron pipe not buried to buried PVC pipe as specified elsewhere in this section. Transition shall be made as close as possible to the floor for sanitary DWV piping systems and at test tee "minimum 12 inches A.F.F." for storm drainage piping. Support vertical cast iron pipe from floor anchors using riser clamp and galvanized all thread rod as specified in Section 22 05 29.

Y All grooved system tools and components (couplings, adapters, fittings, gaskets, and specialties) shall be the product of a single domestic system manufacturer.

Z Grooved pipe system manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products at no additional cost to the owner.

3.03 APPLICATION

A Provide union downstream of all valves at equipment or apparatus connections.

B Provide unions downstream of all threaded isolation valves in the domestic water system to facilitate any future valve replacement.

C Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections.

D Provide approved isolation valves for shut-off and to isolate all equipment items and distinct parts of systems. Isolation valves shall be provided for both hot and cold water in locations including, but not necessarily limited to, the following:

1. At the domestic water service entry.
2. At each wing of the building.
3. At each floor for each domestic water tap branching off from a vertical riser.
4. At each domestic water branch line capped for future use.
5. At each restroom or restroom group.
6. At each hose bibb, wall hydrant, roof hydrant, hose reel, and trap primer device (except for flush valve or tailpiece type trap primer devices).
7. At each domestic water branch line within 24” of the corresponding main.
8. At each plumbing fixture not otherwise served by a localized fixture group isolation valve.
9. At each kitchen or similar food service space.

E Each plumbing water rough-in stub out shall be fitted with a supply stop.

F Valves installed in insulated piping shall be fitted with extended lever operators of sufficient length to raise handle above the insulation jacket material. Where valve is used for throttling service, the valve handle shall be equipped with adjustable memory stop device.

G Provide non-slam type check valves on discharge lines from all water pumps. Install at a minimum length of 5 times the pipe diameter from the pump and in accordance with manufacturer’s installation recommendations.

3.04 ERECTION TOLERANCES

A All gravity drainage piping shall be provided at a uniform and continuous slope in accordance with the prevailing plumbing code and as described below. If any of the criteria below conflicts with the prevailing code then the code requirements shall govern:

1. Gravity piping 3" and smaller shall be provided at no less than 1/4" per foot slope.
2. Gravity piping 4" and larger shall be provided at no less than 1/8" per foot slope.
3. Where the code allows for a shallower slope than indicated above, this shall be allowed if required per project conditions.
4. Where the code requires a steeper slope than inidcated above (such as for grease waste piping) than such requirements shall control.

B All vent and branch vent pipes shall be graded and connected as to drip back by gravity to the drainage pipe it serves. A slope of 1 inch per 40 feet will suffice for this requirement, subject to the approval of the local Authority Having Jurisdiction.

C Slope all horizontal water piping with uniform pitch of 1/8 inch per 10 feet to low points to allow for complete system drainage. For long runs, where constant pitch cannot be maintained, provide intermediate low points and rise up again from such locations. Slope horizontal branches back to mains or risers. Provide clearly identified supplementary drain valves where hose bibbs, hydrants, or sill cocks will not suffice for this requirement.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A Prior to starting work, all domestic water systems shall be complete, thoroughly flushed clean and free of all foreign matter or erection residue.

B Ensure PH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C On building side of the main shut off valve, provide a 3/4" connection through which chlorine can be introduced into the water piping

D Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, in sufficient quantity to obtain 50 to 80 mg/L residual free chlorine solution throughout the entire domestic water piping systems.

E Bleed water from outlets as required to ensure complete distribution and test for disinfectant residual at a minimum 15 percent of total outlets.

F Maintain disinfectant in system for 24 hours.

G If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I Take samples no sooner than 24 hours after flushing, from 5 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.06 SERVICE CONNECTIONS

A Provide new sanitary and storm sewer services connecting to existing building services or utility lines as shown on the drawings.

B Before commencing work, field verify invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover as required.

C Provide new domestic water service connecting to existing building services or utility lines as shown on plans. Assure connections are in compliance with requirements of the jurisdiction having authority.

D Extension of services to the building shall be fabricated from the same materials as the utility service lines or those materials specified herein.

E Should points of connection vary from those indicated on the drawings contractor shall properly allow for this in the actual connections field fabricated.

3.07 RODDING SEWERS

A All sanitary soil and waste lines, both in the building and out, shall be rodded out after completion of the installation.

B This Work shall be done, as part of the contract, to make certain that all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing a rotary cutter, which shall be full size of pipe being cleaned.

3.08 VIDEO INSPECTION AND DOCUMENTATION

A It shall be the responsibility of the plumbing contractor to retain the services of a qualified, independent company (other than the installing plumbing contractor) with no less than ten (10) years of experience in digital video camera inspection/investigation of plumbing drainage waste and vent lines for commercial/institutional building projects.

B The independent company shall perform a complete video camera inspection of all waste piping buried inside the building. This shall include sanitary waste and any specialty waste (grease waste, oily waste, etc.) systems and shall extend from the building all the way to any associated outdoor traps/interceptors.

C The independent company shall create a permanent digital video record of their inspection with accompanying definitive identification (audio or visual) to indicate different systems and different areas of the systems inspected.

D The independent company shall prepare a comprehensive written report including, but not necessarily limited to, the following:

1. Complete company contact information.
2. Project name and address.
3. Date(s), time(s), and conditions during the inspection(s).
4. Name(s) of the operator(s) performing the inspection(s).
5. A general summary of the inspection results.
6. A written description of any and all material and/or installation deficiencies or irregularities found, with accompanying pictorial documentation. This shall include conditions such as:
    a. Deformed or damaged piping
    b. Full or partial blockage of piping
    c. Deleterious material or debris within the piping
    d. Slope deficiencies (inadequate, inconsistent, or absent slope)
    e. Valleys or “dips” in the piping

f. Improper fittings in the piping including reductions in pipe size in the direction of flow

E The written report shall be submitted under this Section but separately from other submittals of this Section. This shall occur immediately prior to substantial completion.

F The written report and the digital video record (DVD or USB flash drive) shall also be submitted as part of the Project Record Documents.

3.09 TESTING OF PLUMBING PIPING SYSTEMS

A During the progress of the work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Architect. The Architect or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B Tests shall be conducted as part of this work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems testing shall be accomplished prior to the application of insulation.

D All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours. Tests shall be witnessed by the Architect or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

F Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

G Domestic Water: Pressure test at one and one half times the normal working pressure or 125 psig, whichever is the greater, for 24 hours.

H Sanitary Soil, Waste and Vents and Storm Sewer:

1. After the rough-in soil, waste and vent and other parts of the sanitary sewer including branch laterals have been set from the lowest level, at point of connection to existing utility lines, to above the floor line, all outlets shall be temporarily plugged or capped, except as are required for testing as described herein. Ground work shall not permit the backfill of trenches to cover any joints until the completion of testing. Back fill shall be limited to mid sections of full joints of piping only. For pipe in ground the piping shall be readied as described herein and filled with water to a verifiable and visible level to 10' above the lowest portions of the system being tested.

2. On multi-level buildings only one floor level shall be tested at a time. Each floor shall be tested from a level below the structure of the floor, or the outlet of the building in the case of the lowest level, to a level of 12 inches above the floor immediately above the floor being tested, or the top of the highest vent in the case of the highest building level. The pipes for the level being tested shall be filled with water to a verifiable and visible level as described above and be allowed to remain so for 24 hours. If after 24 hours the level of the water has been lowered by leakage, the leaks must be found and stopped, and the water level shall again be raised to the level described, and the test repeated until, after a 24 hour retention period, there shall be no perceptible lowering of the water level in the system being tested.

3. Should the completion of these tests leave any reasonable question or doubt of the integrity of the installation, additional tests including peppermint smoke, or other measures shall be performed to demonstrate the reliability of these systems to the complete satisfaction of the Owner's duly authorized representative. Such tests shall be conducted and completed before any joints in plumbing are concealed or made inaccessible.

3.10 COMPLETE FUNCTIONING OF WORK

A All work reasonably implied as essential to the complete functioning of the systems shown on the Drawings and Specification shall be completed as part of the work of this Division, unless specifically stated otherwise. It is the intention of the Drawings and Specification to establish the type and function of systems but not to set forth each item essential to the functioning of any system. In case of doubt as to the work intended or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for Supplementary Instructions and Drawings, etc.

END OF SECTION 22 10 00

SECTION 22 11 19 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the specialties covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Hose Bibbs and Hydrants
2. Backflow Preventers
3. Water Hammer Arresters
4. Strainers and Filters
5. Thermostatic Mixing Valves
6. Floor Drains and Floor Sinks
7. Cleanouts
8. Trap Primers
9. Interceptors and Separators
10. Roof Drains and Overflow Nozzles

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 10 00 - Plumbing Piping

C Section 22 30 00 - Plumbing Equipment

D Section 22 40 00 - Plumbing Fixtures

1.04 REFERENCES

A ASME A112.6.3 - Floor Drains; 2022.

B ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2022.

C ASME A112.14.1 - Backwater Valves; 2008.

D ASME A112.1070 - Performance requirements for water temperature limiting devices; 2020.

E ASSE 1010 - Performance Requirements for Water Hammer Arresters; 2004.

F ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2023.

G ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2021.

H ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.

I ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.

J ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2023.

K ASSE 1052 - Performance Requirements for Hose Connection Backflow Preventers; 2016.

L ASSE 1060 - Performance Requirements for Outdoor Enclosures for Fluid Conveying Components; 2017 (Reaffirmed 2021).

M ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves; 2020.

N ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2020.

O ASSE 1071 - Performance Requirements for Temperature Actuated Mixing Valves for Plumbed Emergency Equipment; 2012.

P IAPMO (UPC) - Uniform Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

R NSF 372 - Drinking Water System Components - Lead Content; 2022.

S PDI-WH 201 - Water Hammer Arresters; 2017.

T ASME A112.6.7 - Sanitary Floor Sinks

U ASSE 1057 - Performance Requirements for Freeze Resistant Sanitary Yard Hydrants with Backflow Protection

V ASSE 1069 - Performance Requirements for Automatic Temperature Control Mixing Valves

W AWWA C510 - Standard for Double Check Valve Backflow Prevention Assembly

X NSF 61 - Drinking Water System Components - Health Effects

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

1.06 SUBMITTALS

A Submit under provisions of Division One.

B Submit shop drawings and product data under provisions of Division One.

C Include component sizes, rough-in requirements, service sizes, and finishes.

D Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of equipment and backflow preventers.

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Operation Data: Indicate frequency of treatment required for interceptors and separators.

C Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.09 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A Furnish under provisions of Division One.

B Provide two loose keys for hose bibbs and hydrants and spare hose end vacuum breakers.

1.11 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes, and corrections.
6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A Conform to applicable codes for the provision and installation of all required backflow prevention devices.

B Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

C Provide backflow prevention assembly test and maintenance report for all devices. A printed and signed form by the licensed tester that performed the work shall be provided both to the Owner and to the Public Water System in accordance with TCEQ (Texas Commission on Environmental Quality) requirements.

PART 2 - PRODUCTS

2.01 HOSE BIBBS/HYDRANTS

A General: Provide an operating handle for each loose keyed device on the project.

B Hose Bibb: Bronze or brass construction, replaceable stem assembly, hose thread spout, complete with vandal resistant lockshield and ASSE 1011 integral vacuum breaker. Provide chrome plated and with removable key where exposed in public areas.

C Wall Hydrant: Bronze or brass construction, replaceable stem assembly, hose thread spout, non-freeze, self-draining type with integral vacuum breaker. ASSE 1019. Unless specifically noted otherwise, provide recessed complete with heavy cast aluminum or nickel plated brass lockable box and loose key operator.

D Floor Hydrant: Bronze or brass construction, replaceable stem assembly, hose thread spout, non-freeze, self-draining type with ASSE 1052 approved backflow preventer and vacuum breaker. All brass pipe and stem of suitable bury depth. Provide recessed in flush-mounted nickel plated brass lockable box with loose key operator. Ensure to located out of heavy traffic area unless box is appropriately rated.

E Roof/Post Hydrant: Free-standing, low-lead, self-draining, non-freeze hydrant with cast iron handle and hose thread brass spout atop galvanized pipe riser. Complete with ASSE 1052 anti-siphon vacuum breaker. For rooftop applications provide complete with manufacturer’s recommended mounting hardware for a secure installation and coordinate with roofing contractor to ensure a watertight seal is provided per the roofing system and any local code requirements.

F ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam
7. Chicago (interior use hose bibbs only)
8. Woodford
9. Prier

2.02 RECESSED VALVE BOX

A Washing Machine: Pre-formed galvanized or stainless steel rough-in box with brass long shank valves with wheel handles, threaded drain fitting for waste, and matching secured faceplate. PVC constructed box, faceplate, and bracket will be acceptable within dwelling units only, in residential occupancies only.

B Refrigerator: Pre-formed galvanized or stainless steel rough-in box with brass long shank valve with wheel or quarter-turn handle and matching secured faceplate. PVC constructed box, faceplate, and bracket will be acceptable within dwelling units only, in residential occupancies only.

C ACCEPTABLE MANUFACTURERS:

1. Guy Gray
2. Mifab
3. Sioux Chief
4. Oatey

2.03 BACKFLOW PREVENTERS

A General Requirements: All assemblies shall be suited for the system anticipated working pressure and temperature as well as the intended orientation (vertical or horizontal) of the installation. All assemblies shall be lead-free per NSF 372, unless specifically noted otherwise on the Drawings.

B Strainer Requirements: Lead-free compliant strainers shall be provided at all backflow preventers on the upstream side of each assembly. Strainer bodies shall be either bronze/cast copper alloy or of cast iron/ductile iron construction with an FDA approved epoxy coating. Screens and internal components shall be stainless steel.

C Reduced Pressure Backflow Preventers: ASSE 1013; Bronze or FDA approved epoxy coated cast iron body with corrosion resistant internal parts and stainless steel springs; two independently operating, spring loaded check valves; intermediate internal pressure intermediate relief valve with water outlet; test cocks and isolation valves.

D Double Check Valve Assemblies: ASSE 1015; Cast copper alloy or FDA approved epoxy coated cast iron body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves, test cocks and isolation valves.

E Dual Check Valve with Intermediate Atmospheric Vent: ASSE 1012; Brass body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

F ACCEPTABLE MANUFACTURERS:

1. Watts
2. Wilkins
3. Ames
4. Febco
5. Conbraco

2.04 WATER HAMMER ARRESTERS

A Engineered water hammer arresters: ASSE 1010 listed, lead-free, pre-charged, permanently sealed, maintenance- free, suited for concealed installation, with a working temperature range of 33 to no less than 212 degrees F and a maximum working pressure of no less than 250 psi during pressure surges. Stainless steel or copper body construction. Shall be sized and located in accordance with Plumbing Drainage Institute standard PDI-WH 201.

B ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Wade
5. Josam
6. P.P.P.
7. Sioux Chief

2.05 THERMOSTATIC MIXING VALVES

A Provide thermostatic mixing valves in accordance with manufacturer’s recommendations and as indicated and scheduled on Drawings.

1. Unless scheduled otherwise, all units other than under-counter point of use units shall be provided complete in lockable cabinet of 16 gage (1.5 mm) prime coated steel when located in finished areas.

2. All under-counter point of use units shall be provided complete with integral checks and dual stainless steel strainers on inlets for protection against fouling.

B Types and Requirements:

1. Where hot and cold water is supplied to emergency safety fixtures, the temperature shall be controlled by a temperature actuated mixing valve complying with ASSE 1071.

2. Valves for individual showers are addressed in Section 22 40 00 - Plumbing Fixtures

3. (Master) mixing valves serving multiple showers, each with a single tempered water supply pipe, shall conform to ASSE 1069 or CSA B125.3. Such valves shall be provided complete with unions, checks, and ball valves at all connections as well as a temperature gauge on the outgoing water line.

4. Mixing valves serving (athletic area) whirlpool applications shall conform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3. Such valves shall also be configured with appurtenances as described above.

5. Mixing valves supplying tempered water to lavatories and sinks shall conform to ASSE 1070 / ASME A112.1070 / CSA B125.70 or CSA B125.3.

C ACCEPTABLE MANUFACTURERS:

1. Bradley

2. Powers

3. Symmons

4. Acorn

2.06 FLOOR DRAINS AND FLOOR SINKS

A Provide floor drains and floor sinks in accordance with manufacturer's recommendations, as appropriate for floor construction per ASME A112.6.3, and as indicated and scheduled on Drawings.

B Provide clamping devices for all drains in membrane floor areas.

C ACCEPTABLE MANUFACTURERS:

1. J.R. Smith

2. Zurn

3. Mifab

4. Watts

5. Wade

6. Josam

D Provide drains of suitable and compatible material for specialized piping systems conveying acid waste.

2.07 CLEANOUTS

A General: Provide cleanouts as indicated and scheduled on Drawings and also as required by the prevailing code, whether shown on the Drawings or not.

B Construction: All cleanouts shall have tapered PVC, ABS, or polypropylene plugs.

C Provide clamping devices for all cleanouts in membrane floor areas.

D Provide cleanouts of suitable and compatible material for specialized piping systems conveying acid waste.

E Types:

1. Finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel bronze scoriated top.

2. Resilient or tile finished floor cleanouts: Provide cast iron body, with adjustable floor level assembly, and round nickel-bronze top with gasketed water tight cover and depressed top to receive flooring finish material.

3. Interior finished wall cleanouts: Provide cast iron tee body or cleanout ferrule as required for wall construction and provide counter-sunk plug with stainless steel access cover and securing screw(s).

4. Interior unfinished accessible cleanouts: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

F ACCEPTABLE MANUFACTURERS:

1. J.R. Smith

2. Zurn

3. Mifab

4. Watts

5. Wade

6. Josam

2.08 TRAP PRIMERS

A General: Provide trap primers as indicated and scheduled on Drawings and in accordance with manufacturer’s recommendations.

B ACCEPTABLE MANUFACTURERS:

1. J.R. Smith
2. Zurn
3. Mifab
4. Watts
5. Wade
6. Josam
7. P.P.P.
8. Sioux Chief

2.09 INTERCEPTORS

A General requirements:

1. Provide in type, materials of construction, and with appurtenances as indicated on the Drawings and as required for a complete, functioning, and compliant installation. This shall include, but not necessarily be limited to, the following: venting, flow control, inlet and outlet piping adapters/transitions, and cleanouts.
2. Unless specifically noted otherwise, each interceptor shall be provided with an approved sampling well/sampling port in accordance with local AHJ requirements.
3. All interceptors shall be a of flow rate/capacity, size, and design as suited to the waste stream being served and in accordance with local AHJ requirements.
4. Buried interceptors shall be provided with suitable extensions up to finished grade/paving.
5. Buried interceptors shall be provided with approved and suitable access lids/manhole covers.
    a. In vehicular traffic areas these shall be provided in material and load rating accordingly, suited for the weight of the traffic to be encountered.
    b. In no case shall lids be rated for anything less than pedestrian traffic.
    c. All lids shall be lined/gasketed for odor control.
6. Where steel constructed interceptors are provided buried, vaulted, or in-floor they shall be fully enamel coated on the exterior with bituminous coating outside as well for corrosion resistance.
7. Interceptors shall not be provided of a material or at an installed depth they are not suited for. Maximum installation depths and bedding-backfill-bury requirements shall be adhered to in strict accordance with the manufacturer's recommendations.

8. Buried interceptors in high water table locations shall be provided complete with the manufacturer's approved anchoring kit. The same shall apply to unburied interceptors in flood prone locations.

9. Interceptor placement and installation shall be coordinated accordingly with adjacent items and equipment, floor/slab construction, site paving/grading, etc. to ensure a compliant installation and all required service and maintenance access.

10. IAPMO (UPC), ICC (IPC), and local AHJ approval.

11. Polyethylene constructed interceptors shall be lifetime guaranteed.

B Grease Interceptors:

1. Hydromechanical grease interceptors shall be ASME A112.14.3 / PDI-G 101 compliant.

2. Gravity grease interceptors shall be IAPMO / ANSI Z1001 compliant.

3. Concrete constructed grease interceptors shall be provided complete with interior PVC liner from the manufacturer.

4. Grease interceptors shall have a maximum operating temperature of no less than 150 degrees F continuous.

5. Polyethylene constructed grease interceptors shall be third party performance tested. For hydromechanical units, this documentation shall include actual grease retention capacity in pounds.

C Acceptable manufacturers (where such units are detailed/specified on the Drawings):

1. Steel constructed: J.R. Smith, Zurn, Wade, Josam, Park-USA

2. Precast concrete constructed: Park-USA, Old Castle Precast

3. Fiberglass reinforced plastic (FRP) constructed: Zurn Proceptor, Green Turtle Technologies

4. Polyethylene constructed: Schier, Striem (also acceptable for point-of-use PVC constructed)

2.10 BACKWATER VALVES

A ASME A112.14.1; Lacquered cast iron body and cover, brass valve, access cover, extension sleeve as required and cover at finished elevation

B ACCEPTABLE MANUFACTURERS:

1. J.R. Smith

2. Zurn

3. Mifab

4. Watts

5. Wade

6. Josam

2.11 ROOF DRAINS, PLANTER DRAINS, AND OVERFLOW NOZZLES

A Roof drains (RD): ASME A112.6.4; Lacquered cast iron body with sump, removable aluminum dome strainer, membrane flange and clamp with integral gravel stop, adjustable underdeck clamp, roof sump receiver, waterproofing anchor flange, adjustable extension as required for insulation, perforated or slotted ballast guard extension for inverted roof.

B Roof overflow drains (OD): Lacquered cast iron body and features similar to roof drain, with 2 inch external water dam or pipe extended to 2 inches above flood elevation.

C Planter drains: Lacquered cast iron body with flange, integral clamping collar, seepage openings and either adjustable perforated standpipe (length as necessary) with secured dome or dome with secured stainless steel screen.

D ACCEPTABLE MANUFACTURERS:

1. J.R. Smith

2. Zurn

3. Mifab

4. Watts

5. Wade

6. Josam

PART 3 - EXECUTION

3.01 INSTALLATION AND APPLICATION

A Install specialties in accordance with manufacturer's instructions to provide intended performance.

B Install equipment specific drains appropriately located to serve the equipment. Drain placement shall not conflict with housekeeping pads, casework, equipment access, clear space for foot travel, etc. In kitchens and similar settings final drain locations must be carefully coordinated to ensure that equipment casters, table legs, etc. do not bear upon drain grates.

C Water hammer arresters:

1. The contractor shall provide water hammer arresters as shown on Drawings and also in accordance with PDI-WH 201, whether shown on Drawings or not.

2. Water hammer arresters shall be PDI certified and sized and placed as recommended by manufacturer.

3. Provide above lay-in ceiling, within chase or wall or above solid ceiling complete with access panel, or otherwise accessible location complete with isolation valve to facilitate replacement.

4. Provide for both domestic hot and cold water services.

5. The provision of air chambers for the control of water hammer shall not be acceptable, but for within dwelling units only, in residential occupancies only.

D Backflow preventers:

1. Provide strainers at all backflow preventers.

2. Contractor shall certify all newly installed backflow preventers and provide proof of certification to the Owner.

3. Pipe relief line from backflow preventer via manufacturer's air gap assembly, full size to nearest suitable drain. Such routing shall not pose a trip hazard. Where a suitable drain of appropriate size is not provided, route line to the outdoors.

4. All backflow preventers shall be securely supported with wall supports and/or pipe stands as appropriate for the size and weight of the unit and shall be installed with sufficient access and clearance for testing and maintenance. Unless specifically noted otherwise on Drawings, all backflow preventers shall be installed at 48"-60" above finished floor.

5. Unless specifically noted otherwise on the Drawings, outdoor installations shall be housed within an appropriately sized, ASSE 1060 Class I freeze and vandal protective insulated, marine grade aluminum constructed enclosure complete with drain panel and removable/movable panel(s) for device maintenance and testing. Provide complete with manufacturer's recommended electric heater. Safe-T-Cover by Hydrocowl.

E Cleanouts:

1. Provide two-way cleanouts at all waste outfalls from the building.

2. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at all cleanouts for access and for rodding of drainage system.

3. Wall cleanouts provided at the end of horizontal piping runs shall be installed vertically above the flow line of the pipe served.

4. All cleanouts outside of building on grade shall be set in an 18" x 18" x 4" thick concrete pad, flush with final grade/paving.

5. All cleanouts shall be the same nominal size as the pipe they serve, up to 4 inches. For pipes larger than 4 inches, provide a 4 inch cleanout.

F Interceptors:

1. Coordinate with casework to ensure that all interceptors are readily accessible and removable for servicing and cleaning.

2. Coordinate with casework to ensure that all point of use interceptors do not interfere with required accessibility requirements. Provide offset(s) as required and in accordance with code.

3. Provide approved sampling well downstream of centralized interceptors and separators and in all such locations where required by the local Authority Having Jurisdiction.

4. Installation shall be in accordance with the manufacturer's recommendations.

5. The following general installation requirements shall apply to concrete constructed interceptors, however these requirements are not intended to supercede the manufacturer's recommendations, which shall govern.

    a. The bottom of the excavation shall be covered with clean sand or pea gravel to a depth of no less than one foot, suitably graded and leveled. Limestone shall not be acceptable.

    b. If the installation location has significant variation in ground water levels, the bedding material shall be fine gravel or pea gravel rather than sand.

    c. The backfill shall be free from any material which may cause damage to the tank coating (if any) and placed accordingly.

G Trap primers:

1. In unfinished areas such as mechanical rooms, such devices may be installed exposed.

2. In finished areas, all devices must be installed concealed from public view. If not readily accessible (such as above a lay-in ceiling) ensure to provide an access door.

END OF SECTION 22 11 19

SECTION 22 11 21 - NATURAL GAS PIPING SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the piping system covered by this section, with all appurtenances, ready for the Owner's use. This shall include, but not necessarily be limited to, the following:

1. Pipe and pipe fittings.
2. Adapters, transitions, final flexible connectors.
3. Valves, regulators, and regulator vents.
4. Metering.
5. Testing.

B Coordinate in advance with the local gas utility provider and:

1. Ensure an unobstructed and acceptable pathway for the incoming gas service.
2. Ensure compliant gas meter location(s) with all required clearances and maintenance access.
3. Pay for all fees & inspections and secure all necessary permits required for a complete and operating gas service to the project.

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 05 53 - Identification for Plumbing Piping and Equipment

C Section 22 30 00 - Plumbing Equipment

1.04 REFERENCES

A ANSI Z21.80/CSA 6.22 - Line Pressure Regulators; 2019.

B ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C ASME B16.11 - Forged Fittings, Socket-Welding and Threaded; 2021.

D ASME B31.1 - Power Piping; 2022.

E ASME B31.8 - Gas Transmission and Distribution Piping Systems; 2022.

F ASME BPVC - Boiler and Pressure Vessel Code; 2023.

G ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

H ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

I ASTM A105/A105M - Standard Specification for Carbon Steel Forgings for Piping Applications; 2023.

J ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

K ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2020.

L ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2020.

M NFPA 54 - National Fuel Gas Code; 2024.

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

C Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

D Foreign pipe, fittings or valves are unacceptable.

E Welding Materials and Procedures: Conform to ASME BPVC and applicable state labor regulations.

F Welders Certification: In accordance with ASME BPVC-IX.

G Materials, design, fabrication, and testing-inspection shall conform to the requirements of ASME B31.1.

1.06 SUBMITTALS

A Submit product data under provisions of Division One.

B Include pipe materials, pipe fittings, valves, regulators, and accessories. Provide manufacturer’s catalog information, product certifications, and country of origin. Indicate valve data and ratings.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of valves, regulators, and meter(s).

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.09 QUALIFICATIONS

A Manufacturer: Company specializing in manufacturing the Products specified in this section with a minimum of 5 years documented experience and must be a domestic manufacturer.

B Installer: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept product on site in original factory packaging. Receive valves on site in shipping containers with labeling in place. Inspect for damage. Damaged valves shall not be acceptable.

D STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E Provide temporary protective coating on steel valves.

F Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

1.11 EXTRA MATERIALS

A Furnish under provisions of Division One.

1.12 REGULATORY REQUIREMENTS

A Perform and provide all work in accordance with plumbing and building codes having jurisdiction.

B Ensure compliance with fire marshal, utility provider, and Texas Railroad Commission requirements.

C All sleeves passing through return air plenum space shall be of compliant material.

PART 2 - PRODUCTS

2.01 PIPING AND FITTINGS

A All gas piping not buried shall be ASTM A53/A53M schedule 40 black **iron** pipe as manufactured by **Wheatland, Paragon, Bull Moose**, or approved equal domestic manufacturer.

B All gas piping larger than 2" shall have welded fittings. Threaded fittings and joints will only be permitted for sizes 2" and smaller. Unions and valves will not be permitted above ceilings or in walls or chases.

C All **iron** pipe fittings shall be as follows:

1. All dimensions and design for **black iron** fittings shall conform to **ASME B16.3**.
2. The material for all **black iron** fittings shall conform to **ASTM A197**.
3. All welding fittings shall be factory-made and shall be full line size, for each tee, branch, elbow, etc., with reducers after fittings, if required.
4. All threads shall be taper pipe threads and conform to ASME B1.20.1.
5. All threaded fittings shall be **ASTM A197 schedule 40 class 150 malleable black ironfittings** by Ward Manufacturing or approved equal. Threaded joints shall be made up with graphite and oil or Teflon tape.
6. All pipe fittings shall be from a domestic manufacturer.

D All gas piping buried outside the building with 5 pound working pressure or less shall be as follows:

1. The pipe shall be PE 2708/2406 yellow medium density polyethylene (MDPE) with socket heat fusion joints and fittings per ASTM D2513. Pipe sizes 1/2" through 6" shall be SDR 11.
2. All socket heat fusion fittings shall be D.O.T. approved and meet ASTM D2513, ASTM D2683 and ASME B31.8 codes.
3. All gas valves below grade shall be ASTM D2513 polyethylene constructed ball type with NBR seat and seals, rated for natural gas use. Hubbell/Lyall or approved equivalent. All such valves shall be placed in a cast-iron valve box of an adequate size for accessibility and maintenance.

4. All transition meter risers shall be 100% pressure tested, D.O.T. approved, IAPMO/UPC and CSA listed, anodeless service type, fusion coupled only. All gas carrying steel parts shall meet or exceed ASTM A53/A53M and all polyethylene components shall conform to ASTM D2513. Electrostatically bonded epoxy coated exterior steel casing. Hubbell/Continental Industries or approved equal.

5. The contractor shall take thermal expansion under consideration during installation. The contractor shall follow all requirements set by the manufacturer to protect the system from damage due to thermal expansion.

6. The contractor shall provide detector tape approximately 12" above all gas piping.

7. Wrap pipe with 18 gauge minimum copper tracer wire. Tracer wire shall be secured to piping where it extends above buried location and tagged.

E Gas piping installed in unventilated spaces shall be routed in properly vented continuous sleeve where required by the building code.

F Gas valves shall be UL listed as follows:

1. Ball Valves: Nibco T585-70-UL for 1/4” to 1” and T580-70-UL for 1-1/4” to 3”.

2. Plug Valves: ASTM A126 cast iron quarter turn plug valve with no less than 175 psi maximum cold working pressure (CWP).

   a. DeZurik Eccentric plug valve

   b. Flowserve/Nordstrom short pattern all-iron lubricated plug valve, Super Nordstrom or Nordstrom Bolted Gland type.

G Gas pressure regulators:

1. Shall be capable of reducing the incoming gas pressure to the intended outgoing gas pressure at the capacities required by the system gas demand.

2. Shall be installed in accordance with manufacturer's recommendations, accessible for servicing, and protected against physical damage accordingly.

3. Shall not be located above ceilings or in similar installations.

4. Shall be provided with factory-installed overpressure protection devices (OPD's) where required. Reference NFPA 54, Section 5.8 in particular.

5. Line pressure regulators shall be listed in accordance with ANSI Z21.80/CSA 6.22.

6. Each regulator shall be provided complete with:

   a. An upstream shutoff valve

   b. A capped test tee fitting oriented downward for sediment trap and testing purposes, located between the regulator and upstream shutoff valve

   c. Unions on both sides of and within 1 foot of the regulator

d. A capped test tee fitting not less than 10 pipe diameters downstream of the regulator outlet, for testing purposes

7. Shall be as manufactured by Sensus/Rockwell, Emerson/Fisher, Maxitrol, or approved equal.

H All gas regulators located inside the building shall be vented to the outdoors with schedule 40 black steel pipe. This includes all regulators provided with mechanical and plumbing equipment and all other regulators provided under this contract.

1. Vent piping shall be the full size of regulatory port opening, or as recommended by the regulator manufacturer.

2. Each vent shall be run independently of any other regulator vents.

3. Each vent shall terminate at a height and in a location no less than 10'-0" from any door/window/outside air intake and no less than 3'-0" from a possible source of ignition.

4. Each vent shall be located and designed to prevent the entry of water, insects, or other foreign materials that could cause blockage. Each vent shall terminate with an elbow oriented downward, fitted with 12x12 mesh stainless steel screen in the outlet.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A All piping, valves, and appurtenances shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C All underground gas piping shall be laid on 6" of wet compact banks and approximately 24" below grade and buried in a manner to protect it from damage. Backfill trench with wet compacted banksand to 6" above pipe. The remainder of backfill shall be selected backfill and shall meet all compaction requirements set forth by the general trenching and backfill requirements.

D Provide lever handle gas valve, drip leg and union at each piece of equipment and where indicated.

E At kitchen appliances provide commercial grade, ANSI Z21.69/ANSI Z21.24 compliant flexible connections, stationary or moveable (as necessary for the equipment served) of suitable lengths.

F All gas lines entering building shall be valved on the exterior of the building above grade. All gas lines entering (or leaving) buildings shall be sleeved through the exterior wall above grade and sealed watertight.

G Refer to Section 22 05 53 for valve and piping identification requirements, including painting and labeling (pipe markers). Provide as specified.

H Refer to Section 22 05 29 for pipe hanger and support requirements. Provide as specified.

I Gas piping shall not be routed through or beneath a building slab unless specifically indicated as such on the Drawings. For such installations:

1. The gas piping shall be sleeved, sealed, and vented to the outdoors in accordance with the requirements of NFPA 54 or the prevailing gas code, or whichever is the more stringent requirement.

2. All sleeves must be of suitable material for the installed location. This shall include, but is not necessarily limited to, providing sleeves of compliant material and construction where passing through return air plenum spaces.

J Provide an accessibly located valved and capped test tee for each distinct system to facilitate regular pressure testing of all gas piping from the outlet of the meter to each inlet valve of each appliance. Reference Texas Administrative Code Title 16, Part 1, Chapter 8, Subchapter C, Rule 8.230 for additional information as necessary.

3.02 TESTING OF GAS PIPING SYSTEMS

A All gas system testing shall be in compliance with local codes or as required in NFPA 54 National Fuel Gas Code, whichever is the more stringent requirement. Additionally, in school facilities all such testing shall be performed in accordance with the Texas Administrative Code, Railroad Commission of Texas testing requirements for natural gas piping systems. Reference Rule 8.230 in particular.

B All work shall be performed by a Journeyman Plumber holding current State and local licenses.

C All tests shall be accomplished during normal working hours and after having given due notification to building owner, construction manager or designee, of tests to be performed. All tests shall be performed in the presence of and witnessed by the building owner's representative or designee.

D All gas system piping shall be subjected to a pneumatic test pressure of 60 psig for not less than 2 hours upon completion of all rough-in work and prior to covering. While the systems are subjected to this air pressure test, all joints shall have a soapy water solution applied and shall be observed for leaks. During test period there shall be no perceptible drop in test gage pressure.

E A final test shall be performed after all portions of the piping system are completely installed and covered. The entire system shall be tested, with all system outlets plugged or capped, before any equipment or appliances are connected to the piping.

1. Final test shall be with mercury, measured with a manometer or slope gage. Test pressures shall in no case be less than one and one half times the normal operating pressure or as listed below; which ever is the greater:

a. 10.5 inches mercury (5 psig) for systems designed for 0.25 psig or less

b. 21.0 inches mercury (10 psig) for systems designed for greater than 0.25 psig

2. Tests shall prove absolutely tight, showing no perceptible drop for the entire test period, which shall be as follows:

   a. No less than 30 minutes for systems designed for less than 5psig

   b. No less than 60 minutes for systems designed for 5psig or greater

F Purge air from test piping before connecting equipment or appliances. Purge air to outdoors or to ventilated space of sufficient volume to prevent accumulation of flammable mixtures.

END OF SECTION 22 11 21

SECTION 22 30 00 - PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B The Basic Materials and Methods, Section 22 02 00, are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the equipment covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Domestic Water Heaters
2. Water Softeners
3. In-line Circulator Pumps

1.03 RELATED SECTIONS

A Section 11 40 00 - Foodservice Equipment

B Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

C Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

D Section 22 10 00 - Plumbing Piping

E Section 22 11 19 - Plumbing Specialties

F Section 26 05 19 - Wire, Cable and Related Materials

1.04 REFERENCES

A 10 CFR 430, Appendix E to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Water Heaters; Current Edition.

B ANSI Z21.10.3 - Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous; 2019.

C ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2023.

E ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

F ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G NFPA 54 - National Fuel Gas Code; 2024.

H NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I SCAQMD 1146.2 - Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters; 1998, with Amendment (2024).

J UL 1453 - Standard for Electric Booster and Commercial Storage Tank Water Heaters; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Perform Work in accordance with Authorities Having Jurisdiction.

C Provide pumps with manufacturer's name, model number, and rating/capacity identified.

D Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Gas Association (AGA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
5. National Electrical Manufacturers' Association (NEMA).
6. Underwriters Laboratories (UL).
7. American Society of Plumbing Engineers (ASPE)

E Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.06 SUBMITTALS

A Submit under provisions of Division One.

B Shop Drawings:

1. Include water heater and packaged heating system dimensions, sizes and locations of all connections, and performance data.

2. Include dimensions of tanks, tank lining and insulation methods, anchors, attachments, lifting points, sizes and locations of all connections and drains.

3. Include water softening equipment dimensions, sizes and locations of all connections, performance data and capacities, backwash requirements.

4. Include booster system skid dimensions, sizes and locations of all connections, and performance data. Include such information for any field connected items, including, but not necessarily limited to, hydro-pneumatic tanks.

5. Include manufacturer's recommended space requirements, clearances, and maintenance access.

C Product Data:

1. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, materials of construction, capacity, power requirements, and any affected adjacent construction.

3. Submit certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and power and controls connection requirements/capabilities.

D Manufacturer's Installation Instructions.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of equipment.

C Provide written start-up reports.

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division 22.

B Operation Data: Include manufacturer's operating instructions, common trouble conditions and remedies, and trouble-shooting protocols.

C Maintenance Data: Include routine maintenance items and corresponding intervals, identify typical replacement parts including part numbers and availability. Provide location and full contact information including after-hours maintenance/support telephone numbers for manufacturer authorized maintenance and repair companies.

1.09 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled equipment to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of equipment to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept equipment on site in original factory packaging. Inspect for damage. Damaged equipment shall not be acceptable.

D STORAGE: Store equipment in a clean, dry location, protected from weather and damage.

1.10 EXTRA MATERIALS

A Furnish under provisions of Division One.

B Provide two sets of electric water heater elements.

1.11 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two weeks prior to the proposed training session for review and approval.

B Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes, and corrections.
6. On site demonstration.

1.12 REGULATORY REQUIREMENTS

A Conform to AGA, NSF, NFPA 54, NFPA 70 and UL 1453 requirements for water heaters.

B Conform to ASME BPVC-VIII-1 for manufacture of pressure vessels for heat exchangers.

C Conform to water heater minimum efficiency requirements prescribed by ICC (IECC) and ASHRAE Std 90.1 I-P

D Water heaters shall be tested and rated in compliance with 10 CFR 430, Appendix E to Subpart B or ANSI Z21.10.3 as applicable.

1.13 WARRANTY

A Provide one year warranty under provisions of Division One, unless specifically noted otherwise.

B Warranty: Include coverage of domestic water heaters and packaged systems, water storage tanks, water softeners, and domestic pressure booster systems.

PART 2 - PRODUCTS

2.01 COMMERCIAL GAS FIRED WATER HEATER (STORAGE TYPE)

A Acceptable Manufacturers:

1. A.O. Smith
2. State
3. Rheem
4. Lochinvar
5. Bradford White
6. Bock

B Type: Automatic, natural gas-fired, vertical storage.

C Tank: Seamless Glass lined steel tank construction, ASME labeled (unless indicated otherwise on Drawings). Factory applied foam insulation and trim with a heavy gauge, corrosion-resistant enameled steel jacket.

D Burner and heat exchanger: High efficiency, **modulating** gas burner that automatically adjusts the input based on demand. Submerged combustion chamber within tank. Direct spark ignition. Long life, scale resistant heat exchanger lined both externally and internally.

E Accessories: Maintenance free, non-sacrificial powered anodes; brass water connections and dip tube, drain valve, ASME rated temperature and pressure relief valve, hand-hole cleanout, condensate neutralization kit.

F Approvals:

1. Design certified by Underwriters Laboratories (UL), Inc. to ANSI Z21.10.3
2. Thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE Std 90.1 I-P
3. Design certified by Underwriters Laboratories (UL), Inc. to NSF Standard 5 for 180 degrees F water.
4. Complies with SCAQMD 1146.2 and the prevailing local requirements for low-NOx emissions.
5. By AGA as automatic storage water heater and automatic circulating tank water heater for operation at 180 degrees F.
6. Approval for 0" clearance to combustibles

G Controls: Integrated solid-state temperature and ignition control device with integral diagnostics, precise adjustable temperature control to 180 degrees F, graphic user interface, fault history display, and digital temperature readout. Capability for remote monitoring.

H Provide training per 1.11.

2.02 GAS FIRED WATER HEATER - TANKLESS

A Acceptable Manufacturers:

1. Navien
2. Noritz
3. Intellihot

B Type: Packaged, factory-fabricated and assembled, gas-fired, commercial grade, high efficiency, condensing, tankless domestic water heaters.

C Ignition: Direct electronic.

D Installation: Indoor/Outdoor suited, wall-hung or base-mounted steel rack arranged and installed as indicated on Drawings.

E Configuration capability: Master-less cascading capable, up to no fewer than ten (10) units.

F Construction: Corrosion and scale resistant 300 series stainless steel heat exchanger design, stainless steel burner, powder coated steel casing/cabinet.

G Venting: Forced draft, direct vent. Suited for schedule 40 PVC, schedule 40 CPVC, or polypropylene venting material which must be provided in strict accordance with manufacturer's recommendations, local code requirements, and plenum restrictions.

H Safety: Flame rod, exhaust temperature high limit sensing, water temperature high limit switch, fan speed/motor rotation sensing, power surge fuse(s).

I Performance: BTUH input, minimum temperature rise and flow rate requirements shall be as scheduled on the Drawings.

J Warranty: Minimum six (6) year limited heat exchanger warranty, minimum one (1) year warranty on control panel and other components. Warranties based on commercial use.

K Quality Assurance: Certified to ANSI Z21.10.3 / CSA 4.3 and/or compliant with ETL, "Commercial-Industrial Gas Heating Equipment." Low NOx emission compliant.

L Connectivity: Capable of wi-fi based connectivity to building BMS and smartphone/tablet for remote access and monitoring.

M Interface: Internal circuit board control with digital touch display, temperature adjustment, and error code indication.

N Appurtenances: Provide 120VAC power source per manufacturer's requirements, all required wiring for cascading, manufacturer's recommended condensate trap(s) and neutralizer(s), any necessary anti-scale accessories for compliance with manufacturer's recommendations/warranty requirements regarding hardness of water supply, and all required valves and piping for a complete, compliant, and fully functioning installation.

O Ensure to provide complete start-up in the field by a factory authorized representative, with the owner's representative present. Submit a written start-up report for review.

2.03 DIAPHRAGM-TYPE COMPRESSION TANKS

A Acceptable Manufacturers:

1. Watts
2. Amtrol
3. Elbi
4. Bell and Gossett

B Rating: Ensure suitable pressure rating of tank for expected system pressure.

C Construction: Welded steel construction, corrosion-proof anti-microbial polypropylene liner, long-life butyl diaphragm, stainless steel system connection, factory pre-charged, complete with welded air charge fitting with protective cap. Suitable for in-line installation or factory provided with stand/legs for floor-mounted installation.

2.04 IN-LINE CIRCULATOR PUMPS

A Acceptable Manufacturers:

1. Grundfos
2. Bell & Gossett
3. Armstrong

B Type: Canned rotor type.

C Housing: Bronze or stainless steel, rated for 125 psig working pressure.

D Impeller: 304 stainless steel.

E Shaft: Stainless steel or aluminum oxide ceramic.

F Thermal Protection: Internal.

PART 3 - EXECUTION

3.01 WATER HEATER INSTALLATION

A Install water heaters in accordance with manufacturer's instructions and to AGA, NSF, NFPA 54 and UL requirements.

B Coordinate with plumbing piping and related work to achieve operating system.

C Provide intake air/venting and associated piping in accordance with both code requirements and manufacturer's recommendations. The material and installation provided must not only be compatible with the equipment served but must also be suited to and acceptable per project conditions. Any material to be provided in a return air plenum must be compliant for such use. Any plastic piping outdoors shall be painted with latex paint for UV protection.

D Provide a properly sized thermal expansion tank downstream of the associated check valve in the cold water supply to the heater.

E Provide a thermometer at the hot water outlet piping from each water heater.

F Provide a line sized shut-off valve in the cold water supply to and in the hot water outlet from each heater, close to each heater.

G Provide approved heat traps at all storage type water heaters not furnished from the manufacturer with integral heat traps or heat trap nipples.

H Provide a line size plug cock in the gas supply close to each gas-fired water heater.

I Provide approved dielectric couplings at all hot and cold water connections to each heater/tank, and at the T&P relief valve connection.

J All tank type water heaters with more than 20 gallons of storage capacity shall be floor mounted on a concrete housekeeping pad, unless specifically indicated otherwise on the Drawings.

K Each tank type water heater shall be installed within a suitably sized galvanized drain pan. Securely elevate the base of each heater above the floor of the drain pan with structurally sound, non-ferrous, non-absorbent supports. Drain pan shall have no less than a 3/4" piped drain outlet.

L All water heater drain lines shall be full size, copper, and routed to indirect waste receptors.

M Startup:

1. Startup of all water heaters shall be in strict accordance with manufacturer's recommendations.

2. Ensure that storage type water heaters are full of water and downstream fixtures have been run for no less than 3 minutes in order to purge any trapped air from the water heater tank prior to heater startup.

3.02 CARBON MONOXIDE AND FUEL GAS DETECTION

A In each boiler room, and in each water heater room with more than 200,000 BTUH total heating capacity or more than 120 gallons of total storage, provide detectors for carbon monoxide and natural gas (or propane, as appropriate), complete with manual reset.

B Each detector shall be configured/interlocked to:

1. Disable the equipment burners upon loss of power to the detector.

2. Disable the equipment burners when the measured level of carbon monoxide rises above 50 ppm or 10% LEL (lower explosive limit) of the fuel gas

3.03 PUMP INSTALLATION

A Install in accordance with manufacturer's instructions.

B Provide air cock and drain connection on horizontal pump casings.

C Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

D Provide line sized isolating valve and line sized soft seated check valve on each submersible or sump pump discharge. Ensure to drill a 3/16" diameter horizontal weep hole near the base of the discharge piping to allow for venting and prevent air lock of the pump.

E Provide line sized isolating valve and strainer at inlet and line sized soft seated check valve and line sized isolating valve at outlet of each in line circulator pump. Provide unions on both sides of pump.

F Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

G Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

H Align and verify alignment of base mounted pumps prior to start-up. Provide alignment certificate to engineer prior to start-up.

END OF SECTION 22 30 00

SECTION 22 40 00 - PLUMBING FIXTURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 22 02 00 - Basic Materials and Methods for Plumbing shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the fixtures covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Plumbing Fixtures
2. Fixture Carriers
3. Faucets, Supplies, and Trim
4. Flushometers

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 10 00 - Plumbing Piping

C Section 22 11 19 - Plumbing Specialties

D Section 22 30 00 - Plumbing Equipment

1.04 REFERENCES

A ASME A112.4.3 - Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System

B ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

C ASME A112.18.1 - Plumbing Supply Fittings

D ASME A112.18.2 - Plumbing Waste Fittings

E ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures

F ASME A112.19.1 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures

G ASME A112.19.2 - Ceramic Plumbing Fixtures

H ASME A112.19.3 - Stainless Steel Plumbing Fixtures

I ASME A112.19.7 - Hydromassage Bathtub Systems

J NSF/ANSI 61 - Drinking Water System Components - Health Effects

K ANSI Z358.1 - Emergency Eyewash and Shower Equipment

L ASSE 1016 - Performance Requirements for Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.

M ASSE 1037 - Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures

N ADA (Americans with Disabilities Act)

O TAS (Texas Accessibility Standards)

1.05 QUALITY ASSURANCE

A Manufacturer: For each product specified, provide components by the same manufacturer throughout.

B Warranty: Warrant the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or non-conforming materials and workmanship.

C Defects shall include, but not necessarily be limited to, the following:

1. Noisy operation.

2. Noticeable deterioration of finish.

3. Leakage of water.

1.06 SUBMITTALS

A Submit under provisions of Division One.

B Submit product data under provisions of Division One.

C Include component sizes, rough-in requirements, service sizes, finishes, materials, dimensions, performance information, and accessories.

D Manufacturer’s Installation Instructions: Indicate assembly and support requirements.

1.07 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Provide pre-printed operating and maintenance instructions for each item specified. Instruct and demonstrate the proper operation and maintenance to the Owner's designated representative.

1.08 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled specialties to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept specialties on site in original factory packaging. Inspect for damage. Damaged specialties shall not be acceptable.

D STORAGE: Store materials in a clean, dry location, protected from weather and damage.

1.09 FIELD MEASUREMENTS

A Verify that field measurements are as indicated on the Contract Documents.

B Confirm and field coordinate that millwork is constructed with adequate provisions for the installation of counter top lavatories and sinks.

PART 2 - PRODUCTS

2.01 PLUMBING FIXTURES

A GENERAL: Provide plumbing fixtures in accordance with manufacturer's recommendations and as indicated and scheduled on Drawings. Acceptable manufacturers of each fixture type are as indicated below.

1. Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise.

2. Fixture drilling shall match faucet spread and match any related trim and accessories.

B WATER CLOSETS, URINALS, LAVATORIES (Vitreous China)

1. American Standard

2. Kohler

3. Zurn

4. Sloan

5. Toto

C SINKS - COUNTER MOUNTED (Stainless Steel)

1. Elkay

2. Just

3. Moen Commercial

D SINKS - FREESTANDING (Stainless Steel)

1. Elkay

2. Just

3. Advance Tabco

4. Amtekco Industries

E SHOWER ENCLOSURES

1. Comfort Designs

2. Aquarius Bathware

3. Hamilton Bathware

F MOP SINKS

1. Stern-Williams

2. Fiat

3. E.L. Mustee & Sons

G EMERGENCY SAFETY FIXTURES

1. Bradley

2. Guardian

3. Chicago

4. Haws

5. Speakman

6. Stingray Systems

H DRINKING FOUNTAINS AND WATER COOLERS

1. Halsey Taylor

2. Elkay

3. Haws

4. Oasis

2.02 FAUCETS, SUPPLIES, AND TRIM

A GENERAL: Provide faucets, supplies, and trim in accordance with manufacturer's recommendations, as appropriate for fixtures to be served, and as indicated and scheduled on Drawings. Acceptable manufacturers for each type of appurtenance are as indicated below.

1. Flushometer flush rate shall match gallon-per-flush criteria of fixtures served.

2. Strainers shall be heavy cast brass chrome plated with matching grid type strainer, with or without overflow as required, 17 gauge seamless brass tailpiece of length determined by installation requirements. Provide complete with washers and brass locknut.

3. P-traps shall be 17 gauge seamless chrome plated brass, adjustable type. Provide complete with cleanout plug, chrome plated brass slip nuts, wall bend, and wrought brass escutcheon of depth determined by installation requirements.

4. Angle stops shall be lead-free commercial pattern chrome plated brass, quarter turn ball type with loose key handles. Provide complete with chrome plated copper supply risers and wrought brass escutcheon of depth determined by installation requirements.

5. Toilet seats shall be commercial grade and provided complete with stainless steel posts and self-sustaining check hinges.

6. Pipe trim insulation shall be compliant, white molded vinyl, fade/discoloration-resistant, bacteria/fungal-resistant insulation.

7. Where an exposed flush valve assembly will conflict with the installation height of a grab bar or where there will be insufficient clearance above the top cover of an exposed flush valve for maintenance access relative to the installation height of a grab bar, provide an offset type flush valve tube. Make water rough-in and other adjustments as necessary for a compliant and functioning installation.

B FAUCETS

1. Chicago

2. T&S Brass

3. Zurn

4. Moen Commercial

5. Delta Commercial

6. American Standard

7. Kohler

8. Symmons Commercial

9. Speakman

C SHOWER VALVES

1. Acorn

2. Bradley

3. Symmons Commercial

4. Chicago

5. Powers
6. Zurn
7. Speakman

D FLUSHOMETERS

1. Sloan
2. Zurn
3. Moen Commercial
4. Delta Commercial
5. American Standard
6. Toto

E SUPPLY STOPS

1. McGuire
2. Zurn
3. Chicago

F CHROME PLATED TUBULAR BRASS

1. McGuire
2. Zurn
3. Kohler

G TOILET SEATS

1. Church
2. Bemis
3. American Standard
4. Zurn
5. Toto
6. Centoco

H PIPE TRIM INSULATION

1. Truebro
2. McGuire
3. Plumberex

2.03 FIXTURE CARRIERS

A GENERAL: ASME A112.6.1M; Provide floor-affixed fixture carriers as appropriate for all wall-hung plumbing fixtures unless specifically noted otherwise. Fixture carrier foot supports shall be securely anchored to the floor with 1/2" bolts and anchors at all locations.

1. Chair type carriers shall be adjustable, with coated cast iron body with integral no hub waste and vent connections, complete with gasketed adjustable faceplate assembly, adjustable nipple with test cap, neoprene bowl gasket, lugs for floor and wall attachment, threaded fixture studs, and hardware. Provide single or double type of vertical or horizontal configuration as required and with auxiliary inlet as required.

2. Lavatory carriers shall be adjustable, with steel uprights and welded base feet, coated cast iron support brackets, cast or ductile iron concealed support arms, alignment rod, complete with leveling and support hardware. Provide single or back to back configuration as required.

3. Drinking fountain and urinal carriers shall be adjustable, with steel uprights and welded base feet, upper and lower bearing plates, threaded rods, and mounting hardware. Provide single or side-by-side configuration as required

B ACCEPTABLE MANUFACTURERS

1. J.R. Smith

2. Zurn

3. Mifab

4. Watts

5. Wade

6. Josam

PART 3 - EXECUTION

3.01 PREPARATION

A EXAMINATION OF CONDITIONS: Examine conditions affecting this work. Report unsatisfactory conditions to the proper authority and do not proceed until those conditions have been corrected. Commencing work implies acceptance of existing conditions as satisfactory to the outcome of this work.

B Coordinate cutting of floor construction to receive drains to required invert elevations.

3.02 INSTALLATION

A Install fixtures in locations and heights as shown on Drawings and as directed by the Architect.

B Install materials plumb, level, securely, and in accordance with manufacturer's recommendations.

C All rough-in pipe openings for final connections with supply, waste, vent, and storm systems shall be closed with caps or plugs during early stages of construction and installation. Tape shall not be considered sufficient protection.

D Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

E Provide ball valves in piping serving batteries of fixtures. Label stops "Hot" and "Cold." Valves shall be located above accessible ceilings. If ceilings are not accessible, provide access panels of adequate size to ensure valves are fully accessible and can be fully operated.

F Provide lockable ball valves in piping serving emergency safety fixtures and clearly label such valves as to the fixtures served.

G Plumbing fixtures shall be supported by a concealed carrier where required to properly support the fixture specified. All carriers to be securely mounted, bolted and checked prior to concealment.

H Caulk around fixtures with best grade white silicone caulking. Do not use grout.

I All handles on supply and drainage fittings or other brass items shall be properly lined up and adjusted. Fittings shall not be left in any haphazard manner.

J All fixtures shall have individual chrome plated heavy pattern loose key quarter-turn cutoff stops on supply lines, complete with escutcheons. Where same are not specified as a part of the fixture trim, they shall be installed as close to fixtures as possible in the hot and cold water supply. A loose key for each stop shall be provided to the Owner.

K Install each fixture with trap, easily removable for servicing and cleaning.

L All showers and similar installations shall be installed with type “L” copper pipe between shower valve and shower head rough-in. The termination point shall have a brass drop ear elbow for shower head arm connection. Contractor shall provide proper anchoring support.

3.03 INTERFACE WITH OTHER PRODUCTS

A Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

B Review architectural drawings. Confirm configuration and orientation of shower controls and trim prior to rough-in and installation.

3.04 ADJUSTING

A Adjust work under provisions of Division One.

B Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.05 CLEANING

A Clean work under provisions of Division One.

B At completion clean plumbing fixtures and appurtenances.

3.06 PROTECTION OF FINISHED WORK

A Protect finished Work under provisions of Division One.

B Do not permit use of fixtures.

3.07 ADA ACCESSIBLE FIXTURES

A At all locations required to be accessible, such fixtures, controls, and final installations shall comply with the requirements of ADA and any applicable state accessibility standards. Install fixtures to heights, indicated on architectural drawings.

B All exposed water supply and drain pipes under accessible lavatories and sinks shall be insulated with securely fastened pipe trim insulation kits of the proper model for the fixtures specified.

C Wall mounted drinking fountains and coolers which protrude into passages or corridor space, whether single or paired with an adjacent accessible fixture, shall be supplied with a matching skirt or apron to lower the underside clearance of the non-accessible fixture equal to that required for accessible fixture.

END OF SECTION 22 40 00

SECTION 22 61 00 - COMPRESSED AIR SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 22 02 00 - Basic Materials and Methods for Plumbing shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A The scope of the work shall include the furnishing and complete installation of the system covered by this Section, with all appurtenances, ready for the Owner's use.

B Include the following work in addition to items normally part of this Section:

1. Compressed air pipe and fittings.
2. Transitions, connectors, and valves.
3. Filters, regulators, pressure gauges.
4. Compressor and air dryer equipment.

C Refer to Division 26 sections for the following work not covered by this Section, and coordinate accordingly.

1. Power supply wiring from power source to power connection on compressed air equipment. Include starters, disconnects, and required electrical devices, except where furnished or factory-installed by equipment manufacturer.
2. Interlock wiring between electrically-operated compressed air equipment units and between equipment and any field-installed control devices, except where factory-installed by equipment manufacturer.

D Provide the following electrical work as part of this section, complying with requirements of Division 26 sections: Control wiring between field-installed controls, indicating devices, and unit control panels.

1.03 RELATED WORK

A Section 22 05 29 - Hangers and Support for Plumbing Piping and Equipment

B Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping

C Section 22 05 53 - Identification for Plumbing Piping and Equipment

1.04 REFERENCES

A ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.

B ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.

C ASME B31.3 - Process Piping; 2022, with Errata (2023).

D ASME B31.9 - Building Services Piping; 2020.

E ASME BPVC - Boiler and Pressure Vessel Code; 2023.

F ASTM B32 - Standard Specification for Solder Metal; 2020.

G ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

H ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

I CAGI - The Compressed Air and Gas Handbook; 2003.

J CAGI 3075 - B19.1 - Safety Standard for Compressor Systems; 2011.

K NSF 61 - Drinking Water System Components - Health Effects; 2023, with Errata.

L NSF 372 - Drinking Water System Components - Lead Content; 2022.

M ASME Section IX -Welding and Brazing Qualifications.

N ASME B16.14 - Ferrous Pipe Plugs, Bushings, and Locknuts with Pipe Threads.

O ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.

P ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.

Q ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

R AWS A5.8 -Specification for Filler Metals for Brazing and Braze Welding.

S AWS 5.31 - Specification for Fluxes for Brazing and Braze Welding.

T ASSE 1079 -Performance Requirements for Dielectric Pipe Unions.

1.05 QUALITY ASSURANCE

A Valves: Manufacturer's name, size, and pressure rating shall be cast or marked on valve body or handle.

B Piping shall be labeled along its entire length indicating size, class, material specification, manufacturer’s name and country of origin.

C Foreign pipe, fittings or valves are unacceptable.

D Codes and Standards:

1. ASME Compliance: Provide compressed air pressure vessels and relief valves in accordance with ASME BPVC; provide ASME Code Symbol Stamp.

2. ASME Compliance: Fabricate and install compressed air systems in accordance with ASME B31.3 and ASME B31.9.

3. CAGI Compliance: Fabricate and install compressed air systems in accordance with Compressed Air and Gas Institute Standards CAGI 3075 - B19.1.

4. UL Compliance: Provide electrical components which are UL listed and have UL label affixed.

1.06 SUBMITTALS

A Submit under provisions of Division One.

B Product Data: Submit manufacturer's technical product data for compressed air pipe and fittings, connectors, filters, regulators, equipment and tanks. Include installation instructions for filters, regulators, equipment and tanks.

C Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to equipment. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.07 PROJECT RECORD DOCUMENTS

A Submit under provisions of Division One.

B Record actual locations of valves.

1.08 OPERATION AND MAINTENANCE DATA

A Submit under provisions of Division One.

B Operation Data: Include manufacturers’ instructions, start-up data, and trouble-shooting check lists for compressors, tanks, air dryers, and regulators.

C Maintenance Data: Include manufacturers’ literature, cleaning and maintenance procedures, replacement parts lists, and repair data for compressors, tanks, air dryers, regulators, and filters. Include wiring diagrams for electrically powered equipment.

1.09 QUALIFICATIONS

A Manufacturer: Company regularly engaged in the manufacture of compressed air systems equipment and products, of the types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B Installer: Firm with at least 3 years of successful installation experience on projects with compressed air systems work similar to that required for the project.

1.10 DELIVERY, STORAGE, AND HANDLING

A DELIVERY: Deliver clearly labeled equipment, tanks, piping and valves to; and store, protect and handle products on site in accordance with the provisions of Division One.

B TIMING AND COORDINATION: Arrange for delivery of materials to allow for minimum storage time at the project site. Coordinate with the scheduled time of installation.

C ACCEPTANCE: Accept equipment, tanks, and products on site in original factory packaging. Receive equipment, tanks, and valves on site in shipping containers with labeling in place. Inspect for damage. Damaged equipment, tanks, or valves shall not be acceptable.

D STORAGE: Store materials in a clean, dry location, protected from weather and damage.

E Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

F Protect installed piping systems from entry of foreign materials by providing temporary covers, as completing sections of the work, and isolating parts of completed systems. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, CONNECTORS, AND VALVES

A Pipe and fittings shall be:

1. Copper Tubing: ASTM B88, Type L, hard drawn.

2. Fittings: ASME B16.18, cast bronze or ASME B16.22 wrought copper alloy solder joint pressure fittings.

3. Joints between copper pipe and fittings shall be made in accordance with ASTM B828 using ASTM B32 Alloy HB lead-free solder.

B Connectors at all piping to air compressors shall be:

1. Flexible metallic type (no rubber or plastic components) connectors, capable of compensating for lateral movement and vibration.

2. Suited for the maximum system operating pressure.

3. Manufactured complete with section of 300 series stainless corrugated steel hose with outer braid, with inlet and outlet connections as required based on equipment connection size.

4. Provided with double braid design to increase working pressure rating as necessary.

5. Metraflex Company SSTC series or approved equivalent.

C Valves shall be:

1. Ball type, all bronze cast construction two-piece 600 psi body, blow-out proof stem, Teflon seated, lead-free, with stainless steel trim (including ball, stem, and valve handle). Threaded connections. Certified lead-free to NSF 61/NSF 372 and suited to 180 degrees F.

2. Basis of design (bronze valves):

a. NIBCO T-585-66-LF (full port) for all sizes up through 2".

b. NIBCO T-580-66-LF (conventional port) for sizes 2-1/2" and 3".

3. Valves 4" and larger shall be split body stainless steel construction, 275 psi cold working pressure, blow-out proof stem, PTFE seated, type 316 stainless steel trimmed, class 150, full port design with manual gear operator. NIBCO F-515-S6-F-66-FS.

4. Acceptable alternate manufacturers: Apollo, Milwaukee.

2.02 AIR COMPRESSORS

A Acceptable Manufacturers:

1. Ingersoll Rand
2. Champion
3. Gardner Denver
4. Quincy Compressor
5. Saylor-Beall

B Reciprocating type, electric driven, tank mounted air compressor assembly complete with:

1. Cast iron constructed compressor pump(s)
2. NEMA rated ODP electric motor
3. ASME coded receiver tank with 0-300 psi air pressure gauge, ASME safety relief valve, manual drain and automatic tank drain
4. Mounted and wired motor starter(s), magnetic
5. Industrial grade intake filter and silencer
6. Air cooled aftercooler
7. Automatic start/stop operation with NEMA 1 pressure switch
8. Vibration isolators
9. Single point electrical connection, voltage indicated on Drawings.

C Compressor shall be designed to deliver the scheduled capacity as indicated on the Drawings.

2.03 AIR DRYERS

A Acceptable Manufacturers:

1. Ingersoll Rand
2. Champion

3. Gardner Denver

4. Quincy Compressor

5. Saylor-Beall

B Unless indicated otherwise on the Drawings: Refrigerated type, floor mounted, electric-powered air dryer from the same manufacturer as the associated compressor unit and matched to the scheduled compressor capacity. Single point electrical connection, voltage indicated on Drawings.

2.04 APPURTENANCES

A Provide in-line central system air filters (1 micron rating unless indicated otherwise on Drawings), suited for the system demand, complete with pressure gauge and isolation valves. Located both upstream and downstream of the air dryer.

B Provide a regulator based, single point air system pressure controller, downstream of the final filter to adjust outgoing system pressure as indicated on the Drawings or as indicated by the Owner. Provide complete with pressure gauges on both sides of unit.

C Provide final filter/regulators, each complete with isolation valve, drain valve, and quick connect fitting(s) at each general purpose air drop.

2.05 BASIC VIBRATION CONTROL

A Provide heavy duty rubber vibration isolators beneath each air compressor unit complete with lag screws and other required hardware to mount the equipment to a concrete housekeeping pad in accordance with manufacturer's recommendations.

B Provide spring type hanger accessories for air system piping hangers adjacent to the compressor for a distance of no less than 20 feet. Eaton B-Line B3262 series or equivalent.

C General: Adhere to the requirements of Section 22 05 48.

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A General requirements for piping:

1. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

2. Remove any scale, oil and dirt, on inside and outside, before assembly.

3. Prepare piping connections to equipment with flanges or unions.

4. Confirm pipe placement and elevation prior to any installation.

5. All piping shall be installed free of sags and bends.

6. Make branch connections from the top of the associated main.

7. Provide piping with 1% downward slope in the direction of flow

8. Provide a drip leg with drain valve at starting point of air system piping and provide auxiliary drain points as necessary (bottoms of risers and at low points).

B General requirements for valves:

1. Install valves with stems upright or horizontal, not inverted.

2. Valves shall be line-sized unless specifically noted otherwise.

3. Provide clearance for access to valves and operable fittings. Valves that must be installed beyond reasonable reach shall be provided with a chain operator.

4. Provide access doors where valves and operable fittings are not otherwise accessible. Access doors shall be of approved types set in locations pre-approved by submittal to the Architect.

C Install all materials in accordance with the manufacturer's published instructions.

D Route piping in an orderly manner, parallel and perpendicular to building column grid lines, unless indicated otherwise on Drawings, and maintain gradients.

E Install piping to conserve building space and not conflict with other trades or interfere with intended use of space.

F Group piping whenever practical at common elevations.

G Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H Support and label all piping, valves, and equipment in accordance with the requirements of related Sections.

I Provide male adapters each side of threaded valves in copper piped system. Sweat solder adapters to tube prior to make-up of threaded connections

J Solder joints shall be wiped clean at each joint, remove excess metal while molten and flux residue when cooled.

K Route drain lines to approved disposal points or indirect waste receptors.

3.02 INSTALLATION OF EQUIPMENT

A Ensure all compressed air equipment is provided with sufficient clearances for installation, operation, inspection, and maintenance and in accordance with manufacturer’s recommendations.

B Provide 4” thick reinforced concrete housekeeping pad(s) for base-mounted equipment, to extend no less than 4” from equipment footprint on all sides. Cast anchor bolt inserts into pad(s).

C Provide compressor air intake from the outside air, with open end of intake pipe well hooded and screened to prevent rain and dust or dirt from entering. Route intake piping full size and as short and direct as possible, with long radius elbows where bends are necessary. For long lengths of run, piping shall be upsized accordingly.

D Intake pipe shall be located no less than 6 feet above ground and located clear from any exhaust outlets to prevent contamination.

E Slope discharge piping away from the compressor with sufficient pitch to prevent either condensate or oil draining back into the compressor.

F Provide union downstream of all valves at equipment or apparatus connections.

G Electrical Wiring: Install electrical devices furnished by manufacturer but not provided factory-mounted. Furnish a copy of the manufacturer's wiring diagram submittal to the Electrical Installer.

H Verify that electrical wiring installation is in accordance with the manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to the equipment installer.

3.03 CLEANING, TESTING, AND FIELD QUALITY CONTROL

A Blow out the system piping to ensure it is clear and free of all foreign matter or installation residue prior to connecting equipment or filters.

B Provide Architect/Engineer with reasonable advance notice of system testing, no less than 48 hours prior.

C Piping system shall be tested for leaks and integrity with clean, dry air at 150% of the system working pressure (but in no case less than 150 psi) for no less than one hour, with no leakage detected. If leaks are present, they shall be repaired. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks.

D Gauges for pressure testing shall be incremented for 2% or less of the required test pressure with a pressure range not exceeding twice the test pressure applied.

E Start-up and test equipment for proper operation in accordance with manufacturer’s recommendations. Test all alarms for both high pressure and low pressure conditions.

F Prior to turnover of the system to the Owner, ensure that all system filters are new and clean.

END OF SECTION 22 61 00

SECTION 23 02 00 - BASIC MATERIALS AND METHODS FOR HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings is deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect/Engineer for review as soon as practicable. No such departures shall be made without the prior written approval of the Architect/Engineer.

C Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalog number, such reference shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product, material, fixture, form or type of construction which in the judgment of the Architect/Engineer, expressed in writing, is the equivalent of that specified.

1.02 SCOPE OF WORK

A The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form complete and functioning systems in all of their various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The Contractor shall review all pertinent drawings, including those of other contracts, prior to commencement of Work.

B This Division requires the furnishing and installing of all items as specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C The approximate locations of Mechanical (HVAC) items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E All discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to bidding. Where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I The Contractor shall participate in the commissioning process as required; including, but not limited to, meeting attendance, completion of checklists, and participation in functional testing.

1.03 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A The Contract Documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the reviewed shop drawings.

B All duct or pipe or equipment locations as indicated on the documents do not indicate every transition, offset, or exact location. All transitions, offsets, clearances and exact locations shall be established by actual field measurements, coordination with the structural, architectural and reflected ceiling plans, and other trades. Submit shop drawings for review.

C All transitions, offsets and relocations as required by actual field conditions shall be performed by the Contractor at no additional cost to the Owner.

D Additional coordination with electrical contractor may be required to allow adequate clearances of electrical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.04 SITE VISIT AND FAMILIARIZATION

A Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

B Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

C Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.05 WORK SPECIFIED IN OTHER SECTIONS

A Finish painting is specified. Prime and protective painting are included in the work of this Division.

B Owner and General Contractor furnished equipment shall be properly connected to Mechanical (HVAC) systems.

C Furnishing and installing all required Mechanical (HVAC) equipment control relays and electrical interlock devices, conduit, wire and J-boxes are included in the Work of this Division.

1.06 PERMITS, TESTS, INSPECTIONS

A Arrange and pay for all permits, fees, tests, and all inspections as required by governmental authorities.

1.07 DATE OF SUBSTANTIAL COMPLETION

A The date of final acceptance shall be the date of substantial completion. Refer to Division One for additional requirements.

B The date of final acceptance shall be documented in writing and signed by the Architect, Owner and Contractor.

1.08 DELIVERY, STORAGE, AND HANDLING

A Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct - properly protected from incidental damage and weather damage.

C Damaged equipment, duct or pipe shall be promptly removed from the site and new, undamaged equipment, pipe or duct shall be installed in its place promptly with no additional charge to the Owner.

1.09 NOISE AND VIBRATION

A The heating, ventilating and air conditioning systems, and the component parts thereof, shall be guaranteed to operate without objectionable noise and vibration.

B Provide foundations, supports and isolators as specified or indicated, properly adjusted to prevent transmission of vibration to the building structure, piping and other items.

C Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise.

D All equipment shall be selected to operate with minimum of noise and vibration. If, in the opinion of the Architect, objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of the Work, the Contractor shall rectify such conditions without extra cost to the Owner.

1.10 DELEGATED DESIGN FOR ANCHORAGE OF ROOF MOUNTED EQUIPMENT

A The Contractor shall engage a qualified professional engineer to design all roof mounted equipment curbs, equipment supports, equipment tie downs, equipment connections, and methods of attachment for components that are to be anchored to the building structure. The design shall comply with wind load and uplift requirements utilizing design criteria per ICC (IBC) and ASCE 7 unless criteria is otherwise indicated in the Construction Documents.

B Submittal: Signed and sealed engineering analysis data and accompanying details, drawings, and supplemental installation information shall be submitted to the engineer for review.

1.11 APPLICABLE CODES AND STANDARDS

A Obtain all required permits and inspections for all work required by the Contract Documents and pay all required fees in connection thereof.

B Arrange with the serving utility companies for the connection of all required utilities and pay all charges, meter charges, connection fees and inspection fees, if required.

C Comply with all applicable codes, specifications, local ordinances, industry standards, utility company regulations and the applicable requirements which includes and is not limited to the following nationally accepted codes and standards:

1. Air Moving & Conditioning Association, AMCA.
2. American Standards Association, ASA.
3. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., ASHRAE.
4. American Society of Mechanical Engineers, ASME.
5. American Society of Plumbing Engineers, ASPE.
6. American Society of Testing Materials, ASTM.
7. American Water Works Association, AWWA.

8. National Bureau of Standards, NBS.

9. National Fire Protection Association, NFPA.

10. Sheet Metal & Air Conditioning Contractors' National Association, SMACNA.

11. Underwriters' Laboratories, Inc., UL.

12. International Building Code, IBC.

13. International Energy Conservation Code, IECC.

14. International Fire Code, IFC.

15. International Fuel Gas Code, IFGC.

16. International Mechanical Code, IMC.

D Where differences existing between the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the nationally accepted codes and standards, the more stringent or costly application shall govern. Promptly notify the Engineer in writing of all differences.

E When directed in writing by the Engineer, remove all work installed that does not comply with the Contract Documents and applicable state or city building codes, state and local ordinances, industry standards, utility company regulations and the applicable requirements of the above listed nationally accepted codes and standards, correct the deficiencies, and complete the work at no additional cost to the Owner.

1.12 DEFINITIONS AND SYMBOLS

A General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 01.

B Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I Installer: Entity (person or firm) engaged by the Contractor, or its Subcontractor or Sub-subcontractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor or, when so noted, by other identified installers or entities.

K Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by the latest ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DRAWINGS AND SPECIFICATIONS

A These Specifications are intended to supplement the Drawings and it will not be the province of the Specifications to mention any part of the Work which the Drawings are competent to fully explain in every particular and such omission is not to relieve the Contractor from carrying out portions indicated on the Drawings only.

B Should items be required by these Specifications and not indicated on the Drawings, they are to be supplied even if of such nature that they could have been indicated thereon. In case of disagreement between Drawings and Specifications, or within either Drawings or Specifications, the better quality or greater quantity of work shall be estimated and the matter referred to the Architect or Engineer for review with a request for information and clarification at least 7 working days prior to bid opening date for issuance of an addendum.

C The listing of product manufacturers, materials and methods in the various sections of the Specifications, and indicated on the Drawings, is intended to establish a standard of quality only. It is not the intention of the Owner or Engineer to discriminate against any product, material or method that is the equivalent of the standards as indicated and/or specified, nor is it intended to preclude open, competitive bidding. The fact that a specific manufacturer is listed as an acceptable manufacturer should not be interpreted to mean that the manufacturer’s standard product will meet the requirements of the project design, Drawings, Specifications and space constraints.

D The Architect or Engineer and Owner shall be the sole judge of quality and equivalence of equipment, materials and methods.

E Products by other reliable manufacturers, other materials, and other methods, will be accepted as outlined, provided they have equivalent capacity, construction, and performance. However, under no circumstances shall any substitution be made without the written permission of the Architect or Engineer and Owner. Request for prior approval must be made in writing 10 calendar days prior to the bid date without fail.

F Wherever a definite product, material or method is specified and there is not a statement that another product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method is the only one that shall be used without prior approval.

G Wherever a definite material or manufacturer's product is specified and the Specification states that products of similar design and equivalent construction from the specified list of manufacturers may be substituted, it is the intention of the Owner or Engineer that products of manufacturers that are specified are the only products that will be acceptable and that products of other manufacturers will not be considered for substitution without approval.

H Wherever a definite product, material or method is specified and there is a statement that "OR EQUIVALENT" product, material or method will be acceptable, it is the intention of the Owner or Engineer that the specified product, material or method or an "OR EQUIVALENT" product, material or method may be used if it complies with the Specifications and is submitted for review to the Engineer as outline herein.

I Where permission to use substituted or alternative equipment on the project is granted by the Owner or Engineer in writing, it shall be the responsibility of the Contractor or Subcontractor involved to verify that the equipment will fit in the space available which includes allowances for all required Code and maintenance clearances, and to coordinate all equipment structural support, plumbing and electrical requirements and provisions with the Mechanical (HVAC) Design Documents and all other trades, including Division 26.

J Changes in architectural, structural, electrical, mechanical, and plumbing requirements for the substitution shall be the responsibility of the bidder wishing to make the substitution. This shall include the cost of redesign by the affected designer(s). Any additional cost incurred by affected Subcontractors shall be the responsibility of this bidder and not the Owner.

K If any request for a substitution of product, material or method is rejected, the Contractor will automatically be required to furnish the product, material or method named in the Specifications. Repetitive requests for substitutions will not be considered.

L The Owner or Engineer will investigate all requests for substitutions when submitted in accordance with the requirements listed above; and if accepted, will issue a letter allowing the substitutions.

M Where equipment other than that used in the design as specified or shown on the Drawings is substituted (either from an approved manufacturers list or by submittal review), it shall be the responsibility of the substituting Contractor to coordinate space requirements, building provisions and connection requirements with their respective trade(s) and all other trades; and to pay all additional costs to other trades, the Owner, the Architect or Engineer, if any, due to the substitutions.

1.14 SUBMITTALS

A Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty-day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.

2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.

6. Identification of each item of material or equipment matching that indicated on the Drawings.

7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.

8. Additional information as required in other Sections of this Division.

9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B Refer to Division 00 and Division 01 for additional information on shop drawings and submittals.

C Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or Drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit. The Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating that the submittal meets all conditions of the Contract Documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified. The Contractor will automatically be required to furnish the product, material or method named in the Specifications. Contractor shall not order equipment when submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F Materials and equipment which are purchased or installed without submittal review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H Submittals are required for, but not limited to, the following items subject to project requirements:

1. Coordination Drawings
2. Hangers and Support for Piping and Equipment HVAC
3. Vibration and Seismic Controls for HVAC Piping and Equipment
4. Testing, Adjusting, and Balancing
5. Duct Insulation
6. HVAC Equipment Insulation
7. HVAC Piping Insulation
8. Energy Management and Control System
9. Above Ground Hydronic Piping
10. Metal Ductwork

11. Ductwork Accessories
12. Duct Silencers
13. HVAC Fans
14. High-Volume Low-Speed Propeller Fans
15. Air Distribution Devices
16. HVAC Gravity Ventilators
17. Air Filters
18. Gas Fired Furnaces
19. Rooftop Heating and Cooling Units Electric Cooling-Gas Heating
20. Split System Air-Conditioners - Wall-Mounted
21. Fan Coil Unit
22. Electric Unit Heaters

I Refer to other Division 23 sections for additional submittal requirements. Provide samples of actual materials and/or equipment to be used on the Project upon request of the Owner or Engineer.

1.15 COORDINATION DRAWINGS

A Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access, and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:
    a. Wall and type locations.
    b. Clearances for installing and maintaining insulation.
    c. Locations of light fixtures and sprinkler heads.
    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
    e. Equipment connections and support details.
    f. Exterior wall and foundation penetrations.
    g. Routing of storm and sanitary sewer piping.

h. Fire-rated wall and floor penetrations.

i. Sizes and location of required concrete pads and bases.

j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C By submitting coordination drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 RECORD DOCUMENTS

A Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 23.

B The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D Record Drawings shall indicate, at a minimum, the following installed conditions:

1. Duct mains and branches, size and location, for both exterior and interior; locations of dampers, fire dampers, duct access panels, and other control devices; filters, fuel fired heaters, fan coils, condensing units, and roof-top A/C units requiring periodic maintenance or repair.

2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Indicate actual inverts and horizontal locations of underground piping.

3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.

4. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

5. Contract Modifications, actual equipment and materials installed.

E Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

F If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

G The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.17 OPERATING AND MAINTENANCE MANUALS

A Prepare operating and maintenance manuals in accordance with Division 00 and Division 01 and, in addition to the requirements specified in those Divisions, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

    a. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

    b. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

    c. Servicing instructions and lubrication charts and schedules.

1.18 CERTIFICATIONS AND TEST REPORTS

A Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and scheduled date for each test. This detailed completion and test schedule shall be submitted at least 90 days before the projected substantial completion date.

B Test result reporting forms shall be submitted for review no later than the date of the detailed schedule.

C Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of substantial completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D Certifications and test reports to be submitted shall include, but not be limited to, those items outlined in Section 23 02 00.

1.19 OPERATING AND MAINTENANCE MANUALS

A Prepare Operations and Maintenance manuals in accordance with the requirements of Division 01 and Division 23. In addition to the requirements of other Sections, this shall include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.

2. Valve tag lists with valve number, type, color coding, location and function.

3. Reviewed Shop Drawing submittals with exceptions noted compliance letter.

4. Fabrication drawings.

5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.

6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

8. Servicing instructions and lubrication charts and schedules.

9. Equipment and motor name plate data.

10. Wiring diagrams.

11. Exploded parts views and parts lists for all equipment and devices.

12. Color coding charts for all painted equipment and conduit.

13. Location and listing of all spare parts and special keys and tools furnished to the Owner.

14. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

B Coordinate with Division 01 for Operations and Maintenance manual requirements. Unless noted otherwise, bind together in “D ring” style three-ring binders (National model no. 79-883 or equivalent). Binders shall be large enough to allow ¼” of spare capacity. Include three (3) sets with all approved Shop Drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections with tabbed insertable dividers, labeled for easy reference. Utilize the individual specification section numbers shown in the Mechanical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 23 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

C In addition to the bound “hard-copy” Operation and Maintenance manuals referenced above, provide an identical electronic copy in searchable PDF format, with all sections bookmarked within the file for easy reference. Provide a USB flash drive with the final manual to the Owner.

D Operating and Maintenance Manuals shall be turned over to the Owner or Engineer for review a minimum of fourteen (14) working days prior to the beginning of the operator training period.

E Operating and Maintenance Manuals which the Engineer deems incomplete, poorly organized, or otherwise unacceptable will be rejected in writing. The Contractor will subsequently be required to again turn over Operating and Maintenance Manuals, with all deficiencies corrected, until deemed acceptable by the Engineer.

1.20 OPERATOR TRAINING

A The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include a minimum of 12 hours of onsite training in three (3) shifts of four (4) hours each.

B Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period, obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C Refer to other Division 23 Sections for additional Operator Training requirements.

1.21 FINAL COMPLETION

A At the completion of the Work, all equipment and systems shall be tested and faulty equipment and material shall be repaired or replaced. Refer to Sections of Division 23 for additional requirements.

B Clean and adjust all air distribution devices and replace all air filters immediately prior to Substantial Completion.

C Touch up and/or refinish all scratched equipment and devices immediately prior to Substantial Completion.

1.22 CONTRACTOR'S GUARANTEE

A Use of the HVAC systems to provide temporary service during construction period will not be allowed without permission from the Owner in writing; and, if granted, shall not cause the warranty period to start, except as defined below.

B Contractor shall guarantee to keep the entire installation in repair and perfect working order for a period of one year after the date of the Substantial Completion, and shall furnish (free of additional cost to the Owner) all materials and labor necessary to comply with the above guarantee throughout the year beginning from the date of Substantial Completion, Beneficial Occupancy by the Owner, or the Certificate of Final Payment as agreed upon by all parties.

C This guarantee shall not include cleaning or changing filters except as required by testing, adjusting and balancing.

D All air conditioning compressors shall have parts and labor guarantees provided by the equipment manufacturer for a period of not less than 5 years beyond the date of Substantial Completion.

E Refer to Sections in Division 23 for additional guarantee or warranty requirements.

1.23 TRANSFER OF ELECTRONIC FILES

A Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D Any reuse or modifications will be at the Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The Contract Documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A Provide materials and equipment manufactured by a domestic United States manufacturer and assembled in the United States for all local and Federal Government projects. These materials and equipment shall comply with "Buy American Act."

B Access Doors: Provide access doors as required for access to equipment, valves, controls, cleanouts and other apparatus where concealed. Access doors shall have concealed hinges and screw driver cam locks.

C All access doors located in wet areas such as restrooms, locker rooms, shower rooms, kitchen and any other wet areas shall be constructed of stainless steel.

D Access Doors: shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surface: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install doors only in locations approved by the Architect.

2.02 EQUIPMENT PADS

A Provide 6-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum extension of 6 inch beyond the equipment on all sides. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

PART 3 - EXECUTION

3.01 ROUGH-IN

A Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected via reviewed submittals.

B Refer to equipment specifications in Divisions 2 through 48 for additional rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

A General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with architectural action markings on submittal, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, resolve conflicts and submit proposed solution to the Architect for review.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as possible, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location and label.

11. Install access doors where units are concealed behind finished surfaces. Refer to paragraph 2.1 in this section and architect for access doors specifications and location.

12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

13. Provide roof curbs for all roof mounted equipment. Coordinate with roof construction for pitched roof. Provide roof curbs which match the roof slope and provides a level top for equipment installation. Refer to Architectural drawings and details.

14. The equipment to be furnished under these Specifications shall be essentially the standard product of the manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the product of the same manufacturer.

15. The Architectural and Structural features of the building and the space limitations shall be considered in selection of all equipment. No equipment shall be furnished which will not suit the arrangement and space limitations indicated.

16. Lubrication: Prior to start-up, check and properly lubricate all bearings as recommended by the manufacturer.

17. Where the word "Concealed" is used in these Specifications in connection with insulating, painting, piping, ducts, etc., it shall be understood to mean hidden from sight as in chases, furred spaces or suspended ceilings. "Exposed" shall be understood to mean the opposite of concealed.

18. Identification of Mechanical Equipment:

    a. Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

    b. Tags shall be attached to all valves, including control valves, with nonferrous chain. Tags shall be brass and at least 1-1/2 inches in diameter. Nameplate and tag symbols shall correspond to the identification symbols on the temperature control submittal and the "as-built" drawings.

19. Provide construction filters for all air handling units, fan coil unit, VAV boxes, and all other air handling equipment during the entire construction period.

20. Provide temporary construction strains for all strainers in the hydronic systems during the initial flushing of the systems.

3.03 CUTTING AND PATCHING

A Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover Work to provide for installation of ill-timed Work.

2. Remove and replace defective Work.

3. Remove and replace Work not conforming to requirements of the Contract Documents.

4. Remove samples of installed Work as specified for testing.

5. Install equipment and materials in existing structures.

6. Upon written instructions from the Engineer, uncover and restore Work to provide for Engineer/Owner's observation of concealed Work, without additional cost to the Owner.

7. Patch existing finished surfaces and building components using new materials matching existing materials and experienced Installers. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers; refer to the materials and methods required for the surface and building components being patched; Refer to Paragraph 1.11 I for definition of "Installer."

C Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, mechanical ducts and HVAC units, and other mechanical items made obsolete by the new Work.

D Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

3.04 WORK SEQUENCE, TIMING, COORDINATION WITH OWNER, ARCHITECT AND ENGINEER

A The Owner will cooperate with the Contractor, however, the following provisions must be observed:

1. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Sub-Contractors and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

2. During the construction of this project, normal facility activities will continue in existing buildings until renovated areas are completed. Plumbing, fire protection, lighting, electrical, communications, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.

3. Contractor shall not start-up any of the HVAC equipment unless the Owner, Architect and Engineer are signed off.

4. Start-up for major HVAC equipment such as chillers, cooling towers, variable frequency drives and hot water boilers shall be performed by a factory technician. The start-up shall include a written report signed off by Contractor, Engineer and Owner.

END OF SECTION 23 02 00

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT - HVAC

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Pipe, and equipment hangers, supports and associated anchors.

B Sleeves and seals.

C Flashing and sealing equipment and pipe stacks.

1.03 RELATED WORK

A Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

B Section 23 07 16 - HVAC Equipment Insulation

C Section 23 07 19 - HVAC Piping Insulation

D Section 23 21 13 - Above Ground Hydronic Piping

1.04 REFERENCES

A ASME B31.1 - Power Piping; 2022.

B ASME B31.9 - Building Services Piping; 2020.

C MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018, with Amendment (2019).

1.05 QUALITY ASSURANCE

A Hangers and Supports for HVAC Piping: In conformance with ASME B31.1 and ASME B31.9.

B Hangers and Supports for HVAC Piping: In conformance with MSS SP-58.

1.06 SUBMITTALS

A Submit shop drawings and product data under provisions of Division One.

B Indicate hanger and support framing and attachment methods.

C Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

PART 2 - PRODUCTS

2.01 PIPE HANGERS AND SUPPORTS

A Hangers for Pipes Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.

B Hangers for Pipes Sizes 2 to 4 Inch: Carbon steel, adjustable clevis.

C Hangers for Pipes Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roller, double hanger.

D Multiple or Trapeze Hangers: Steel channels with welded spacers, pre-formed manufactured saddles and hanger rods; cast iron roller and stand for pipe sizes 6 inches and over.

E Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

F Wall Support for Pipe Sizes 4 Inches and over: adjustable steel yoke and cast iron roller.

G Vertical Support: Steel riser clamp.

H Floor Support for Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

I Floor Support for Pipe Sizes 6 Inches and Over: Adjustable cast iron roller and stand, steel screws, and concrete pier or steel support.

J Roof Pipe Supports and Hangers: Galvanized Steel Channel System as manufactured by Portable Pipe Hangers, Inc. or approved equal.

1. For pipes 2-1/2” and smaller - Type PP10 with roller
2. For pipes 3” through 8” - Type PS
3. For multiple pipes - Type PSE - Custom

K Copper Pipe Support and Hangers: Electro-galvanized with thermoplastic elastomer cushions; Unistrut “Cush-A-Clamp” or equal. Hangers: Plastic coated; Unistrut or equal.

L Shields for Vertical Copper Pipe Risers: Sheet lead.

M Pipe Rough-In Supports in Walls/Chases: Provide preformed plastic pipe supports, Sioux Chief “Pipe Titan” or equal.

2.02 HANGER RODS

A Galvanized Hanger Rods: Threaded both ends, threaded one end, or continuous threaded.

2.03 INSERTS

A Inserts: Malleable iron case with galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.04 FLASHING

A Metal Flashing: 20 gage galvanized steel.

B Lead Flashing: 4 lb. /sq. ft. sheet lead for waterproofing; 1 lb. /sq. ft. sheet lead for soundproofing.

C Caps: Steel, 20 gage minimum; 16 gage at fire resistant elements.

D Coordinate with roofing contractor/Architect for type of flashing on metal roofs.

2.05 EQUIPMENT CURBS

A Fabricate curbs of hot dipped galvanized steel.

B For metal roof construction, roof curbs shall be made of aluminum or stainless steel. Coordinate with Architectural Drawings and details.

2.06 SLEEVES

A Sleeves for Pipes through Non-fire Rated Floors: Form with 18 gage galvanized steel, tack welded to form a uniform sleeve.

B Sleeves for Pipes through Beams, Interior Walls, Exterior Walls, Footings, and Potentially Wet Floors: Form with steel pipe, Schedule 40, galvanized.

C Sleeves for Pipes through Fire Rated and Fire Resistive Floors and Fireproofing: Prefabricated fire rated steel sleeves including seals, UL listed, manufactured by Hilti.

D Fire Stopping Insulation: Glass fiber type, non-combustible, UL listed.

E Caulk: Paintable 25-year acrylic sealant.

F Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted, two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

2.07 MECHANICAL SLEEVE SEALS

A Modular sealing element unit, designed for field assembly, to continuously fill annular space between pipe and sleeve and create watertight seal.

1. Approved Manufacturers:

    a. Link-Seal by Garlock Pipeline Technologies (GPT)

    b. Innerlynx by Advance Products & Systems, Inc.

    c. MetraSeal by Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material, size of pipe, and service requirements.

3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.08 FABRICATION

A Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

B Design hangers without disengagement of supported pipe.

C Design roof supports without roof penetrations, flashing or damage to the roofing material.

2.09 FINISH

A Exposed steel hangers, supports, and appurtenances shall be hot-dipped galvanized. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.01 INSERTS

A Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Coordinate with Structural Engineer for placement of inserts.

B Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

C Where concrete slabs form finished ceiling, provide inserts to be flush with slab surface.

D Where inserts are omitted, drill through concrete slab from below and provide thru-bolt with recessed square steel plate and nut recessed into and grouted flush with slab. Verify with Structural Engineer prior to start of work.

3.02 PIPE HANGERS AND SUPPORTS

A Support horizontal piping as follows:

PIPE SIZE	MAX. HANGER SPACING	HANGER DIAMETER
(Steel Pipe)		
1/2 to 1-1/4 inch	7'-0"	3/8"
1-1/2 to 3 inch	10'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(Copper Pipe)		
1/2 to 1-1/4 inch	5'-0"	3/8"
1-1/2 to 2-1/2 inch	8'-0"	3/8"
3 to 4 inch	10'-0"	3/8"
6 to 8 inch	10'-0"	1/2"

(Cast Iron Pipe)		
2 to 3 inch	5'-0"	3/8"
4 to 6 inch	10'-0"	1/2"
8 to 10 inch	10'-0"	5/8"
12 to 14 inch	10'-0"	3/4"
15 inch and over	10'-0"	7/8"
(PVC Pipe)		
1-1/2 to 4 inch	4'-0"	3/8"
6 to 8 inch	4'-0"	1/2"
10 inch and over	4'-0"	5/8"

B Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

C Place a hanger within 12 inches of each horizontal elbow, and at the vertical to horizontal transition.

D Use hangers with 1-1/2 inch minimum vertical adjustment.

E Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F Support vertical piping at every floor.

G For vertical shaft or chase applications where floor slab supported riser clamps cannot be provided to keep the pipe in alignment and to support the weight of the pipe and its contents, ensure to provide suitable fasteners, hardware, braces, unistrut, structural steel members, and appurtenances required to accommodate the pipe installation. Coordinate all such work with the project structural engineer to ensure that necessary members and attachment points are provided accordingly to bear the weight of the functioning piping.

H Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

I Support riser piping independently of connected horizontal piping.

J Install hangers with nut at base and above hanger; tighten upper nut to hanger after final installation adjustments.

K Portable pipe hanger systems shall be installed per manufacturer’s instructions.

L Distances between supports are maximum distance. Supports shall be provided to carry the pipe/equipment load.

3.03 INSULATED PIPING

A Clamps: Attach galvanized clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ASME B31.9.

B Saddles: Install galvanized protection saddles MSS Type 39 where insulation without vapor barrier is indicated. Fill interior voids with segments of insulation that match adjoining pipe insulation. Secure the full contact area of the saddle to the pipe insulation with 1/8" thick coat of mastic.

C Shields: Install protective shields MSS SP-58 Type 40 on cold and chilled water piping that has vapor barrier. Secure the full contact area of the shield to the pipe insulation with 1/8" thick coat of mastic.

D Shields shall span an arc of 180 degrees and shall have dimensions in inches not less than the following:

Nominal Pipe Size	Shield Length	GaugeThickness
1/4 through 3-1/2 inch	12	18
4 inch	12	16
5 through 6 inch	18	16
8 through 14 inch	24	14
16 through 24 inch	24	12

E Piping 2" and larger: provide galvanized sheet metal shields with calcium silicate insulation at hangers/supports.

F Insert material shall be at least as long as the protective shield.

G Thermal Hanger Shields: Install where indicated, with insulation of same thickness as piping.

3.04 EQUIPMENT BASES AND SUPPORTS

A Provide equipment bases of concrete.

B Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

D Construct support of steel members. Brace and fasten with flanges bolted to structure.

E Provide rigid anchors for pipes after vibration isolation components are installed.

3.05 FLASHING

A Provide flexible flashing and metal counter flashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B Provide curbs for mechanical roof installations that extend minimum 8 inches above adjacent roofing surface. Contact Architect for all flashing details and roof construction. Seal penetrations watertight.

3.06 SLEEVES

A Sleeves shall be provided at the following locations:

1. Piping passing through rated and non-rated floor assemblies, rated ceiling assemblies, and roof assemblies.

2. Piping passing through concrete, masonry, and rated gypsum board walls and partitions.

3. Piping passing through exterior wall assemblies above and below grade.

4. Piping passing through non-rated gypsum board walls and partitions where indicated on the drawings or where exposed to view.

5. Piping passing through structural members where indicated on the drawings or where exposed to view.

6. Any other locations indicated on the drawings.

B Set sleeves in position in formwork. Provide reinforcing around sleeves.

C Extend sleeves through floors minimum one inch above finished floor level. Sleeves located in walls, ceilings, and structural members shall be flush with the outer surfaces of the assembly being penetrated.

D Where sleeved piping penetrates a floor, ceiling, or interior wall assembly, pack annular space between pipe and sleeve with UL listed fire stopping insulation and caulk seal airtight with fire barrier sealant. Provide close fitting metal collar or escutcheon covers at both sides of wall penetrations and exposed side of ceiling penetrations.

E Install all UL listed, prefabricated fire rated steel sleeves per the manufacturer's installation instructions to ensure fire rating is maintained.

F Sleeves at exterior walls below grade shall be sealed with mechanical sleeve seal. Install seal per manufacturer's installation instructions. Select type and number of sealing elements required for pipe material, pipe size, and service requirements. Position pipe in center of sleeve. Assemble mechanical sleeve seal and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal. Locations above grade shall be provided with close fitting metal collar or escutcheon covers at both sides of penetration.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Vibration and sound control products.

1.03 QUALITY ASSURANCE

A Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration control products of type, size, and capacity required, whose products have been in satisfactory use in similar service for not less than 5 years.

B Vibration and sound control products shall conform to ASHRAE criteria for average noise criteria curves for all equipment at full load conditions.

C Unless otherwise indicated, sound and vibration control products shall be provided by a single manufacturer.

1.04 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A VMC Group

B Mason Industries, Inc.

C Kinetics Noise Control, Inc.

D Vibration Eliminator Co., Inc.

2.02 GENERAL

A Provide vibration isolation supports for equipment, piping and ductwork, to prevent transmission of vibration and noise to the building structure that may cause discomfort to the occupants.

B Model numbers of VMC Group products are included for identification. Products of the listed manufacturers will be acceptable provided they comply with all the requirements of this specification.

2.03 SUSPENDED FANS AND FAN COIL UNITS

A Provide VMC Group model HS spring hangers sized for 1'' static deflection.

2.04 CONDENSING UNITS

A Provide VMC Group model NRC, 1" thick ribbed elastomeric isolation pads sized for approximately 40 psi loading and 1/8'' deflection.

B Pads shall be located in accordance with the condensing unit manufacturer's recommendations.

2.05 PIPING

A Provide VMC Group model HRS combination spring and elastomeric isolation hangers in mechanical equipment rooms, for a minimum distance of 50 feet from isolated equipment for all chilled water and hot water piping 1-1/2'' diameter and larger. Isolators shall be sized for the same deflection as the isolators specified for the equipment up to a maximum of 2" deflection for at least the first three piping hangers; the remaining hangers shall have isolators sized for 1" deflection.

B Floor supported piping is required to be isolated with VMC Group model AW-1 open springs sized for 1'' deflection.

C All condenser water piping shall be supported with VMC Group model AW-1 open springs sized for 1" deflection for floor or roof mounted piping and VMC Group model HRS-1 combination spring and elastomeric isolation hangers sized for 1" deflection for suspended piping.

D Provide line size flexible connectors at supply and return of pumps, chillers, and all other locations indicated on the mechanical drawings and details. Flexible pipe connectors shall be VMC Group model 2800 single sphere EPDM construction and shall include 150 lb. cadmium plated carbon steel floating flanges.

2.06 CORROSION PROTECTION

A All vibration isolators shall be designed and treated for resistance to corrosion.

B Steel components: PVC coated or phosphate coated and painted with industrial grade enamel. Nuts, bolts, and washers: zinc-electroplated.

PART 3 - EXECUTION

3.01 INSTALLATION

A All equipment shall be installed in accordance with the manufacturer's recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C If internal isolation option is used on air handling units, the mechanical contractor shall verify proper adjustment and operation of isolators prior to start-up. All shipping brackets and temporary restraint devices shall be removed.

D The vibration isolation supplier shall certify in writing that he has inspected the installation and that all external isolation materials and devices are installed correctly and functioning properly.

END OF SECTION 23 05 48

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

B Refer to Architectural Sections for additional requirements.

1.03 REFERENCE STANDARDS

A ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

PART 2 - PRODUCTS

2.01 VALVE AND PIPE IDENTIFICATION

A Valves:

1. All valves shall be identified with a 1-1/2" diameter brass disc wired onto the handle. The disc shall be stamped with 1/2" high depressed black filled identifying numbers. These numbers shall be numerically sequenced for all valves on the job.

2. The number and description indicating make, size, model number and service of each valve shall be listed in proper operational sequence, properly typewritten. Three copies to be turned over to Owner at completion.

3. Tags shall be fastened with approved meter seal and 4 ply 0.018 smooth copper wire. Tags and fastenings shall be manufactured by the Seton Name Plate Company or approved equal.

4. All valves shall be numbered serially with all valves of any one system and/or trade grouped together.

B Pipe Marking:

1. All interior visible piping located in accessible spaces such as above accessible ceilings, equipment rooms, attic space, under floor spaces, etc., shall be identified with all temperature pipe markers as manufactured by W.H. Brady Company, 431 West Rock Ave., New Haven, Connecticut, or approved equal.

2. All exterior visible piping shall be identified with UV and acid resistant outdoor grade acrylic plastic markers as manufactured by Set Mark distributed by Seton (Name plate Company Factory location 20 Thompson Road, Branford, Connecticut) or approved equal.

3. Generally, markers shall be located on each side of each and every partition, on each side of every tee, on each side of every valve and/or valve group, on each side of every piece of equipment, and, for straight runs, at equally spaced intervals not to exceed 75 feet. In congested area, marks shall be placed on each pipe at the points where it enters and leaves the area and at the point of connection of each piece of equipment and automatic control valve. All markers shall have directional arrows.

4. Provide pipe markers that meet labeling requirements of ASME A13.1 for all refrigerant piping located in areas other than the room or space where the associated equipment is located. Pipe markers shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation. The minimum height of the identification lettering shall be 1/2". The pipe identification shall indicate the refrigerant designation and safety group classification of the refrigerant used in the piping system. For Group A2, A3, B2, and B3 refrigerants, the identification shall also include the following statement: “DANGER – Risk of Fire or Explosion. Flammable Refrigerant.” For any Group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant”.

5. Markers shall be installed after final painting of all piping and equipment and in such a manner that they are visible from the normal maintenance position. Manufacturer's installation instructions shall be closely followed.

6. Markers shall be colored as indicated below per ASME A13.1.

SYSTEM	COLOR	LEGEND
Chilled Water	Green	Chilled Water Supply; Chilled Water Return
Hot Water	Reddish Orange	Hot Water Supply; Hot Water Return
Condenser Water	Green	Condenser Water Supply; Condenser Water Return
Compressed Air	Blue	Compressed Air
Pneumatic Control	Yellow	Pneumatic Controls
Oxygen	Yellow	Oxygen
Nitrogen	Green	Nitrogen
Deionized Water	Green	Deionized Water
Steam	Yellow	Steam Supply; Steam Return

C Pipe Painting:

1. All piping exposed to view shall be painted as indicated or as directed by the Architect in the field. Confirm all color selections with Architect prior to installation.

2. All piping located in mechanical rooms and exterior piping shall be painted as indicated below:

SYSTEM	COLOR
Condenser Water Supply and Return	Light Green
Chilled Water Supply and Return	Light Blue
Heating Hot Water Supply and Return	Reddish Orange

2.02 EQUIPMENT IDENTIFICATION

A Mechanical equipment shall be identified by means of nameplates permanently attached to the equipment. Nameplates shall be engraved laminated plastic or etched metal with minimum 1/2 inch high letters manufactured by Seton Company or approved equal. Submittals shall include dimensions and lettering format for approval. Attachment shall be with escutcheon pins, self-tapping screws, or machine screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A All labeling equipment shall be installed as per manufacturer's printed installation instructions.

B Provide printable label on ceiling grids and access doors at all locations that provide access to mechanical equipment, valves, motorized dampers, and accessories located above ceiling. The label shall be white with black text with 1/4 inch high letters and shall identify the component that is accessible at that location.

C Provide printable label on ceiling grids and access doors at all locations that provide access to fire dampers, smoke dampers, and combination fire/smoke dampers located above ceiling. The label shall be white with red text with 1/2 inch high letters reading: FIRE/SMOKE DAMPER, SMOKE DAMPER, or FIRE DAMPER to identify the damper type that is accessible at that location.

D All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Contractor's price shall include all items required as per manufacturer's requirements.

E All piping shall be cleaned of rust, dirt, oil and all other contaminants prior to painting. Refer to Division 9 for Architect's required paint system(s).

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 RELATED DOCUMENTS

A Approved submittal date on equipment installed, to accomplish the test procedures, outlined under paragraph 3.01 of this Section, will be provided by the Contractor.

1.03 DESCRIPTION

A The TAB of the air conditioning systems shall be performed by an impartial technical firm hired by the Owner whose operations are limited only to the field of professional TAB. The TAB work will be done under the direct supervision of a qualified engineer employed by the TAB firm.

B The TAB firm will be responsible for inspecting, adjusting, balancing, and logging the date on the performance of fans, dampers in the duct system, and air distribution devices. The Contractor and the various Subcontractors of the equipment installed shall cooperate with the TAB firm to furnish necessary data on the design and proper applications of the system components and provide labor and material required to eliminate deficiencies or malperformance.

1.04 QUALITY ASSURANCE

A QUALIFICATIONS OF CONTRACTOR PERSONNEL: Submit evidence to show that the personnel who shall be in charge of correcting deficiencies for balancing the systems are qualified. The Owner and Engineer reserve the right to require that the originally approved personnel be replaced with other qualified personnel if, in the Owner and Engineer's opinion, the original personnel are not qualified to properly place the system in condition for balancing.

B QUALIFICATIONS OF TAB FIRM PERSONNEL:

1. A minimum of one registered Professional Engineer licensed in the State, is required to be in permanent employment of the firm.

2. Personnel used on the jobsite shall be either Professional Engineers or technicians, who shall have been permanent, full time employees of the firm for a minimum of six months prior to the start of Work for that specified project.

3. Evidence shall be submitted to show that the personnel who actually balance the systems are qualified. Evidence showing that the personnel have passed the tests required by the Associated Air Balance Council (AABC) shall be required.

C CALIBRATION LIST: Submit to the Engineer for approval, a list of the gauges, thermometers, velometer, and other balancing devices to be used in balancing the system. Submit evidence to show that the balancing devices are properly calibrated before proceeding with system balancing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SERVICES OF THE CONTRACTOR

A The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjustment devices for the purpose of adjustment to obtain optimum operating conditions. Install these devices in a manner that leaves them accessible, and provide access as requested by the TAB firm.

B Have systems complete and in operational readiness prior to notifying the TAB firm that the project is ready for their services, and certify in writing to the Architect and Owner that such a condition exists.

C As a part of the Work of this Section, make changes in the sheaves, belts, and dampers or the addition of dampers required for correct balance of the new work as required by the TAB firm, at no additional cost to the Owner.

D Fully examine the existing system to be balanced, to determine whether or not sufficient volume dampers, balancing valves, thermometers, gauges, pressure and temperature taps, means of reading static pressure and total pressure in duct systems, means of determining water flow, and other means of taking data needed for proper water and air balancing are existing. Submit to the Engineer in writing a listing of omitted items considered necessary to balance existing systems. Submit the list and proposal as a cost add item.

E Verify that fresh air louvers are free of blockage, coils are clean and fresh air ducts to each air handling unit have individually adjustable volume regulating dampers.

F Provide, correct, repair, or replace deficient items or conditions found during the testing, adjusting, and balancing period.

G In order that systems may be properly tested, balanced, and adjusted as specified, operate the systems at no expense to the Owner for the length of time necessary to properly verify their completion and readiness for TAB period.

H Project construction schedules shall provide time to permit the successful completion of TAB services prior to Substantial Completion. Complete, operational readiness, prior to commencement of TAB services, shall include the following services of the Contractor:

1. Construction status of building shall permit the closing of doors, windows, ceilings installed and penetrations complete, to obtain project operating conditions.

2. AIR DISTRIBUTION SYSTEMS:

a. Verify installation for conformity to design. Supply, return, and exhaust ducts terminated and pressure tested for leakage as specified.

b. Volume and fire dampers properly located and functional. Dampers serving requirements of minimum and maximum outside air, return and relief shall provide tight closure and full opening, smooth and free operation.

c. Supply, return, exhaust and transfer grilles, registers and diffusers shall be installed.

d. Air handling systems, units and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., shall be blanked and sealed to eliminate excessive bypass or leakage of air.

e. Fans (supply and exhaust) operating and verified for freedom from vibrations, proper fan rotation and belt tension; overload heater elements shall be of proper size and rating; record motor amperage and voltage and verify that these functions do not exceed nameplate ratings.

f. Furnish or revise fan drives or motors as necessary to attain the specified air volumes.

3. AUTOMATIC CONTROLS:

a. Verify that control components are installed in accordance with project documents and functional, electrical interlocks, damper sequences, air and water resets, fire and freeze stats.

b. Controlling instruments shall be functional and set for design operating conditions. Factory precalibration of room thermostats and pneumatic equipment will not be acceptable.

c. The temperature regulation shall be adjusted for proper relationship between the controlling instruments and calibrated by the TAB Contractor. Advise Engineer of deficiencies or malfunctions.

I Contractor shall repair any insulation removed from piping system by TAB Contractor during water balancing.

3.02 SERVICES OF THE TAB FIRM

A The TAB firm will act as liaison between the Owner, Engineer, and the Contractor and inspect the installation of mechanical piping system, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems being retrofitted, repaired, or added under this Contract. The reinspection of the Work will cover that part related to proper arrangement and adequate provision for the testing and balancing and will be done when the Work is 80 percent complete.

B Upon completion of the installation and start-up of the mechanical equipment, to check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building. Prepare and submit to the Engineer complete reports on the balance and operations of the systems.

C Measurements and recorded readings of air, water, and electricity that appear in the reports will be done by the permanently employed technicians or engineers of the TAB firm.

D Make an inspection in the building during the opposite season from that in which the initial adjustments were made. At the time, make necessary modifications to the initial adjustments required to produce optimum operation of system components to affect the proper conditions as indicated on the Drawings. At time of opposite season check-out, the Owner's representative will be notified before readings or adjustments are made.

E In fan systems, the air quantities indicated on the Drawings may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the Contractor to furnish or revise fan drive and motors if necessary, without cost to the Owner, to attain the specified air volumes.

F Contractor shall utilize ultrasonic flow meter to balance water flow of existing water system if the original pressure drop data is not available. Contractor shall remove insulation as necessary to use flow meter.

G Participate in the commissioning process, which shall include but not be limited to attending commissioning meetings, coordinating work with and completing checklists as required by the commissioning team.

3.03 PROFESSIONAL REPORT

A Before the final acceptance of the report is made, the TAB firm will furnish the Engineer the following data to be approved by the Owner and Engineer:

1. Summary of main supply, return and exhaust duct pitot tube traverses and fan settings indicating minimum value required to achieve specified air volumes.

2. A listing of the measured air quantities at each outlet corresponding to the temperature tabulation as developed by the Engineer and TAB firm.

3. Air quantities at each return and exhaust air handling device.

4. Static pressure readings entering and leaving each supply fan, exhaust fan, filter, coil, balancing dampers and other components of the systems. Including the retrofit Work. These readings will be related to performance curves in terms of the CFM handled if available.

5. Motor current readings at each equipment motor on load side of capacitors. The voltages at the time of the reading shall be listed.

6. The final report shall certify test methods and instrumentation used, final velocity reading obtained, temperatures, pressure drops, RPM of equipment, amperage of motors, air balancing problems encountered, recommendations and uncompleted punch list items. The test results will be recorded on standard forms.

7. A summary of actual operating conditions shall be included with each system outlining normal and ventilation cycles of operation. the final report will act as a reference of actual operating conditions for the Owner's operating personnel.

3.04 BALANCING AIR CONDITIONING SYSTEM

A GENERAL:

1. Place all equipment into full operation, and continue operating during each working day of balancing and testing. If the air conditioning system is balanced during Off-Peak cooling season Contractor shall return to rebalance air side system as required to put system in proper balance at that season.

2. The Contractor shall submit detailed balancing and recording forms for approval. After approval by the Engineer, prepare complete set of forms for recording test data on each system. All Work shall be done under the supervision of a Registered Professional Engineer. All instruments used shall be accurately calibrated to within 1% of scale and maintained in good working order.

3. Upon completion of the balancing and testing, the TAB Contractor shall compile the test data in report forms, and forward five copies to the Engineer for evaluation.

4. The final report shall contain logged results of all tests, including such data as:

   a. Tabulation of air volume at each outlet.

   b. Outside dry bulb and wet bulb temperature.

   c. Inside dry bulb and wet bulb temperatures in each conditioned space room or area.

   d. Actual fan capacities and static pressures. Motor current and voltage readings at each fan.

B AIR SYSTEMS: Perform the following operations as applicable to balance and test systems:

1. Check fan rotation.

2. Check filters (balancing shall be done with clean filters).

3. Test and adjust blower rpm to design requirements.

4. Test and record motor full load amperes.

5. Test and record system static pressures, suction and discharge.

6. Test and adjust system for design cfm, return air and outside air (±2%). Change-out fan sheaves as required to balance system.

7. Test and record entering air temperatures, db and wb.

8. Test and record leaving air temperatures, db and wb.

9. Adjust all zones to design cfm (±2%).

10. Test and adjust each diffuser, grille, and register to within 5% of design.

C AIR DUCT LEAKAGE: (From SMACNA Duct Standards latest edition) Test all ductwork (designed to handle over 1000 CFM) as follows:

1. Test apparatus

   a. The test apparatus shall consist of:

   b. A source of high pressure air - a portable rotary blower or a tank type vacuum cleaner.

   c. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

2. Test Procedures

   a. Test for audible leaks as follows:

      1) Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

      2) Start the blower with its control damper closed.

      3) Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.

      4) Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

   b. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:

      1) Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.

      2) Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.

      3) Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

4) Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which must be corrected.

D DX SYSTEMS:

1. Test and record suction and discharge pressures at each compressor and record ambient air temperature entering the condensing coils.

2. Test and record unit full load amps and voltage.

3. Test and record staging and unloading of unit required by sequence of operation or drawing schedule.

E Automatic temperature controls shall be calibrated; and all thermostats and dampers adjusted so that the control system is in proper operating condition, subject to the approval of the Engineer/Owner.

F The TAB Contractor shall report to Engineer all air distribution devices or other equipment that operate noisily so that corrective measures may be implemented by the Contractor at no additional cost to the Owner or Architect/Engineer.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A External Duct Insulation

1. Fiberglass / Glass Mineral Fiber Flexible Blanket Insulation
2. Fiberglass / Glass Mineral Fiber Rigid Board Insulation
3. Fiberglass / Glass Mineral Fiber Segmented Board Pipe and Tank Insulation
4. Fiberglass / Glass Mineral Fiber Continuous Mat Pipe and Tank Insulation
5. Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation

B Internal Duct Insulation

1. Fiberglass / Glass Mineral Fiber Flexible Duct Liner Insulation
2. Fiberglass / Glass Mineral Fiber Rigid Plenum Liner Insulation

C Adhesives

D Mastics

E Lagging Adhesives

F Sealants

G Glass Fiber Fabric Reinforcing Mesh

H Securements

1.03 RELATED SECTIONS

A Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B Section 23 05 53 - Identification for HVAC Piping and Equipment

C Section 23 31 13 - Metal Ductwork

1.04 REFERENCE STANDARDS

A 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

D ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

E ASTM C165 - Standard Test Method for Measuring Compressive Properties of Thermal Insulations; 2023.

F ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

G ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

H ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016 (Reapproved 2021).

I ASTM C1393 - Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks; 2019.

J ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019 (Reapproved 2022).

K ASTM D1644 - Standard Test Methods for Nonvolatile Content of Varnishes; 2001.

L ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.

M ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

N ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

O ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

P ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

Q ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

R ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

S ASTM E2336 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems; 2020.

T ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

U ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

V ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

W ASTM G22 - Standard Practice for Determining Resistance of Plastics to Bacteria; 2023.

X ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y MIL-DTL-3316 - Adhesives, Fire-Resistant, Thermal Insulation; 2020d.

Z NAIMA FGDLS - North American Insulation Manufacturers Association (NAIMA) Fibrous Glass Duct Liner Standards; Current Edition, Including All Revisions.

AA NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

BB NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

CC SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

DD SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

EE UL 2824 - GREENGUARD Certification Program Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers; Current Edition, Including All Revisions.

FF UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

GG UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

A Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

C Duct and plenum insulation shall comply with minimum R-value requirements of ICC (IECC) and ASHRAE Std 90.1 I-P unless greater values are indicated otherwise in the contract documents.

D Adhesive and other insulation materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

E Vapor retarder mastics used on the interior of the building shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D

F Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or polybrominated diphenyl ether fire retardants.

G Fiberglass insulations shall have a minimum of 50 percent recycled glass content.

H Fiberglass insulations shall have a formaldehyde-free binder and shall be UL GREENGUARD Gold certified.

1.06 WARRANTY

A Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective, or nonconforming materials and workmanship.

B Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.07 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.08 DELIVERY, STORAGE AND HANDLING

A Deliver insulation materials to site in unopened containers with manufacturer’s product name, ASTM standard designation, type and grade, maximum use temperature, nominal dimensions, manufacturer lot or date code.

B Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

A The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and approved before any insulation is installed.

B A sample quantity of each type of insulation and each type of application shall be installed and approval secured prior to proceeding with the main body of the Work.

2.02 ACCEPTABLE MANUFACTURERS

A Fiberglass/Glass mineral fiber materials shall be as manufactured by Knauf Insulation, Certain-Teed, Johns-Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor retarder, etc., as the types specified herein, subject to review by the Engineer.

B Adhesives, mastics, and sealants shall be as manufactured by 3M Company, Carlisle/Hardcast, Design Polymerics, Foster/Childers, Mon-Eco Industries, or Vimasco Corporation and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

C Ceramic fiber materials shall be as manufactured by 3M Company, Alkegen/Unifrax, or Morgan Advanced Materials/Thermal Ceramics.

D Metal jacketing and fitting covers shall be as manufactured by Johns Manville or RPR Products, Inc.

2.03 EXTERNAL INSULATIONS

A Fiberglass / Glass Mineral Fiber Flexible Blanket Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1290 and ASTM C553, Type I, II, and III. Provide insulation with factory applied FSK vapor retarding facing complying with ASTM C1136, Type I, II, VIII, X. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.27 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 250 degrees F with facing, 350 degrees F for unfaced material. Provide Knauf Insulation Atmosphere Duct Wrap with ECOSE Technology, Johns Manville Microlite FSK or approved equal.

B Fiberglass / Glass Mineral Fiber Rigid Board Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C553 Type I, II, III, ASTM C612 Type IA, IB. Provide insulation with factory applied FSK facing vapor retarder facing complying with ASTM C1136, Type I, II. Thermal conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 450 degrees F. Provide Knauf Insulation Earthwool Insulation Board with ECOSE Technology, Johns Manville 800 Series Spin-Glas or approved equal.

C Fiberglass / Glass Mineral Fiber Segmented Board Pipe and Tank Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1393, Category 1. Semi-rigid, segmented board in roll form with glass fibers adhered perpendicular to the vapor retarder facing. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. Compressive strength per ASTM C165 C165, not less than 120 PSF at 10% deformation. Thermal conductivity (k-value) at 100 degrees F mean temperature shall be 0.26 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 850 degrees F. Provide Knauf Insulation Earthwool Pipe & Tank Insulation with ECOSE Technology or approved equal.

D Fiberglass / Glass Mineral Fiber Continuous Mat Pipe and Tank Insulation: Glass fibers bonded with a thermosetting resin, complying with ASTM C1393; Type I, II, IIIA, IIIB Category 2. Semi-rigid, continuous mat in roll form. Provide insulation with factory applied FSK vapor retarder facing complying with ASTM C1136, Type II, IV, X. Compressive strength per ASTM C165, not less than 25 PSF at 10% deformation. Thermal conductivity (k-value) at 100 degrees F mean temperature shall be 0.25 Btu x in. /h x sq. ft. x degrees F, or less. Maximum service temperature of 850 degrees F. Provide Knauf Insulation KwikFlex Pipe & Tank Insulation, Johns Manville Micro-Flex or approved equal.

E Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation: High-temperature ceramic fiber blanket thermal insulation encapsulated in a fiberglass reinforced aluminized polyester foil. Fire-rated blanket insulation shall have a nominal thickness of 1-1/2" and a nominal density of 6.0 pcf. Provide 3M Fire Barrier Duct Wrap 615+, Alkegen/Unifrax FyreWrap Elite 1.5, or Morgan Advanced Materials/Thermal Ceramics FireMaster FastWrap XL.

2.04 INTERNAL INSULATIONS

A Fiberglass / Glass Mineral Fiber Flexible Duct Liner Insulation: Rotary glass fibers bonded with thermosetting resin, complying with ASTM C1071 Type I. Airstream side to have a tightly bonded, black mat finish withstanding maximum rated air velocity of 6,000 ft/minute. Mat finish shall be treated with EPA-registered biocide for use in HVAC systems and verified to be microbially resistant in accordance with ASTM G21, ASTM G22, ASTM C1338, and UL 2824. The outer edges of the Liner shall have a factory applied encapsulating coating. Nominal density shall be 1.5 pcf minimum and when tested in accordance with ASTM C423 (Type A Mounting), shall provide a Noise Reduction Coefficient of 0.70 at 1.0", 0.80 at 1.5", and 0.95 at 2.0" thickness. Maximum service temperature of 250 degrees F. Thermal Conductivity (k-value) at 75 degrees F mean temperature shall be 0.24 Btu x in. /h x sq. ft. x degrees F, or less. Provide Knauf Insulation Atmosphere Duct Liner with ECOSE Technology, Johns Manville Linacoustic RC or approved equal.

B Fiberglass / Glass Mineral Fiber Rigid Plenum Liner Insulation: Glass fibers bonded with thermosetting resin, complying with ASTM C1071 Type II. Airstream side to have a tightly bonded, black mat finish withstanding maximum rated air velocity of 5,000 ft/minute. Mat finish shall be treated with EPA-registered biocide for use in HVAC systems and verified to be microbially resistant in accordance with ASTM G21 and ASTM C1338. The outer edges of the Liner shall have a factory applied encapsulating coating. Nominal density shall be 3.0 pcf minimum and when tested in accordance with ASTM C423 (Type A Mounting), shall provide a minimum Noise Reduction Coefficient of 0.65 at 1.0", 0.85 at 1.5", at 0.95 at 2.0" thickness. Maximum service temperature of 250 degrees F. Thermal Conductivity (k-value) at 75 degrees F mean temperature shall be 0.23 Btu x in. /h x sq. ft. x degrees F, or less. Provide Knauf Insulation Atmosphere Rigid Plenum Liner with ECOSE Technology, Johns Manville Linacoustic R-300 or approved equal.

2.05 ADHESIVES

A Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B Fiberglass / Glass Mineral Fiber Adhesive: Comply with MIL-DTL-3316C, Class 2, Grade A. Provide Childers CP-82 or approved equal.

C Duct Liner Adhesive: Duct Liner adhesives shall comply with ASTM C916.

2.06 MASTICS

A Materials shall be compatible with insulation materials, jackets, and substrates.

B Vapor-Retarder Mastic: Water based; suitable for indoor and outdoor use on below ambient services. Water-Vapor Permeance shall be 0.09 perms at 55-mils dry film thickness when tested in accordance with ASTM E96/E96M, Procedure A. Service Temperature Range shall be -20 to +180 degrees F. Solids content shall be 59 percent by volume and 71 percent by weight per ASTM D1644. Provide Childers CP-35 or approved equal.

2.07 LAGGING ADHESIVES

A Materials shall be compatible with insulation materials, jackets, and substrates.

B Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct, equipment, and pipe insulation. Service Temperature Range shall be 0 to +180 degrees F. Provide Childers CP-52 or approved equal.

2.08 SEALANTS

A Materials shall be compatible with insulation materials, jackets, and substrates.

B FSK and Metal Jacket Flashing Sealants shall be fire and water-resistant, flexible, elastomeric sealants with a service temperature range of -40 to +250 degrees F. Provide Childers CP-76 or approved equal.

C Fire Barrier Sealant shall be a latex-based, intumescent sealant that dries to form a monolithic firestop seal. Fire barrier sealant shall be firestop tested up to 4 hours in accordance with ASTM E814 and fire resistance tested in accordance with ASTM E1966. Provide 3M CP 25WB+ or approved equal.

2.09 GLASS FIBER FABRIC REINFORCING MESH

A Woven Glass Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. inch. Provide Childers Chil-Glas No. 10 or approved equal.

2.10 SECUREMENTS

A Bands

1. Approved Manufacturers
    a. Childers
    b. PABCO
    c. RPR Products
2. Stainless Steel: ASTM A240/A240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing or closed seal.
3. Aluminum: ASTM B209/B209M, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B Insulation Pins

1. Approved Manufacturers
    a. AGM Industries, Inc.
    b. Midwest Fasteners, Inc.
    c. GEMCO
    d. Duro-Dyne
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
3. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, minimum 0.106-inch-diameter shank, length to suit depth of insulation indicated.
4. Insulation Retaining Washers: Self-locking washers formed from 0.016 inch thick, galvanized steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C Staples

1. Outward-clinching insulation staples, nominal 1/2-inch-wide, stainless steel or Monel.

PART 3 - EXECUTION

3.01 GENERAL

A To ensure that external fiberglass/glass mineral fiber flexible blanket and rigid board insulation will achieve its highest possible performance and serve its intended purpose, install all mechanical insulation materials and associated accessories in accordance with manufacturer's published instructions and industry practices detailed by the North American Commercial and Industrial Insulation Standards (NACIIS) Manual as published by the Midwest Insulation Contractors Association (MICA).

B To ensure that internal fiberglass/glass mineral fiber flexible duct and rigid plenum liner insulation will achieve its highest possible performance and serve its intended purpose, install duct liner, plenum liner, and all associated accessories in accordance with manufacturer's published instructions and industry practices detailed by NAIMA FGDLS and SMACNA (DCS).

C Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

D Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces, free of voids throughout the length of, ducts and fittings.

E All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

3.02 EXTERNAL DUCT INSULATION

A Fasten all longitudinal and circumferential laps with outward clinching staples 3" on center. On rectangular ducts over 24" wide apply as above and hold insulation in place on bottom side with mechanical pins and clips on 12" centers.

B Seal all joints, fastener penetrations and other breaks in vapor retarder with 3-inch wide strips of glass fiber fabric reinforcing mesh embedded between two coats of vapor retarder mastic.

C External duct wrap is required on all outside air ducts, supply and return air ducts that are not internally insulated. External duct wrap is also required on all exhaust and relief air ducts that are used in airside energy recovery systems. Any exhaust ductwork located in an unconditioned space that conveys air from conditioned spaces or vice versa shall also be provided with external duct wrap. Duct wrap shall be provided as follows:

1. 1½" thick, 1.0 pcf density minimum; minimum installed R-value of 4.5 when ducts are located in directly conditioned spaces.

2. 2” thick, 1.0 pcf density minimum; minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air or located indoors concealed within chases or shafts.

3. 3" thick, 0.75 pcf density minimum; minimum installed R-value of 8.3 when ducts are located in unconditioned spaces.

D Any ductwork located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 or UL 723 testing requirements or UL 2043 for discrete products in plenums shall be provided with a single layer of duct wrap to establish a noncombustible rating per ASTM E136. Duct wrap products which are approved for such non-compliant combustible duct materials located in air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Alkegen/Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

3.03 DUCT LINER

A Duct liner shall be kept clean and dry during transportation, storage, installation, and throughout the construction process care should be taken to protect the liner from exposure to the elements or damage from mechanical abuse.

B Duct liner shall be adhered to the sheet metal with a full coverage of approved adhesive complying with ASTM C916. All exposed leading edges and transverse joints shall be coated with factory-applied or field-applied edge coating, Childers CP-50A HV2 Black or approved equal and shall be neatly butted without gaps. Shop or field cuts shall be liberally coated with an edge coating. All coatings and adhesives shall be designed for duct liner application.

C Metal nosings shall be securely installed over transversely oriented liner edges facing the airstream at forward discharge and at any point where lined duct is preceded by unlined duct.

D When velocity exceeds 4,000 fpm (20.3 m/sec), use metal nosing on every leading edge. Nosing may be formed on duct or be channel or zee attached by screws, rivets or welds.

E Line supply and return ductwork at connection of fan-powered HVAC units to a point of 15 feet upstream and downstream of the equipment, 15 feet downstream of fan powered terminal units, and in return air boots.

F Duct liner shall be provided as follows:

1. 1” thick, 1.5 pcf density minimum, with a minimum installed R-value of 4.2 when ducts are located in directly conditioned spaces.

2. 1 ½” thick, 1.5 pcf density minimum, with a minimum installed R-value of 6.0 when ducts are located in indirectly conditioned spaces such as ceiling plenum space used for return air.

3. 2” thick, 1.5 pcf density minimum, with a minimum installed R-value of 8.0 when ducts are located in indoor, unconditioned spaces or located outdoors.

4. 1 ½” thick, 3.0 pcf density minimum, with a minimum R-value of 6.3 for rigid plenum liner applications.

3.04 EXPOSED DUCTWORK LOCATED INDOORS

A Duct required to be insulated by any section of this specification that is routed exposed in occupied spaces shall be double wall.

B Duct routed exposed shall be double wall with perforated inner liner and fiberglass/glass mineral fiber insulation. Provide 1” thick insulation when ductwork is located in conditioned spaces and 2” thick in unconditioned spaces, insulation density shall be a minimum of 1.0 pcf. Double wall duct shall be United McGill model Acousti-k27 for round or oval ducts and Rectangular-k27 for rectangular ducts or approved equal.

3.05 AIR DEVICE AND MISCELLANEOUS DUCT INSULATION

A The backside of all supply air devices shall be insulated with taped and sealed external duct wrap matching the thickness, density, and R-value of the associated duct system.

B The contractor shall install an additional layer of 1-½ inch thick external fiberglass / glass mineral fiber duct wrap on any portion of the supply air, return air, outside air, or exhaust air system that has condensation forming during any period of operation. The insulation shall be taped and vapor-sealed and located until all evidence of the condensation has been eliminated, at no additional cost to the Owner.

3.06 KITCHEN GREASE HOOD EXHAUST DUCT

A All type I kitchen range hood exhaust duct shall be enclosed with 2-hour fire rated enclosure.

B The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant. Refer to Division 7 for further requirements regarding “"Through-Penetration Firestop Systems”.

C The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E As an alternate method, the contractor may use two layers of 2-hour Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:

1. Duct insulation system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 2 hours.

2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).

3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.

4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F Insulation and all other requirements shall be provided per local codes.

3.07 DRYER VENT DUCT

A All dryer vent duct routed within an air plenum shall be enclosed within a 1-hour fire rated enclosure.

B The duct enclosure shall be sealed around the duct at the points of penetration with an approved fire barrier sealant. Refer to Division 7 for further requirements regarding ""Through-Penetration Firestop Systems".

C The enclosure shall be separated from the duct by at least 3 inches and not more than 12 inches.

D Cleanout openings at exhaust duct with access openings at the fire rated enclosure and access doors shall be provided at each duct offset and as required for proper operation and maintenance.

E As an alternate method, the contractor may use two layers of 2-hour Fire-Rated High-Temperature Ceramic Fiber Flexible Blanket Insulation in lieu of the fire rated enclosure, provided that all the following constraints are satisfied:

1. Duct insulation system shall be tested per ASTM E2336 internal fire testing and have an achieved minimum fire resistance rating of 1 hour.

2. Product shall be approved by the local Authority Having Jurisdiction (AHJ).

3. Duct wrap system shall be mechanically attached to the duct using steel banding and/or weld pins per manufacturer's instructions.

4. Duct wrap system shall be installed in strict accordance with the manufacturer's instructions, including but not limited to zero clearance to combustibles at all locations on the wrap surface.

F Insulation and all other requirements shall be provided per local codes.

END OF SECTION 23 07 13

SECTION 23 07 16 - HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B Work specified elsewhere.

1. Basic materials and methods.
2. Piping systems.
3. Air distribution equipment.

1.03 REFERENCE STANDARDS

A ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

E NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

F SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

G UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 QUALITY ASSURANCE

A Installer’s Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

B All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 and UL 723.

C All HVAC equipment insulation shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

D Adhesives and other materials shall comply with NFPA 90A and NFPA 90B. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

1.05 WARRANTY

A Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.06 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

1.07 DELIVERY AND STORAGE

A Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 EQUIPMENT INSULATION

A It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed before any insulation is installed.

C A sample quantity of each type of insulation and each type application shall be installed and reviewed prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D Glass mineral wool materials as manufactured by Knauf Insulation, Owens/Corning, Certain-Teed or Johns Manville will be acceptable, if they comply with the specifications.

E Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

F All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

PART 3 - EXECUTION

3.01 INSTALLATION

A All insulation shall be installed in accordance with the manufacturer’s recommendations and printed installation instructions.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer’s requirements.

END OF SECTION 23 07 16

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

B Furnish and install piping insulation to:

1. Chilled water and heating hot water piping.
2. Condensate drain piping.
3. Refrigerant piping.
4. All pipes subject to freezing conditions shall be insulated.

C Work specified elsewhere.

1. Painting.
2. Pipe hangers and supports.

D For insulation purpose piping is defined as the complete piping system including supplies and returns, pipes, valves, automatic control valve bodies, fittings, flanges, strainers, thermometer well, unions, reducing stations, and orifice assemblies.

1.03 RELATED SECTIONS

A Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B Section 23 05 53 - Identification for HVAC Piping and Equipment

C Section 23 21 13 - Above Ground Hydronic Piping

1.04 REFERENCE STANDARDS

A ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B ASTM C1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2019.

C ASTM C1136 - Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation; 2023.

D ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2023.

E ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2022a.

F ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

G ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.05 WARRANTY

A Warrant the Work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B Defects shall include, but not be limited to, the following:

1. Mildewing.
2. Peeling, cracking, and blistering.
3. Condensation on exterior surfaces.

1.06 SUBMITTALS

A SHOP DRAWINGS: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

B PRODUCT DATA: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, project variations, and accessories.

1.07 DELIVERY AND STORAGE

A Deliver insulation, coverings, cements, adhesives, and coatings to site in unopened containers with manufacturer’s stamp, clearly labeled with flame and smoke rating, affixed showing fire hazard indexes of products.

B Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged or wet insulation; remove such from project site.

PART 2 - PRODUCTS

2.01 HVAC PIPING INSULATION

A It is the intent of these specifications to secure superior quality workmanship resulting in an absolutely satisfactory installation of insulation from the standpoint of both function and appearance. Particular attention shall be given to valves, fittings, pumps, etc., requiring low temperature insulation to insure full thickness of insulation and proper application of the vapor seal. All flaps of vapor barrier jackets and/or canvas covering must be neatly and securely smoothed and sealed down.

B The type of insulation and its installation shall be in strict accordance with these specifications for each service, and the application technique shall be as recommended by the manufacturer. All insulation types, together with adhesives and finishes shall be submitted and reviewed prior to installation.

C A sample quantity of each type of insulation and each type application shall be installed and accepted prior to proceeding with the main body of the work. Condensation caused by improper installation of insulation shall be corrected by Installing Contractor. Any damage caused by condensation shall be made good at no cost to the Owner or Architect/Engineer.

D All insulation shall be listed and labeled to have a composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to insulation) flame spread index of not more than 25 and smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723.

1. Exception: Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150.

E All HVAC piping insulation thicknesses shall comply with minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P.

F Accessories, such as adhesives, mastics and cements shall have the same component ratings as listed above. Additionally, all adhesives and sealants used on the interior of the building (i.e., inside of the weatherproofing system and applied on-site) shall be comprised of low-emitting materials that comply with VOC limits prescribed by SCAQMD 1168.

G All products or their shipping cartons shall have a label affixed, indicating flame and smoke ratings do not exceed the above requirements.

H Any existing piping located in an air plenum that is comprised of materials that do not comply with the 25/50 flame and smoke rating per ASTM E84 testing requirements shall be provided with a single layer of high-temperature insulation to establish a noncombustible rating per ASTM E136. Insulation products which are approved for such non-compliant combustible piping materials located air plenums shall be 3M Fire Barrier Plenum Wrap 5A+ or Unifrax FyreWrap 0.5 Plenum. Insulation products for this application shall be installed in strict accordance with the manufacturer’s instructions.

2.02 APPROVED MANUFACTURERS

A Calcium silicate materials shall be as manufactured by Johns Manville.

B Glass mineral wool materials shall be as manufactured by Knauf Insulation, Johns Manville or Owens-Corning and shall have the same thermal properties, density, fire rating, vapor barrier, etc., as the types specified herein, subject to review by the Engineer. All glass mineral wool insulation shall be UL GREENGUARD Gold certified.

C Adhesives shall be as manufactured by Childers, Foster, HB Fuller or Armacell, and shall have the same adhesive properties, fire rating, vapor seal, etc., as the types specified herein, subject to review by the Engineer.

D Flexible elastomeric cellular thermal insulation by Armacell.

E Phenolic foam insulation shall be as manufactured by Resolco, Inc. (Insul-Phen) or Polyguard (Poly-phen).

F Metal jacketing and fitting covers shall be as manufactured by Childers or RPR Products.

2.03 MATERIALS

A CHILLED WATER PIPING: Provide phenolic foam in accordance with ASTM C1126 with ASJ jacket and all joints sealed.

B HEATING HOT WATER PIPING: Provide glass mineral wool pipe insulation in accordance with ASTM C547 with ASJ+ SSL+ jacket or phenolic foam in accordance with ASTM C1126 with ASJ and all joints sealed.

C CONDENSATE DRAINAGE PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums; insulation not required when piping is exposed on roof.

D REFRIGERANT PIPING: Provide flexible elastomeric cellular thermal insulation in accordance with ASTM C534/C534M, model "Armaflex Ultra", fire rated for use in environmental air plenums. Apply manufacturers recommended finish and sealant for exterior applications.

E METAL JACKETING: Utilize Childers “Strap-On” jacketing. Provide preformed fitting covers for all elbows and tees.

F ALL SERVICE JACKETING (ASJ+): Vapor retarder jacket for interior applications shall be composed of an aluminum foil layer, reinforced with glass scrim, bonded to a layer of white kraft paper, interleaving with an outer polymer film leaving no paper exposed; complying with ASTM C1136. Vapor retarder jacket for exterior applications shall be composed of a 3-ply composite membrane consisting of a white 0.5 mil polyester film, 1.0 mil aluminum foil, and one 0.5 mil clear polyester film; complying with ASTM C1136.

PART 3 - EXECUTION

3.01 GENERAL

A All insulation shall be installed in accordance with the manufacturer's recommendations and printed installation instructions, including high density inserts at all hangers and pipe supports to prevent compression of insulation.

B All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

C All heat recovery piping between air conditioning equipment and hydronic or domestic hot water piping shall be insulated per the High Temperature Surfaces Schedule below.

D All condenser water piping located in a ceiling plenum shall be insulated per the requirements for indoor chilled water piping as indicated in the Low Temperature Surfaces Schedule below.

E Pipes located outdoors or in tunnels shall be insulated same as concealed piping and shall have a jacket of 0.016 inch thick, smooth aluminum with longitudinal modified Pittsburg Z-Lock seam and 2 inch overlap. Jacketing shall be easily removed and replaced without damage. All insulation butt joints shall be sealed with gray silicone. Galvanized banding is not acceptable.

F All insulated piping located over driveways shall have an aluminum shield permanently banded over insulation to protect it from damage from car antennas.

G Provide all HVAC piping insulation to comply with the ASHRAE Std 90.1 I-P Minimum Thickness Schedule and as indicated below.

1. Minimum Insulation Thickness for Low Temperature Surfaces

    a. Condensate drain lines: 1 inch

3.02 FIRE RATED INSULATION

A All pipe penetrations through walls and concrete floors shall be fire rated by applying Owens Corning Thermafiber in the space between the concrete and the pipe.

B The penetration shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty.

C All fire rating material shall be insulated in accordance with manufacturer's printed instructions.

END OF SECTION 23 07 19

SECTION 23 09 63 - ENERGY MANAGEMENT AND CONTROL SYSTEM (EMCS)

PART 1 - GENERAL

1.01 GENERAL

A The Energy Management and Control System (EMCS) shall be comprised of a Local Area Network (LAN) infrastructure, Operator Workstations (OWS), Engineering Workstations (EWS), a Primary Network Server (PNS), Network Area Controllers (NAC), Application Specific Controllers (ASC), Unitary System Controllers (USC), and Field Devices installed within the facility. The EMCS Contractor shall provide a completely wired system. Wireless components and wireless communication are not acceptable.

B The Workstations, Primary Network Server, and Network Area Controllers shall be connected by a EMCS Contractor supplied and installed Local Area Network. The LAN shall comply with all IEEE Standards as outlined in the latest revision of IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

C If the EMCS contractor wishes to connect to the Owner's Wide Area/Local Area Network as part of the control system network, the EMCS contractor shall acquire permission in writing and include the letter in the submittal. Any system that requires connection to the owner's network for communication between NAC, ASC, USC and/or field devices that is submitted without the written permission from the owner shall be rejected. The EMCS Contractor shall coordinate with the Owner and supply all required information.

D Access to the system, either locally in the building, or remotely from a central site or sites, shall be accomplished through standard web browsers, via the Internet and/or a local area network.

E All EMCS controllers and workstations shall communicate using the protocols and network standards as defined by ASHRAE Std 135, latest revision. Management level TCP/IP Ethernet network speeds shall be 1 Gbps minimum and the Automation Level MS/TP network speeds shall be 76.8 Kbps minimum.

F The Server shall gather data from the system and generate HTML pages accessible through a conventional web browser from all personal computers (PCs) connected to the network. System shall include any and all software and hardware to support at least 50 simultaneous users. The EMCS shall be compatible with all common web browsers.

G Facility Operators shall be able to view and configure systems through the standard web browser and all graphical/data representations shall appear identical, whether the user is on site or viewing via the Internet at a remote location. Standard operator functions such as control point manipulation, configuration and viewing of trends, schedules and alarms shall be performed through the standard browser. Each mechanical system and building floor plan shall be depicted on the operator workstation by point-and-click graphics.

H The EMCS shall directly control HVAC equipment as specified in the Sequence of Operations. Furnish Energy Conservation features such as Optimal Start/Stop, Night Setback, Setpoint Reset logic, and Demand Control Ventilation.

I The EMCS vendor shall provide the following additional services as part of this specification: warranty and service during the warranty period; submittals, samples and record documentation; comprehensive startup and testing of the EMCS with documentation; training services for the owner and facility operators; coordination with other contractors and suppliers; operator and technician training program, and shall cooperate fully with the Project Commissioning Agent.

J Products furnished under this specification but installed by others.

1. Mechanical devices installed under Division 23 by the mechanical contractor or other suppliers:

    a. Temperature sensing thermowells.

    b. Automatic control valves and actuators.

    c. Pipe taps for flowmeters.

    d. Water pressure sensors and switches.

    e. Automatic control dampers and actuators not installed in air handling unit mixing boxes or louvers.

    f. Damper actuators for automatic control dampers installed in air handling unit mixing boxes.

    g. Damper actuators for variable air volume (VAV) terminal units.

    h. Mounting cost of controller and actuator for variable air volume (VAV) terminal units.

2. Electrical devices installed under Division 26 by the electrical contractor:

    a. 120 VAC power to controllers and control panels at locations indicated on the drawings. Review and verify that these locations are adequate for the proposed EMCS.

    b. Interlock wiring to duct mounted smoke detector or fire alarm shutdown relays to HVAC equipment motor starters and variable frequency drives (VFD).

K Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

1.02 RELATED DOCUMENTS & REFERENCES

A Drawings and general provisions of the contract documents, apply to this section including:

1. Division 01 for General Conditions and Supplementary Conditions.

2. Division 21 for fire protection equipment.

3. Division 22 for plumbing equipment and domestic water systems.

4. Division 23 for mechanical equipment, ductwork, and piping systems.

5. Division 26 for electrical equipment, lighting control, and fire alarm systems.

B The latest edition of the following standards and codes in effect as approved by the authority having jurisdiction and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

1. ANSI MC85.1 - Terminology for Automatic Control.
2. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
3. ASHRAE Std 135 - BACnet.
4. BTL Mark by the BACnet Testing Laboratories.
5. Uniform Building Code (UBC), including local amendments.
6. UL 916 - Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
7. NFPA 70, National Electrical Code (NEC).
8. FCC Part 15, Subpart J, Class A.
9. National Institute of Standards and Technology (NIST).
10. IEEE 802: Local and Metropolitan Networks: Overview and Architecture.

1.03 RELATED WORK IN OTHER SECTIONS

A Refer to Division 00 and Division 01 for allowances and related contractual requirements.

B Refer to Division 21 for General Fire Protection Provisions and fire suppression pump.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

C Refer to Division 22 for General Plumbing Provisions, domestic water heating systems, domestic water pumping systems, domestic water metering, and natural gas metering.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.
2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

D Refer to Division 23 for General Mechanical Provisions for equipment such as chillers, cooling towers, boilers, pumps, air-handling units, terminal units, ventilation fans, variable frequency drives, unitary AC units, etc.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

E Refer to Section 26 for General Electrical Provisions for equipment such as electrical switchgear control, electrical power monitoring, emergency generators, lighting control system, etc.

1. The EMCS contractor shall provide communications integration via BACnet/IP interface to each installed system listed above. BACnet MS/TP is acceptable if IP interface is not available from equipment manufacturer.

2. The EMCS contractor shall coordinate with all vendors providing above systems to obtain communications requirements and points lists. Map all available points to EMCS.

1.04 ELECTRICAL POWER PROVISIONS

A Primary power will be provided under Division 26 by the electrical contractor to the panel locations indicated on the mechanical & electrical drawings. Provide step down transformers within panel enclosures. Provide all necessary fuses and circuit protection devices.

B Power will be provided to the controllers serving fan powered terminal units with electric heat via the control transformer provided with the unit.

C All components of the EMCS shall be powered from the sources above. Provide final terminations from the locations indicated on the Division 23 Drawings.

D The EMCS Contractor shall provide any additional control power that is required as part of this contract and not indicated by other. This shall include all conduit, cabling, circuit breakers, etc.

1.05 CONTRACTOR QUALIFICATIONS

A The EMCS Contractor shall:

1. Have a local staff of trained personnel capable of giving instructions and providing routine and emergency maintenance on the EMCS, all components and software/firmware and all other elements of the EMCS.

2. Have a proven record of experience in the supply and installation of equivalent BACnet systems over a minimum period of five years. Provide documentation of at least three equal and complexity, if so requested by the Owner’s Representative.

3. Be a factory certified representative of the native BACnet EMCS manufacturer for design, installation, and service of the proposed system.

4. Have comprehensive local service, training and support facilities for the total EMCS as provided. Maintain local, supplies of essential expendable parts.

1.06 SUBMITTALS

A ALL DOCUMENTS SUBMITTED SHALL BE IN NATIVE PDF FORMAT. NO SCANS.

B Shop Drawings:

1. The following information shall be included on the cover page for each shop drawing and equipment documentation submittal:

   a. Project name with date. Refer to the applicable specifications by name and number.

   b. Provide submittal number and re-submittal number and date as applicable.

   c. Provided name and address of Consulting Engineer, Mechanical Contractor, General Contractor

2. Shop drawings shall be CAD generated, plot size of 8-1/2" x 11" or 11" x 17". Drawings shall include diagrams, mounting instructions, installation procedures, equipment details and software descriptions for all aspects of the system to be installed.

3. Provide schematic of systems indicating instrumentation locations, all interconnecting cables between supplied cabinets on a mechanical floor plan.

4. Software specifications and descriptions including operating sequences.

5. Provide a bill of material that indicates specific manufacturer, part number, part description and quantity of each device for all system components.

6. Provide a list of the wire labels to be installed on each end of the control wiring, at the device and the control panel terminal. Labels shall be machine generated, typed and legible with a maximum of 17 characters. The label description "AHU-1 SAT" shall indicate the supply air temperature of AHU-1.

7. Equipment Schematic: Provide an electronic equipment schematic for each piece of mechanical equipment. The schematic shall display all mechanical equipment characteristics including fans, dampers, valves, sensors and other applicable control devices. The schematic shall show wiring terminations to each control device as shown in the submittal and as-build documentation. Control devices shall be labeled by a symbol that can easily be identified in a bill of material that is shown on this graphic. The bill of material shall show the device symbol, description, manufacturer and part number.

8. Sequence of Operations: The control sequences shall be viewable for each piece of mechanical equipment and be in a text format as shown in the as built documentation. The sequence of operations shall be selectable at the applicable location for the control program.

C Control component submittals:

1. Component technical data sheets with mounting and installation details.

2. The documentation shall include comprehensive and complete details of the BIBB and automation level documentation including address, associated controller type, etc. as required and for the interface to the EMCS.

3. Details of networks/communications equipment, cabling and protocols proposed. Provide schedule of cabling including details of proposed cable types.

4. Module Drawing: Provide an electronic wiring diagram of each control module (as shown in submittal documentation). Diagram shall display wiring schematic and terminations to end devices. Diagram shall display each input and output terminals and label those that are used for the control application. Diagram shall display module type/name and network address.

5. Field sensor and instrumentation specification sheets. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.

6. Schedule and specification sheets for dampers, valves and actuators.

7. Design and provide layout of all components of panel mounted control devices, terminal strips and power supplies.

D Colorgraphics: Provide sample layout of color graphic representations of the systems for review. The submittal shall indicate the quality of the graphic to be provided with the system with a sample of the specific control points to be included. Control points shall as a minimum include points indicated in the input/output summary, control schematic and primary controlling points defined in the sequences of operation. Provide a sample of a floor plan layout, typical AHU, terminal unit, outside air pretreatment unit, variable frequency drive, exhaust/supply fan, chiller plant and hot water plant. For control points to be provided by equipment BACnet integration provide sample of the control points, up to 25 total.

E Verification Reports: The submittal shall include a sample of the verification reports to be utilized during the verification section of this specification. Sample reports shall be approved as submitted or be modified by the engineer or owner's representative. The verification reports shall be included in the final Operation & Maintenance Manuals. Reports shall be provided in electronic PDF format.

1. Project Systems Verification Form for each controller.

a. General information for each form shall include: project name; associated equipment with mark number; control panel number and location; controller number and model number; controller device instance number (address); MS/TP LAN segment number; verifying technician and date.

b. Each connected control point and device shall contain the following columns with a separate line for each connected physical point: point description (same as device label); input/output number for each connected control device (AI-XX, AO-XX, DI-XX, or DO-XX).

c. Check boxes confirming that the verification tasks have been completed: device location, proper termination at device; proper termination at control panel; sequence is verified; point trend is enabled.

d. Data entry boxes indicating measured/confirmed values: preliminary control point value on the graphic; observed control point value; calibration or adjustment value to correct offset; final displayed point value on the color-graphic; date of verification; engineer or owner's representative verification.

2. Control Panel Verification Form for each control panel.

a. General information: panel location and identification number; panel dimensions and NEMA rating; panel properly installed; Class 1 and Class 2 wiring are properly separated; correct voltage to the panel; no shorts or grounds in panel; no induce voltages in panel wiring; point to point termination match submittal; devices are mounted in the correct location; controller software revision number; address of controllers; panel device checkout is complete; panel startup is complete.

3. Sequence of Operation Verification Form per piece of equipment (AHU, VAV, chiller, boiler, etc.).

a. General information: project name; system identifier; building area served; control panel and controller numbers; controller model number and instance number (address); MS/TP LAN segment number; name of verifying technician and date.

b. Each step of the sequence of operation for each piece of equipment shall be documented shall include a "description of test", "input to trigger test" and "expected outcome". A pass/fail checkbox shall indicate each of these actions. Provide space for technician approval with associated date.

F Operating and Maintenance (O&M) manuals: Provide O&M manual with full information to allow the owner to operate, maintain and repair installed products. Include trade names with model numbers, color, dimensions and other physical characteristics.

1. Format: Produce on 8-1/2 x 11-inch pages, and bind in 3-ring/binders with durable plastic covers. Label binder covers with printed title "OPERATION AND MAINTENANCE MANUAL", title of project, and subject matter and "Number _ of _" of binder. Provide substantial dividers tabbed and titled by section/component number.

2. Table of Contents for each volume:

    a. Part 1: Directory with name, address and telephone number of Designer, Contractor and Subcontractors and Suppliers for each Project Manual section.

    b. Part 2: Operation and maintenance instructions, arranged by Project Manual Section number where practical and where not, by system. Include:

3. Product design criteria, functions, normal operating characteristic and limiting conditions. Installation, alignment, adjustment, checking instructions and troubleshooting guide. Operating instructions for start-up, normal operation, regulation and control, normal shutdown and emergency shutdown. Test data and performance curves.

4. Spare parts list for operating products, prepared by manufacturers including detailed drawings giving location of each maintainable part, lists of spares recommended for user- service inventory and nearest source of in-stock spares.

G Record Documentation:

1. Details of all alarm, diagnostic, error and other messages. Detail the Operator action to be taken for each instance.

2. Detail special programs provided and provide a complete programming instruction manual. Detail operation of all software applications.

3. Detailed list of the database for all installed devices.

4. Record drawings shall be CAD generated and shall include final locations and point ID for each monitored and controlled device.

5. In additional to the required hard-copies, provide a CD-ROM with all of the record documentation in PDF format and a CD-ROM containing backup copies of all installed software and graphics.

6. Online as-built documentation: provide digital replications of as-builts that shall be accessible from each equipment graphic controlled or monitored by the EMCS.

1.07 WARRANTY

A Warranty work and the equipment provided under this contract shall be for a period of one year from the date of Substantial Completion. Warranty shall cover all components, system software, parts and assemblies supplied by this contractor and shall be guaranteed against defects in materials and workmanship for one (1) year from the date of Substantial Completion. Labor to troubleshoot, repair, reprogram or replace system components that have failed due to defects in materials and workmanship shall be provided by this contractor at no charge to the owner during the warranty period. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks. All warranty work shall be performed by the EMCS contractor's local service group.

B Warranty shall not include routine maintenance, e.g., equipment cleaning, mechanical parts lubrication, pilot lamp replacement, operational testing, etc. Warranty shall not cover repair or replacement of equipment damaged by under- or over-voltage, misuse, lack of proper maintenance, lightning, water damage from weather or piping failure.

C Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the EMCS contractor. The maximum acceptable response time to provide this service at the site shall be 24 hours, during normal working hours.

1.08 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions
5. Most likely failure modes, causes and corrections.
6. On site demonstration that includes hands-on demonstration of the manipulation of setpoints, schedules and other adjustable elements of the system.
7. The demonstration shall be on the actual, completed graphic interface pages for the specific project.

B Provide a second training session 3 months after initial session for any follow-up or additional training requested by owner's personnel. Allow 3 hours for the second training session.

1.09 OPERATOR WORKSTATION (OWS)

A The Operator Workstation shall be any personal computer, connected to the LAN, with appropriate web browser software installed.

1.10 ENGINEERING WORKSTATION (EWS)

A The Engineering Workstation shall be any personal computer, connected to the LAN, with a registered copy of the EMCS contractor supplied engineering and/or programming software installed. The EMCS contractor shall provide at least one copy of all required software(s), to enable the Owner complete editing/programming functions of all controllers, graphics, and control logic.

B The EMCS shall provide one personal computer (PC) which is compatible with the performance required by the EMCS Engineering Software if an engineering workstation is specified for the system.

PART 2 - PRODUCTS

2.01 ACCEPTABLE EMCS VENDORS

A ALERTON - Climatec

B AUTOMATED LOGIC - Branch Office

C SIEMENS - Digital Air Control, Inc.

D JOHNSON CONTROLS - Branch Office

E RELIABLE CONTROLS - Unify Energy Solutions - Enviromatic

F TRANE - Branch Office

G DELTA - Team Solutions

H DISTECH - Tekplan Solutions - Climatec

2.02 PRIMARY NETWORK SERVER (PNS)

A The EMCS Contractor shall provide and install the Primary Network Server as part of this system. The PNS shall utilize the Internet and provide efficient integration of standard open protocols. The PNS shall maintain comprehensive database management, alarm management and messaging services, and graphical user interface as follows:

1. Support an unlimited number of users over the Internet/intranet with a standard web browser to access alarms, trend logs, graphics, schedules and configuration data. Access to the PNS shall be password protected utilizing authentication and encryption techniques. An audit trail of database changes indicating user, time stamp, and audit action shall be provided.

2. Enterprise level information exchange using an SQL database and HTTP/HTML/XML text formats.

3. Synchronize controller databases, database storage scheduling, control and energy management routines

4. Alarm processing and routing which includes email, SMS text messages and paging.

5. HTML based help system that includes comprehensive online system documentation.

6. Support of multiple Network Area Controllers (NAC) connected to a Local Area Network.

B Server Functions

1. It shall be possible to access all Network Area Controllers (NAC) via a single connection to the server through the Ethernet LAN. In this configuration, each Network Area Controller can be accessed from a single user login.

2. The PNS shall provide the following functions, at a minimum:

    a. The server shall provide complete access to distributed global data. The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.

    b. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.

    c. The server shall provide scheduling for all NACs and their underlying field control devices.

    d. The server shall provide demand limiting control that operates across all NACs. The network server shall be capable of multiple demand limiting programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

    e. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs. Each Network Area Controller supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.

    f. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include: routing of alarms to a video display, a printer, an email and pager; view and acknowledge alarms; query alarm logs based on user-defined parameters

    g. The server shall provide central management of logged data for all NACs supported by the server. Logged data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: viewing and printing log data; exporting log data to other software applications; query log data based on user-defined parameters

3. The Primary Network Server shall be capable of supporting the following open system drivers;

    a. BACnet/IP

    b. Modbus TCP

C Network Server Platform Requirements

1. Rack-Mounted Server Computer Hardware: DELL PowerEdge R220 or equal, Intel Xeon Gold 3.0 GHz or higher, 32GB RAM, 2 TB hard drive, video card, 22" color monitor, and Ethernet adapter 1Gbps or higher.

2. Operating system software shall be Microsoft Windows® 10 Professional or higher.

2.03 NETWORK AREA CONTROLLER (NAC)

A Provide one or more Network Area Controllers (NAC) to meet the sequence of operations and the type and quantity of devices being integrated into the system. The NAC shall provide the interface between the local area network and the field controllers. The NAC shall provide global supervisory control functions over the associated controllers and shall be capable of executing application control programs to provide: calendar functions; scheduling; trending; alarm monitoring and routing; time synchronization; integration of controller data for each applicable protocol; network management functions for all network devices. The user may view real-time information via web-based data.

B The Network Area Controller shall provide the following hardware features as a minimum: Ethernet Ports 100Mbps or higher, BACnet MS/TP ports, battery backup, DDR RAM memory, flash memory for long term data backup.

C Provide an uninterruptible power source (UPS) per network controller to maintain operation for 1 hours.

D The NAC shall be capable of operation over a temperature range of 32 to 122 °F and operation over a humidity range of 5 to 95% RH, non-condensing; storage temperatures of between 32 and 158 °F.

E The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

F The NAC shall be capable of supporting the following open system drivers;

1. BACnet/IP

2. BACnet MS/TP

3. Modbus TCP

4. Modbus RTU

G Event Alarm Notification and actions: The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers. Alarm conditions shall be routed to any defined user location whether connected to a local or wide-area network.

1. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to: alarm; return to normal; fault.

2. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc. Allow timed routing of alarms by class, object, group, or node.

3. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance (i.e. filter status, fan run status). Authorized users shall be able to reset runtime or event count values with appropriate password control.

4. Control equipment and network failures shall be treated as alarms and annunciated.

5. Alarms shall be annunciated in any of the following manners as defined by the user: screen message text; e-mail of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on: day of the week, time of day and recipient.

6. Color-graphic shall have flashing alarm object(s). Printed message may be routed directly to a dedicated alarm printer.

7. The following shall be recorded by the NAC for each alarm (at a minimum): time and date; location (building, floor, zone, office number, etc.); associated equipment. Upon acknowledgement of the alarm the NAC shall document the time, date and authorized user. The number of alarm occurrences since the last acknowledgement shall be recorded.

8. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user. Alarm actions may be initiated by user defined programmable objects created for that purpose.

9. Alarm archiving: A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user. Provide a "query" feature to allow review of specific alarms by user defined parameters. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

H Data Collection and Storage: The NAC shall have the ability to collect data for any property of any object and store this data for future use.

1. The user shall designate the log as an interval log or deviation log. For an interval log, the object shall be configured for time of day, day of week and the sample collection interval. For deviation log, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

2. All log data shall be stored in a relational database in the NAC and the data shall be accessed from the server or a standard web browser. All log data, when accessed from the server, shall be capable of being manipulated using standard SQL statements.

3. All log data shall be available to the user in the following data formats: HTML, XML, plain text, comma separated values, as a minimum.

4. The NAC shall have the ability to archive its log data either locally or remotely to the server or other NAC on the network.

I Local Access: The NAC shall provide redundancy of system access to the local controllers at the remote building if the Primary Network Server should lose communication or be off-line. The NAC shall maintain setpoint and scheduling features, access to the color-graphic displays, maintain trend logs and reports. Upon restoration of communication with the PNS the archived information shall be transmitted to the server for archiving.

2.04 SOFTWARE FOR THE NAC

A The distributed architecture of the operating system for the PNS and NACs shall provide the operator a comprehensive interface to allow the operator to configure and customize the EMCS to optimize the HVAC system to save energy, schedule and maintain equipment and provide occupant comfort. The provided graphical toolset shall allow the operator to create applications in a drag and drop environment.

1. Input/output capability shall allow the operator to request the current value or status of the control point; command/override equipment to a specific state; add, change or delete control points, alarm limits and controllers; change descriptors to control points and equipment; modify parameters; create or modify DDC loops.

B Operator System Access: Via software password with five access levels at workstations and at each control unit.

C Color graphic tools shall allow the user to create equipment and floor plan graphics from a standard library of symbols; allow custom generation of symbols; utilize over 64 or more colors; create real-time dynamic data for the graphics. Up to 60 control points may be displayed on each graphic.

1. Provide a link between compatible graphics to minimize the paths to additional information. For example, provide the link from the zone sensor to the VAV terminal to the air handling unit and to the central plant. Web pages shall be provided to allow the operator to zoom into specific areas of the facility and then link the space to the floor plan to the overall building and then to the facility site plan.

2. Graphical tools shall allow the creation of bar graphs, pie graphs and other tools to visualize control information such as run time hours, energy consumed and occupant comfort.

D Alarm processing tools shall allow the operator to create alarm messages that include as a minimum: time of alarm, point descriptor, alarm condition and remote annunciation. Critical alarms shall be displayed, archived to a storage device or printed on a alarm printer. Alarms shall be displayed in order of occurrence and have an optional audible alarm indicator.

1. Print alarm messages, up to 60 characters in length, for each alarm point specified.

2. Alarms may be routed to other devices including web-enabled cell phones, pagers, tablet PCs and designated personal computers on the network or Internet.

3. Operator specifies when alarm requires acknowledgment. Continue to indicate unacknowledged alarms after return to normal. An alarm log shall be maintained to archive alarms for future reference with the above specified parameters as well as indicating the person acknowledging the alarm.

4. The graphical display shall indicate the number of the current unacknowledged alarms by individual building site or by sum of all campus-wide facilities.

5. The operator may create and forward an e-mail message to another user directly from the graphical interface so that the message can be read when the second user logs on to the system.

E Upon a power failure to equipment in the facility, the EMCS shall automatically start equipment upon the restoration of power. Program a time delay between individual equipment restart on a schedule to minimize demand charges from the utility company.

F Custom reports may be created by the operator with a requested time and date manually or automatically. All reports may be logged to a storage device for future reference. The data reports shall allow customization and scaling of the X-Y coordinates; plotting of tabular reports; provide multi-point graphical reports with not less than eight variables on the same report. Print reports on daily, weekly, monthly, yearly or scheduled basis as scheduled.

G The network server current operating system, database, color-graphics, custom reports shall be backed up automatically to a remote server or storage device as directed by the owner's representative.

H Maintenance Management capability shall allow the system to monitor and log the run-time for HVAC equipment; schedule maintenance reports that include recommended material and labor for the assigned task.

2.05 APPLICATION SPECIFIC CONTROLLERS (ASC)

A All devices required for single loop control shall be terminated on a single controller. (for example, CHW loop pressure control. The differential pressure sensor and the pump VFD ramp signal.)

B ASCs shall be capable of implementing control strategies for the system based on information from any or all connected inputs. The AC shall utilize factory pre-programmed global strategies that may be modified by field personnel on-site. Global control algorithms and automated control functions should execute via a 32-bit processor

C Programming shall be object-oriented using control program blocks that will support a minimum of 500 Analog Values and 500 Binary Values. Analog and binary values shall support standard BACnet priority arrays. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing.

D Controller shall have adequate data storage to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1 year (cumulative). Battery shall be a field-replaceable (non-rechargeable) lithium type. The onboard, battery-backed real time clock must support schedule operations and trend logs.

E The base unit of the ASC shall host various I/O combinations including universal inputs, binary outputs, and switch selectable analog outputs (0-10V or 0-20 mA). Inputs shall support thermistors, 0-5VDC, 0-10VDC, 4-20mA, dry contacts and pulse inputs directly.

F All binary outputs shall have onboard Hand-Off-Auto switches and a status indicator light. HOA switch position shall be monitored. The position of each HOA switch shall be available system wide as a BACnet object.

G Controller shall be capable of BACnet communication. BACnet Conformance:

1. Standard BACnet object types supported shall include as a minimum: Analog Input, Binary Input, Analog Output, Binary Output, Analog Value, Binary Value, Device, File, Group, Event Enrollment, Notification Class, Program and Schedule object types. All necessary tools shall be supplied for working with proprietary information.

H Schedules: Each ASC shall support a minimum of 10 BACnet schedule objects.

I Logging Capabilities: Each controller shall support a minimum of 100 trend logs. Sample time interval shall be adjustable at the operator's workstation. Controller shall periodically upload trended data to system server for long term archiving if desired. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.

J Alarm Generation: Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures. Alarm logs shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications. Controller must be able to handle up to 200 alarm setups stored as BACnet event enrollment objects -system destination and actions individually configurable.

2.06 UNITARY SYSTEM CONTROLLERS (USC)

A All devices required for single loop control shall be terminated on a single controller. (for example, cooling coil control valve control. The temperature sensor and the valve control signal.)

B The EMCS Contractor shall provide all Unitary System Controllers. USCs shall be fully programmable or applications specific controllers with pre-packaged operating sequences maintained in Flash RAM.

C The USC shall be a node on the automation network and shall control its own communications so that the failure of any one node, shall not inhibit communications on the network between the remaining nodes. USCs shall be totally independent of other network nodes for their monitoring and control functions.

D Provide each USC with a battery back-up for the protection of volatile memory for a minimum of 72 hours. Batteries shall be rated for a seven-year life.

E All associated applications programs shall reside at the USC. The USC shall not require communication to any other panel for normal operating sequences other than time scheduled base commands.

F Control shall be based on algorithms, i.e. proportional plus integral plus derivative (PID), proportional plus integral (PI), or proportional to comply with the sequences of operation PID algorithms shall maintain the system operation within +/- 2% of setpoint.

G The USC shall be configured with sufficient input/output capacity to achieve the required control points to meet the sequence of operations.

2.07 VAV TERMINAL UNIT CONTROLLER (TUC)

A All devices required for single loop control shall be terminated on a single controller. (for example, terminal unit air valve control. The flow sensor and the actuator control signal.)

B The EMCS Contractor shall provide all controllers required for all variable air volume (VAV) terminal units. The number and location of terminal units and airflow rates shall be as indicated on the mechanical drawings.

C The TUC shall be capable of monitoring and controlling the following parameters for VAV terminal units per the sequences of operation and input/output summary: space temperature; primary air flow rate; damper modulation; heating coil stage control, heating valve control, heating SCR control (as applicable); fan on/off control; supply air sensor; occupancy senor; carbon dioxide sensor or humidity sensor.

D Furnish primary damper actuators, for factory mounting, meeting the following requirements: direct shaft mounting; adequate torque, to properly operate the damper from fully open to fully closed without binding; locking “V” groove or similar means to prevent slippage between actuator and shaft.

E The EMCS Contractor shall field install the following components for each terminal unit: space temperature sensor; supply air temperature sensor; occupancy sensor, and carbon dioxide sensor as indicated on the Mechanical Drawings.

F The EMCS Contractor shall furnish to the terminal unit manufacturer the following components for factory installation and wiring for each terminal unit: VAV controller with integral differential pressure transducer and damper actuator.

G The terminal unit manufacturer may provide the following components for each terminal unit for interface and mounting of the TUC: primary air dampers; enclosure to house the TUC and associated components including suitable mounting brackets shall be NEMA 1 rating and located outside the terminal unit; multi-point averaging type flow sensor at the primary air inlet to the terminal unit; 24 VAC control transformer; 24 VAC fan control relay interface; 24 VAC heater control relay interface (up to two stages); 24 volt SCR heater input as scheduled (0-10 Vdc or 4-20 mA).

H Any items required for proper operation but not provided by TU vendor, shall be provided under this section.

2.08 AIR HANDLING UNIT CONTROLLER

A All devices required for single loop control shall be terminated on a single controller. (for example, AHU static pressure control. The differential pressure sensor and the VFD ramp signal.)

B The EMCS Contractor shall provide controllers required for chilled/hot water and DX/electric heat air handling units and fan coil units. Provide an enclosure to house the controller and associated components including suitable mounting brackets shall be NEMA 1 rated and located outside the FCUs.

C The controller shall be capable of monitoring and controlling the following parameters per the sequences of operation and input/output summary; space temperature; space relative humidity sensor; cooling/heating stage control or modulating valve control; fan on/off control and status; supply air sensor; occupancy sensor; carbon dioxide sensor; VFD control and monitoring.

2.09 EMCS CONTROLLER LEVEL NETWORK

A EMCS Automation Level Network shall consist of BACnet MS/TP (76.8 Kbps minimum). Data transfer rate and data throughput as required to meet the alarm annunciation requirements.

2.10 SOFTWARE OVERVIEW

A Dynamic Colored Floor plans: Dynamic colored floor plans that compare actual space conditions to setpoints shall be provided on all floorplan graphics displayed on the front-end. Floorplan enlargements shall also use the thermographs to display space conditions. Zones within the set point range shall appear transparent white. As the space gets warmer the zone color shall gradually modulate from transparent white to transparent red to identify a hot zone. As the space conditions get cooler the zone color shall gradually modulate from transparent white to transparent blue to identify a cold zone. Each zone shall indicate the current actual zone temperature within the zone. The floor plans shall use a dynamic scheduling icon to indicate schedule occupancy for each zone and provide direct one-click access to that zones unique schedule. Provide a designated icon or symbol indicating that the zone is in the occupied/unoccupied condition. From the floorplan graphic, the operator shall be able to click on any zone and go directly to the graphic for the piece of equipment controlling that zone. All dynamic floor plans shall be visible via web interface as well as on the LAN. The authorized system operator shall be able to change the zone or system identifier (or name) on the graphic and that change shall be distributed to other associated graphics and to the equipment controller.

B Pop up Trends: Provide trend logs that automatically pop up when the operator mouse clicks on the point from the graphic. Provide pop up trends for all dampers, control valves, temperature sensors, carbon dioxide sensors, humidity sensors, airflows, static pressures, flow meters, VFD speeds, etc. The EMCS contractor shall set up all trends for the owner. The pop-up trend shall include a trend tool that allows the operator to modify the trend time scale and sample interval for up to 10 sample values. The trends shall be graphical on the computer screen but shall provide an output as an .xls, .csv, .pdf, HTML, or text file.

C Interactive Maps: Implement JAVA SCRIPT API 3.0 or newer, such as Google Interactive maps depicting the facility location to indicate the site plan. This is not a static image and must be completely interactive.

D Custom User HTML applications: The EMCS shall utilize HTML applications as an extra feature. At minimum, provide 7-day forecast, weather radar, traffic map and hurricane tracker. All of these features shall be imbedded into the EMCS system.

E Provided a web-based EMCS platform; contractor shall provide an Open License software. Licenses that are not open are not acceptable. There shall be no per seat or per user licensing fee charged to the owner by the contractor.

F System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. Schedules, setpoints, trends, and alarms shall be BACnet Objects.

G User access shall include 50 assigned operators that shall include five levels of access within the web system. Each operator log-in shall have an expiration date to allow for temporary access to the system. The operator's access description shall include his e-mail address and cell/phone numbers. The operator access can be limited from 5 minutes to permanent access. The user shall be limited to eight bad login attempts before being locked out of the system.

H Global modification: Provide the capability for global modification of user definable parameters of all points shall be provided. Global modification is defined as the mass adjustment of user definable parameters across a defined group, area, facility, campus, or network. Parameters shall include, but not be limited to temperature set point (VAV boxes, AHU Discharge, VAV AHU Static Pressure Setpoints etc.), equipment start/stop, equipment status, valve output signal, VFD speed control signal, and damper position signal. User shall be able to lock the definable parameter to a set value, or adjust a set point to an operator adjustable value. This function shall be accomplished through the standard graphical user interface/workstation and is to be selectively applicable by the user to all controllers on the network, all controllers in a specific facility or all controllers in a specific zone within a specific facility.

I The system operator shall be able to override the output signal to the valves, dampers, variable frequency drives, etc. with the use of the PC mouse click on the device. The system override shall include a Hand-Off-Auto (HOA) capability. If the output is commanded to the hand position the operator shall designate an output value of 0-100% in 1% increments. The hand override position shall be permanent or expire after a designated time period and revert to the auto position. The color-graphic shall indicate the device that has been overridden by a color change of the output value.

J For non-emergency in-warranty events the system operator may submit a Service Request directly from the floor plan or system graphic. The web interface shall include the EMCS suppliers contact information including phone numbers and e-mail address. The service request will be logged into the EMCS suppliers service department. A non-response by the assigned technician shall elevate the request to the next highest manager or supervisor until the system operator receives an response that their request has been received and is scheduled for a resolution. All requests for service shall be maintained in the customer's database for future reference. The service request capability may be extended after the expiration of the warranty as part of a service agreement.

K The web-based system shall be accessible from Tablet PCs and provide the same functionality that is available from personal computers connected through the LAN or WAN to the system operator. The tablet PCs as a minimum shall include an Apple iPad and Google Android based tablet PC. Operation shall include touch screen capability and use of the tablet keyboard screen. The operator shall be able to view color-graphics, system trends, override setpoints, change time schedules, and override damper and valve positions.

2.11 ENERGY SAVING PROGRAMS

A Demand Limiting: Demand limiting programming and sequence shall include, but not be limited to the following:

1. Monitor total power consumption for each power meter and shed associated loads automatically to reduce power consumption to an operator set maximum demand level.

2. Integrate with lighting controls to reduce lighting power to an operator set maximum demand level.

3. Provide a means from the graphical user interface for the system operator to manually initiate or disable the demand limiting sequence.

4. Provide programming that will allow a demand response signal from an approved entity (electrical service provider) to remotely initiate or disable the demand limiting sequence.

5. Provide programming that will initiate demand limiting according to a schedule.

6. When demand limiting is initiated, the EMCS shall:

    a. Increase the space cooling temperature setpoint by 4 degrees F (adj), above the current operating setpoint. The rate of change for the temperature setpoint increase shall be operator adjustable.

b. Decrease the space heating temperature setpoint by 4 degrees F (adj), below the current operating setpoint. The rate of change for the temperature setpoint decrease shall be operator adjustable.

c. Automatically reduce lighting power on the circuits indicated on construction documents.

7. When demand limiting is disabled, the EMCS shall reset temperature setpoints and lighting power levels back to original operating setpoints.

8. Demand limiting shall be confined to “non-critical” zones. For purposes of planning, assume all zones are “non-critical” unless otherwise noted on the construction documents. All zones shall have the option to be added or removed from the demand limiting program, by the system operator.

9. The EMCS shall include a graphic "page" that shows all adjusted setpoints (original setpoints and demand limited setpoints) and the power meters being monitored to confirm the programming is operational and effective at shedding the associated loads.

B Duty Cycling: Periodically stop and start loads, based on space temperature, and according to various on/off patterns.

C Automatic Time Scheduling: Self-contained programs for automatic start/stop/scheduling of building loads. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary schedules.

D Optimal Start/Stop: Perform optimized start/stop as function of outside conditions, inside conditions, or both. Optimization shall be adaptive and self-tuning, adjusting to changing conditions by modifying occupancy period based upon the desired temperature at beginning and end of the occupancy period. Base optimization on occupancy schedules, outside air temperature, seasonal requirements, and interior room temperature. Employ adaptive model prediction for how long building takes to warm up or cool down under different conditions.

E Night-Setback Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours in conjunction with scheduled start/stop and optimum start/stop programs.

F Setpoint Reset: Setpoints for control of variable load systems shall be reset based on load demand, as described in the Sequence of Operations.

G Calculated Points: Define calculations and totals computed from monitored points (analog/digital points), constants, or other calculated points.

H Event Initiated Programming: Any data point capable of initiating event, causing series of controls in a sequence.

I Holiday Scheduling

J Direct Digital Control: Furnish software so operator is capable of customizing control strategies and sequences of operation by defining appropriate control loop algorithms and choosing optimum loop parameters.

K Trend logging shall be provided for all points per the input/output summary where there is a change in the analog or binary signal. Each controller shall be capable of storing trend values and then automatically transfer data to the NAC or the NS hard disk. Trend data shall be updated continuously per the operator assigned interval at intervals as low as one minute. Collect samples at intervals specified in minutes, hours, days, or month. Output trend logs as line-graphs or bar graphs. Binary points (input and output) shall only be logged upon a change of value (COV). Display trend samples on workstation in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time versus data.

2.12 FIELD INSTRUMENTATION

A Temperature Sensors: All temperature sensors shall be thermistor type, factory-calibrated to within 0.5 °F, interchangeable with housing appropriate for application. Sensors shall have a temperature curve rated for the application. Sensor wiring terminations shall be in a galvanized box.

1. Outside air temperature sensors shall be installed in weather proof enclosure with ventilated sun-shied.

2. Duct mounted temperature sensors shall be averaging type for supply air, mixed air and low temperature applications for air handling units. Duct probe temperature sensor shall be acceptable for terminal units.

3. Space temperature sensors shall contain a backlit LCD digital display and user function keys along with temperature sensor, setpoint adjustment and after-hours override use. Override time may be set in one-hour increments.

4. Thermowell temperature sensors shall be stainless steel probe of length that is equivalent to a minimum of 50% of the pipe diameter. End-to-end accuracy shall be ± 0.5 deg. F. Connection box shall be moisture/water proof with conduit fitting. Furnish the stainless steel thermowell to the mechanical contractor for installation. A thermal conducting grease shall be installed in the thermowell to provide uniform temperature sensing.

5. Provide flat plate stainless steel space temperature sensors with no local setpoint adjustment as indicated on the drawings.

B Carbon Dioxide Sensors: The sensor shall be capable of monitoring carbon dioxide concentration with an accuracy of +/- 30 parts per million (PPM). The sensor shall produce a linear 0-10 VDC or 4-20 mA signal over the range of 0 to 2000 PPM. The sensor shall measure using non-dispersed infrared (NDIR) technology to measure carbon dioxide gas and shall be:

1. Wall mounted carbon dioxide sensors shall be Veris CWE series or equivalent.

2. Duct mounted carbon dioxide sensor shall be Veris CWD series or equivalent.

3. The EMCS contractor shall utilize the required calibration devices to properly commission and calibrate the sensors per the manufacturer’s requirements.

C Relative Humidity Sensors: relative humidity sensors shall be a two-wire type, 4-20 mA output proportional to the relative humidity range of 0-100%. The accuracy of the sensors shall be +/- 2% over a range of 10-90% RH.

1. Outdoor relative humidity sensors: provide non-corroding outdoor shield to minimize wind effects and solar heating. Install wall-mount weather proof enclosure with conduit fitting. Sensor shall be Veris HO series, or equivalent.

2. Wall-mounted relative humidity sensor: sensor shall be installed in a wall-mounted enclosure with white cover. Sensor shall be Veris HEW series or equivalent.

3. Duct-mounted relative humidity sensor: sensor shall be provided with a moisture resistant enclosure with conduit fitting. The probe length shall be 8" minimum. Sensor shall be Veris HED series or equivalent.

D Pressure Transducers:

1. Air pressure transducer: The pressure transducer shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 264 or equivalent. Air pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.

   a. Duct mounted pressure sensor shall be stainless steel and provided with mounting flange and hardware. The sensor probe length shall be appropriate for the associated duct dimensions.

   b. Wall mounted space pressure sensor shall include stainless steel wall plate, pressure pick up filter, and mounting hardware.

   c. Ceiling mounted space pressure sensor shall be paintable, low-profile type, with pressure pick up filter, integral surge dampener, and adhesive ring for ceiling mount.

   d. Outdoor pressure sensor shall include an outdoor rated sensor, 50 ft. of vinyl tubing, mounting bracket and hardware. A surge dampener shall also be provided for all outdoor pressure sensor applications to absorb pressure fluctuations.

2. Water pressure transducer: The pressure transducers shall have an input range compatible with the medium being measured. The proportional output signal shall be 0-10 VDC or 4-20 mA. The accuracy shall be +/- 0.25% FS. Transducer shall be SETRA Model 230 or equivalent. Transducer shall be installed with a valved piping bypass and bleed off for each port. Water pressure sensors and all associated tubing, hardware, and accessories shall be provided as appropriate for the application.

E Freezestat: Provide freezestats for all chilled water air handling systems that receive more than 10% untreated outside air. Freezestats shall provide vapor tension elements, which shall serpentine the inlet face on all coils. Provide additional sensors, wired in series, to provide one linear foot per square foot of coil surface area. Freezestat shall be manually reset at the switch. Interlock to the associated fan so that fan will shut down when HOA switch is in hand or auto position. Provide time delay relays with a 0-10 minute time delay relay duration to minimize nuisance freezestat trips. Time delay relay shall be adjustable at the associated control panel.

F Air differential pressure switch: For fan shutdown, provide air differential pressure switches for all fans controlled by a variable frequency drive (VFD) to shut down the associated fan in the event of sensing high differential pressure. Air differential pressure switches shall have an adjustable setpoint with a range of 0-10 inches w.g. with manual reset at the switch. Provide ¼ inch copper tubing with compression fittings to mount to the side of the duct. Sensor shall be DWYER Series 1900 or equivalent.

G Momentary control relays: Provide momentary control relays as indicated. Relays shall have coil ratings of 120 VAC, 50 mA or 10-30 VAC/VDC, 40 mA as suitable for the application. Contact ratings shall be 10 amp. Provide complete isolation between the control circuit and the digital output. Relays shall be located in the UC or other local enclosures and have pin-type terminals. Relays shall have LED indication of status.

H Current sensing relay: Current sensing relays shall be rated for the applicable load. The output relay shall have an accessible trip adjustment over its complete operating range. Enclosure shall have an LED to indicate relay status.

I Photocell: Ambient light level shall by a photocell in a non-corroding in a weatherproof housing with sun shield suitable for exterior installation. The control signal output shall be 4-20 ma or binary contact closure as specified in the sequences of operation. Mount the photocell on the north side of the building on the roof. The sensor reading shall be 0-750 foot-candles.

J Occupancy Sensors

1. Occupancy sensors shall be dual-technology, ceiling mounted type. Sensors shall be capable of detecting presence in the control area by via Doppler shifts in transmitted ultrasound and passive infrared (PIR) heat changes. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off. The sensor shall operate at 24 VDC/VAC. WattStopper DT-300 or approved equal.

2. Sensors shall have a time delay that is adjustable with configuration software or shall have a fixed time delay of 5 to 30 minutes, set by a DIP switch. Sensors shall feature a walk-through mode, where lights turn off 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.

3. The sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options. The sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.

2.13 HVAC VENTILATION SHUTDOWN SWITCH

A The HVAC ventilation shutdown switch shall be a mushroom type switch, STI Series 2000 Stopper Station that complies with the following:

1. Color shall be coordinated with the Owner prior to ordering.
2. Latches when depressed.
3. Twist to reset.
4. Indoor/Outdoor flush type clear plastic cover.
5. Switch label shall read "HVAC VENTILATION SHUTDOWN" or other label approved by the Owner. Coordinate final label text with the Owner prior to ordering.

B Coordinate final location of shutdown switch with the Mechanical Drawings, the Architect, and the Owner prior to installation.

2.14 NATURAL GAS FLOW METERS

A Inline Thermal Mass Flow Meters shall be provided for natural gas sub-metering applications where indicated on mechanical drawings or in control diagrams in piping larger than 3/4". Natural gas flow meters shall be separate from the natural gas meter provided by the utility company. The flow meter shall have a 316L stainless steel insertion probe, built-in flow conditioner, flanged or NPT connections to match adjoining piping system, and weather-tight NEMA 4X electronics enclosure with interface and display; +/- 2.0 % accuracy of actual reading from 100 to 500 SFPM and +/- 1.0 % accuracy of actual reading from 500 to 7,000 SFPM; pulse and analog outputs proportional to flow rate and native BACnet MS/TP. The unit of measurement output from the meter shall be field selectable. The flow meter shall be installed with a minimum straight pipe run upstream and downstream of the flow meter as indicated in the manufacturer's installation manual. Refer to meter manufacturer's installation manual for additional requirements. Meters shall be furnished by Division 23 and installed by Division 22. Meter shall be ONICON F-5500 series or pre-approved substitution.

2.15 AIRFLOW MEASURING STATIONS (AFMS)

A Duct mounted airflow measuring stations with combination airflow and air temperature measurement devices shall have the following features:

1. Multi-point sensors in one or more probe assemblies with a maximum of one to sixteen sensor nodes per location, and a single remotely mounted microprocessor-based transmitter for each measurement location. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. Each sensing point shall independently determine the airflow rate and temperature at each node, which shall be equally weighted in calculations by the transmitter prior to output as the cross-sectional average. Each ducted sensor probe shall have an integral, U.L. Listed, plenum rated cable. Each independent temperature sensor shall have a calibrated accuracy of +/-0.15° F (0.08° C) over the entire operating temperature range of -20° F to 160° F (-28.9° C to 71° C) and shall be calibrated at 3 temperatures against standards that are traceable to NIST. Acceptable manufacturer shall be EBTRON, Inc. GTx116-PC.

2. Each transmitter shall have a display capable of simultaneously displaying both airflow and temperature. Airflow rate shall be field configurable to be displayed as velocity or volumetric rates, selectable as IP or SI units. Each transmitter shall operate on 24 VAC and be fused and protected from over voltage, over current and power surges.

3. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of Reading over the entire calibrated airflow range of 0 to 5,000 fpm (25.4 m/s) and shall be wind tunnel calibrated at 16 points against air velocity standards that are traceable to NIST.

2.16 DAMPERS

A Provide motorized volume control and shutoff dampers as detailed in 23 33 00 - Ductwork Accessories.

2.17 DAMPER ACTUATORS

A Outside and exhaust air damper actuators shall be mechanical spring return. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.

B Outside and return air modulating actuators shall utilize analog (proportional) control 0-10 VDC. Actuators shall be driven in both the open and closed directions.

C Electric damper actuators shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.

D Single section dampers shall have one electronic actuator direct shaft mounted.

E Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section.

F Damper actuators shall be BELIMO or equivalent.

2.18 CONTROL VALVES

A Furnish all valves controlled by the EMCS as shown on the Mechanical Drawings. Furnish all automated isolation valves as shown on the Mechanical Drawings. Control valves shall be factory fabricated of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated. EMCS contractor to size control valve with a maximum of 3 psi pressure drop. 2-position isolation valves shall be full-line size.

1. All chilled water, condenser water, and hot water valves shall meet, at minimum, the following ANSI Class 150 ratings. Valves 0.5 inch to 2 inches shall have NPT female screwed ends. Valves 2.5 inches and larger shall have flanged ends.

2. Equal Percentage control characteristic shall be provided for all water coil control valves.

B Pressure Independent Characterized Control Ball Valves ½" to 6", for two-way modulating applications shall have equal percentage characteristics and control the flow from 0 to 100% full rated flow with an operating pressure differential range of 5 to 50 PSI across the valve. The pressure independent control valve shall be provided and delivered from a single manufacturer as a complete assembly. The actuator shall be integrally mounted to the valve at the factory with a single screw on a direct coupled DIN mounting-base. All valve actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow and/or temperature control. Programming using actuator mounted switches or multi-turn actuators are not acceptable. The control valves shall be sized for the scheduled flow and not pressure drop. Calibrated Balancing Valves and Automatic Flow-Control Valves shall be prohibited from use at coil circuit piping where pressure independent control valves are installed. Contractor shall provide a section of straight pipe five times the pipe diameter with respect to the nominal valve size upstream of the control valve assembly where utilizing integral flow sensor to guarantee sensor accuracy.

1. NPS 3/4" and Smaller: Belimo PIQCV or equal. Forged brass body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, characterizing disc integral to ball, PTFE ball seat, dual EPDM lubricated O-rings, and female NPT union ends. Close off pressure rating of 100 psi. Integral pressure regulator located upstream of ball to maintain a constant pressure differential. Replaceable cartridge type regulators are not permitted.

2. NPS 1" through 2": Belimo ePIV or equal. Forged brass, nickel-plated body rated at no less than 360 PSI, stainless steel ball and blowout-proof stem, PTFE ball seat, dual EPDM lubricated O-rings, stainless steel or TEFZEL characterizing disc, and female NPT union ends. Close off pressure rating of 200 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.

3. NPS 2-1/2" through 6": Belimo ePIV or equal. GG25 cast iron body according to ANSI 125, Class B, stainless steel ball and blowout-proof stem, PTFE ball seat, with a dual EPDM lubricated O-rings and a stainless steel flow characterizing disc. End connection pattern to match ANSI 125 flange. Close off pressure rating of 100 psi. Valve shall be integrated with an electronic (ultra-sonic or electromagnetic) flow sensor (accuracy +/- 2%) providing analog flow feedback. The valve shall reposition to maintain the required flow with a +/- 5% accuracy over a pressure differential range of 1 to 50 psi.

C Characterized Control Ball Valves (CCV) for ½' to 2": for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo or approved equal.

1. Valve housing shall consist of forged brass rated at no less than 400 psi at 250 °F. Three-way valves shall have EPDM O-rings behind ball seals to allow for a minimum close-off pressure of 40 psi with an actuator that provides 35 in-lbs torque for ½ to 2 in. sizes. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

D Globe Valves 2-1/2" to 6": for 3-way modulating applications shall have equal percentage characteristics. Manufacturer shall be Belimo G7 series or approved equal.

1. Valve housing shall consist of cast iron rated at no less than 125 psi at 300 °F. Valve shall have stainless steel stem, plug and seat. Three-way valves shall be installed in a "tee" configuration with actuator perpendicular to the shaft. Confirm mixing or diverting application for correct valve selection.

E Butterfly valves: For chiller and cooling tower isolation control valves, butterfly control valves may be provided.

1. Butterfly Isolation valves shall be line-size. Design velocity shall be less than 12 feet per second when used with standard EPDM seats. Butterfly valves shall have ductile iron body, 304 stainless steel disc and EPDM seat. The valve body close-off pressure rating shall be 150 psi over a range of -20 F to 250 F. The flange shall be ANSI 125/250. Belimo F6 and F7 series or approved manufacturer.

F Actuators for characterized control valves and globe valves: Provide electric actuators for all control valves that are furnished as part of the EMCS contract. Two-way and three- way control valve actuators shall meet, at minimum, the following requirements:

1. Motor driven type with gear assembly made of hardened steel. Actuator shall have an input voltage of 24 VAC. Provide visual mechanical position indication.

2. Actuators installed within the interior of the building envelope shall be provided with NEMA-2 rated housings.

3. Actuators installed exterior to the building envelope shall be provided with NEMA-4 rated housings or a weather shield. All penetrations through exterior actuator housings shall be provided with fittings that prevent water ingress.

4. Valves shall be sized to meet the shut-off requirements when operating at the maximum system differential pressure and with the installed system pump operating at shut-off head. Actuators shall control against system maximum working pressures.

5. Normal and failure positions shall be as indicated in the operating sequences. Provide spring return action per the sequences.

6. Manual declutch lever to enable manual operation of the valve. It shall be possible for an operator to manually modulate valves located in mechanical rooms in the event of loss of power.

7. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for butterfly valve actuators.

8. All actuators shall be capable of being electronically programmed in the field by use of external computer software or a dedicated handheld tool for the adjustment of flow. Programming using actuator mounted switches or multi-turn actuators are not acceptable.

9. Electric actuators shall be Belimo, compatible with the valves furnished.

G Butterfly Valve Industrial Actuators

1. Enclosure shall be NEMA 4 (weatherproof) enclosure and will have an industrial quality coating.

2. Actuator shall have a motor rated for continuous duty. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on a 120 VAC, 1 phase, 60 Hz supply. Two adjustable cam actuated end travel limit switches shall be provided to control direction of travel. A self-resetting thermal switch shall be imbedded in the motor for overload protection.

3. Reduction gearing shall be designed to withstand the actual motor stall torque. Gears shall be hardened alloy steel, permanently lubricated. A self-locking gear assembly or a brake shall be supplied.

4. Actuator shall have a 6 ft wiring harness provided for ease in field wiring (above 1500 in-lbs). Two adjustable SPDT cam-actuated auxiliary switches, rated at 250 VAC shall be provided for indication of open and closed position. Actuator shall have heater and thermostat to minimize condensation within the actuator housing.

5. Actuator shall be equipped with a hand wheel for manual override to permit operation of the valve in the event of electrical power failure or system malfunction. Hand wheel must be permanently attached to the actuator and when in manual operation electrical power to the actuator will be permanently interrupted. The hand wheel will not rotate while the actuator is electrically driven.

6. The actuator shall be analog, floating, or two position as called out in the control sequence of operation. All analog valves shall be positive positioning, and respond to a 2-10 VDC, 4-20 mA, or adjustable signal as required. Analog actuators shall have a digital control card allowing any voltage input for control and any DC voltage feedback signal for position indication.

7. Butterfly valve actuators shall be Belimo furnished with specified butterfly valves.

2.19 PANELS AND ENCLOSURES

A Provide panels and enclosures for all components of the EMCS, which are susceptible to physical or environmental damage.

B Interior panels and enclosures shall meet be NEMA 1 rated painted steel panels with locking door.

C Exterior mounted panels and enclosures shall be NEMA 4 painted steel panels with locking door.

D Panels for USCs shall be mounted on the outside of all unit ventilators and fan coil units with three feet of wall clearance in front of them and no higher than 7 feet to the bottom of the panel.

2.20 LABELING AND WARNING NOTICES

A Provide labeling for all control panels and enclosures.

B Provide labeling of all control wires and input/output points at the controller and at the control device; the label at each end of the wire shall be the same Labels shall be machine generated, typed and clearly legible with a maximum of 17 characters. Hand written labels or labels written on the control wire jacket will not be acceptable. Each label shall be unique to its function and shall reference the applicable system. For example “AHU-1 SAT” will indicate the supply air temperature sensor for AHU-1. Improper labeling shall be removed and shall require re-commissioning of the control device and controller to document correct functionality.

C Provide high voltage warning notices at all equipment controlled by the EMCS and at all associated motor starters when used by equipment controller.

2.21 TUBING AND PIPING

A Provide tubing and piping as required for the field instrumentation.

B Tubing within equipment rooms, vertical risers, and penetrations to ductwork shall be either copper pipe or shall be plastic tubing within conduit. Tubing for all water-based instrumentation shall be copper pipe. Identify the type of tubing proposed in the shop drawing submittal.

C Provide suitable bulk head fittings for duct and panel penetrations.

D Tubing in plenum rated areas may be plastic tubing. Polyethylene tubing shall meet, at minimum, the following requirements: flame retardant; crack resistant; 300 psi burst pressure.

2.22 CONDUIT AND FITTINGS

A Provide all conduits, raceways and fittings for the EMCS monitoring, communication and control cabling. All work shall meet all applicable codes.

B Conduit, where required, shall meet, the requirements specified within Division 26.

C EMCS monitoring and control cable shall not share conduit with cable carrying voltages in excess of 90 VAC.

2.23 CABLING

A Provide all cables for the EMCS. Cable shall meet, at minimum, the following requirements:

1. Minimum 98% conductivity stranded copper.
2. Proper impedance for the application as recommended by the EMCS component manufacturer.
3. Monitoring and control cable shall be #18 AWG or larger, dependent on the application. Analog input and output cabling shall be shielded.
4. Management Level Network cable shall be CAT 6, 24 gauge unshielded.
5. Automation Level Network cable shall be #24 AWG shielded.
6. Shield shall be grounded at the CCP, UC, or control panel. Ground at one end only to avoid ground loops.
7. Identification of each end at the termination point. Identification should be indicated on and correspond to the record drawings.

B 120 VAC power wiring shall be of #12 AWG solid conductor or larger as required.

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION

A The EMCS supplier shall provide a pre-construction coordination meeting with the affected trades to ensure a cooperative efficient process of installation. The invited trades shall include the general contractor, mechanical contractor, electrical contractor, test and balance contractor, commissioning provider, owner's representative, consulting engineer and others with a direct interest in the coordination of the affected systems. The EMCS contractor shall provide an outline of the meeting agenda highlighting the construction schedule, coordination with mechanical and electrical trades. Provide a sign-in sheet and submit it through the attendees along with a summary of the meeting notes for future reference.

3.02 INSPECTION DURING INSTALLATION

A Provide a technician to assist the Engineer or Owner's Representative with inspections made during the installation period that are required to review the progress and quality of ongoing work. The engineer/owner's representative shall generate field observation reports on the findings of the inspection. The engineer or owner's representative shall advise the EMCS contractor during the inspection of any concerns noted with respect to the installation and shall repeat the concerns in writing as soon as possible after the inspection is completed. The EMCS contractor shall take corrective action to meet the requirements of the specifications. Upon correction, the EMCS contractor shall submit written documentation through the contractors to the engineer.

3.03 INSTALLATION OF COMPONENTS

A Provide all interlock and control wiring. All wiring shall be installed in a neat and professional manner in accordance with specification Division 26 and all national, state and local electrical codes.

B Provide wire and wiring techniques recommended by equipment manufacturers. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the Owner's Representative prior to rough-in. Provide auxiliary pilot duty relays on motor starters as required for control function.

C Electrical Contractor shall provide 120 or 277 volt power at a junction box within 48" of the controller. The BAS Contractor shall coordinate with the Electrical Contractor to identify locations of power requirements prior to the installation of the controls.

D Conduit for control wiring shall be provided whenever one of the following conditions exists:

1. Conduit is indicated on the drawings or specifically required by the specifications.

2. Cabling runs through inaccessible areas such as within partitions/walls, above closed in ceilings, under floor; within trenches and underground; on the exterior of the building; exposed on the surface of the building; when encased in concrete or other material that makes the cable inaccessible or when located such that access to the cable is not readily obtained.

3. Cable within mechanical, telecommunications and electrical equipment rooms and control rooms.

4. Conduit shall be installed, inside wall from sensor box to above the wall, for all wall mounted temperature, humidity and CO2 sensors.

E Control wiring located above an accessible ceiling space may be plenum rated cable. Plenum rated wire shall be bundled and routed at right angles to the building lines and secured to the building structure every 15 feet.

F Control wiring located in underground conduits shall be provided with direct-burial-rated insulation.

G When communication bus enters or exits a building, a surge suppressor shall be installed. The surge suppressor shall be installed according to the controls manufacturer's instructions.

H Provide sleeves for all cable and conduit passing through walls, partitions, structural components, floors and roof.

I All sensor wiring shall be labeled to indicate the origination (at the device) and destination of data (at the control panel). The description shall indicate the type and location of the control device such as "AHU-1 SA temp" or "VAV 1-1 space temp".

J Wall temp sensors at 48" above the finished floor to comply with ADA requirements and to match the height of the light switches. Mount humidity sensor at equal height to wall temperature sensor.

K Outdoor pressure sensors shall be installed a minimum of five feet above the roof surface and shall be free of immediate obstructions and sources of turbulence that could affect pressure readings. Sensors shall be attached to the top of roof mounted equipment or provided with stand-alone vertical support if no roof mounted equipment is available. Sensor tubing shall be routed into the building through a sealed weathertight penetration. Provide a heat trap loop in the sensor tubing immediately below the roof.

3.04 VERIFICATION REQUIREMENTS

A Verification shall be provided by the EMCS contractor to demonstrate and confirm that the installed system complies with the specifications and the control sequences of operation herein specified. upon completion of the verification process the EMCS contractor shall demonstrate to the engineer or owner's representative the functionality of the control system devices are in compliance with the contract documents.

B Technicians provided by the EMCS contractor shall be factory trained and qualified in the operation of the provided control system. The EMCS contractor shall provide, if requested, the factory training certificates of the individuals providing the verification services on this project.

C Verification tools, applicable to the system provided, shall be utilized by the factory-trained technicians for proper verification of system operation and functionality. Temperature verification sensors shall be NIST certified within the last 12 months. Meters such as Fluke 52 series or better shall be utilized. Use of non-certified meters may require the system to be re-verified with certified meters at no cost to the owner.

D Documentation of the verification process shall be provided per the project general conditions in electronic PDF format as required. Documentation shall include the following forms:

1. Project System Verification Forms for each controller provided on the project to verify the proper function of each controller, control device and system component provided.

2. Panel Verification Forms for each control panel to document the proper installation and function of each control panel provided.

3. Sequence of Operation Verification Forms for each piece of controlled equipment to confirm compliance of the control system with the specified sequences of operation.

4. Not providing proper documentation for each control devices, panel, or system, upon request by the engineer or owner's representative, may require the EMCS contractor to re-verify the applicable systems at no additional cost to the owner.

E After completion of the verification, the EMCS contractor shall be able to demonstrate the sequence of operations for each system to the engineer and the owner's representative.

F Equipment checkout sheets are to be produced by this contractor showing checkboxes and compliance with the following procedures for each piece of equipment and turned over to the owner and/or mechanical engineer.

3.05 COLORGRAPHICS

A The colorgraphics shall be provided for the EMCS system prior to system acceptance and owner training.

B The colorgraphics provided shall include the following as a template. Provide forward and backward links on the graphic.

1. Site plan with link to overall building plan including detached buildings. The site plan shall be referenced to an automatically updated aerial view or map view of the area such as Google Maps or Bing Maps. Provide link to proceed to the overall building floor plan.

2. The overall building plan shall indicate space temperature conditions referenced by the color of the zone. Specific details of the zone temperatures and equipment are not required. Provide a link to the floor plan wings, upper floors and remote buildings.

3. The floor plan colorgraphics shall indicate the space temperatures by color references. Additional information shall indicate the space temperature, the occupancy of the zone, air handling units, VAV terminals and ductwork with diffusers. A link at each terminal unit or AHU shall automatically connect the system operator to the equipment colorgraphic.

4. The colorgraphics for the equipment shall as a minimum be equal to the points from the input/output summary or control schematic. Primary control devices as required by the sequences of operation shall also be provided.

5. Control points from equipment that are integrated into the EMCS via BACnet shall be provided to convey the operating conditions of the attached equipment. Coordination of the integration points shall be accomplished during the submittal phase. The EMCS contractor shall provide a list of all integrated points on their submittal.

3.06 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

A Startup testing documentation: Prepare the checklist documenting startup testing of each input and output device, with technician's initials and date certifying each device has been tested and calibrated prior to acceptance testing. This document shall indicate proof that the following functions have been commissioned and shall be included in the as-built documentation: short to ground check, configuration of trends, confirmation that color-graphics are accurately representing actual systems, point to point checkout, all damper and valve actuators respond to input change, control modules are addressed and have functional descriptors, specified interlocks are functional, calibration report of all sensors, discrete outputs respond to time schedule or manual enable command.

B Demonstration. Prior to acceptance, demonstrate the following performance tests to demonstrate system operation and compliance with specifications.

1. Engineer, owner’s representative and mechanical contractor shall be invited to observe and review system demonstration. Provide attendees at least 10 days notice.

2. Demonstration shall follow process approved as part of the submittal and shall include complete checklists and forms for each system as part of system demonstration.

3. Demonstrate actual field operation of each sequence of operation as specified. Demonstrate calibration and response of any input and output points requested by engineer or owner’s representative.

4. Demonstrate complete operation of operator interface including review of color-graphics, time schedules, trend logs, alarm notification, functionality of tablet PC operation.

    a. PID loop response. Supply graphical trend data output showing each PID loop's response to a set point change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be selectable from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show set point, actuator position, and controlled variable values.

    b. Demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30-minute period and shall show building kW, demand limiting setpoint, and status of set points and other affected equipment parameters.

    c. Trend logs for each system. Trend data shall indicate set points, operating points, valve positions, and other data as specified. Logs shall be accessible through system's operator interface and shall be retrievable for use in other software programs.

5. Alarms and Interlocks. Check each alarm with an appropriate signal at a value that will trip the alarm. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction. Alarm verification shall include temperatures exceeding alarm threshold (high and low), fan failure safety, duct high static pressure switch, freezestat, and smoke detector shutdown.

6. Tests that fail to demonstrate proper system operation to the engineer shall be repeated after contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.

C Owner Acceptance.

1. After tests described in this specification are performed to the satisfaction of both engineer and owner's representative, the engineer shall accept the control system as meeting completion requirements. Engineer may exempt tests from completion requirements that cannot be performed due to circumstances beyond EMCS contractor's control. Engineer shall provide written statement of each exempted test. Exempted tests shall be performed as part of warranty.

2. System shall not be accepted until completed demonstration forms and checklists are submitted and approved by the engineer.

3.07 DEMONSTRATION AND OWNER TRAINING

A Furnish basic operator training for multiple persons on data display, alarm and status descriptors, requesting data, execution commands and log requests. Include a minimum of 16 hours: 8 hours instructor time for onsite training and 8 hours of hands on class environment training. Training sessions may be provided in 4-hour increments as approved by the owner's representative.

1. Change/modify temperature setpoints.

2. Change/modify time of day, holiday and override schedules.

3. Display, create, and modify trends of system points.

4. Update room numbers on the color-graphics.

B Demonstrate complete and operating system to Owner. Provide written documentation listing the attendees of the specified training with sign-in sheet and training time and date.

3.08 SEQUENCE OF OPERATIONS

A Refer to the Mechanical Drawings for project control schematics and sequence of operations.

END OF SECTION 23 09 63

SECTION 23 21 13 - ABOVE GROUND HYDRONIC PIPING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Pipe and pipe fittings.

B Flanges, unions, dielectric connections, and couplings.

C Valves.

D Condensate drain piping.

1.03 RELATED WORK

A Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

B Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

C Section 23 05 53 - Identification for HVAC Piping and Equipment

D Section 23 07 19 - HVAC Piping Insulation

E Section 232116

1.04 REFERENCES

A ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

B ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

C ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings: DWV; 2021.

D ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings—DWV; 2022.

E ASME B31.1 - Power Piping; 2022.

F ASME B31.3 - Process Piping; 2022, with Errata (2023).

G ASME B31.9 - Building Services Piping; 2020.

H ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

I ASSE 1079 - Performance Requirements for Dielectric Pipe Unions; 2012.

J ASTM B32 - Standard Specification for Solder Metal; 2020.

K ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2020.

L ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2023.

M ASTM D1384 - Standard Test Method for Corrosion Test for Engine Coolants in Glassware; 2005.

N ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

O ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2019).

P ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

Q ANSI/AWWA C110 - Ductile-Iron and Gray-Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

R ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

S ASTM B32 - Solder Metal.

T ASTM B88 - Seamless Copper Water Tube.

1.05 QUALITY ASSURANCE

A Foreign made pipes and fittings will not be acceptable.

B Valves: Manufacturer's name and pressure rating marked on valve body.

C Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

D Welder’s Certification: In accordance with ASME BPVC-IX.

1.06 SUBMITTALS

A Submit product data under provisions of Division One.

B Include data on pipe materials, pipe fittings, valves, and accessories.

C Include welder’s certification of compliance with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

A Deliver products to site under provisions of Division One.

B Store and protect products under provisions of Division One.

C Deliver and store valves in shipping containers with labeling in place.

D Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

E Protect piping systems from entry of foreign materials by temporary covers, proper storage and dunnage, completing sections of the work, and isolating parts of completed system. Tape will not be allowed as an acceptable end cover.

PART 2 - PRODUCTS

2.01 EQUIPMENT DRAINS AND OVERFLOWS

A Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized.

1. Fittings: Galvanized cast iron, or ASME B16.3 malleable iron.

2. Joints: Threaded, or grooved mechanical couplings.

B Copper Drainage Tubing: ASTM B306, DWV.

1. Fittings: ASME B16.23 cast copper alloy solder joint DWV fittings or ASME B16.29 wrought copper alloy solder joint DWV fittings.

2. Joints: Soldered joints made in accordance with ASTM B828 using ASTM B32 Alloy Grade Sn50/Pb50 solder.

2.02 FLANGES, UNIONS, DIELECTRIC CONNECTIONS, AND COUPLINGS

A Pipe Size 2 Inches and Under: Provide 150 psi malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B Pipe Size Over 2 Inches: Provide 150 psi forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; 1/16 inch thick preformed neoprene bonded gasket.

C Dielectric connections for pipe sizes 2 inches and under: Provide dielectric unions, rated at 180°F at 250 psi in compliance with ASSE 1079.

D Dielectric connections for pipe sizes larger than 2 inches: Provide dielectric flanged pipe fittings, rated to 180°F at 175 psi in compliance with ASME B16.1.

E Grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods. All grooved components shall be of one manufacturer, and conform to local code approval and/or is listed by ASME B31.1, ASME B31.3, ASME B31.9, ASME, UL/ULC. FM, IAPMO or BOCA. Grooved end manufacturer to be ISO 9001 certified. Grooved couplings shall meet the requirements of ASTM F1476. Manufacturer shall be Victaulic, Anvil Gruvlok, or Shurjoint. Can be utilized only in mechanical rooms or cooling tower areas.

2.03 ACCEPTABLE MANUFACTURERS - VALVES

A Milwaukee

B Crane

C Nibco

D Apollo

E Bray

F Kitz

2.04 ACCEPTABLE MANUFACTURERS - VALVES (GROOVED ONLY)

A Victaulic

B Anvil Gruvlok

C Shurjoint

2.05 GATE VALVES

A Up to 2 Inches: Bronze body, bronze trim, rising stem, handwheel, inside screw, single wedge or disc, threaded ends.

B Over 2 Inches: Iron body, bronze trim, rising stem, handwheel, OS&Y, single wedge, flanged ends.

2.06 GLOBE VALVES

A Up to 2 Inches: Bronze body, bronze trim, rising stem and handwheel, inside screw, renewable stainless steel disc, threaded ends, with back seating capacity.

B Over 2 Inches: Iron body, bronze trim, rising stem, hand wheel, OS&Y, plug-type disc, flanged ends, renewable seat and disc.

2.07 BALL VALVES

A Up to 2 Inches: Bronze two-piece body, 600 PSI full port, stainless steel ball and stem, teflon seats and stuffing box ring, lever handle, and balancing stops, threaded ends.

B Over 2 Inches: Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, or gear drive hand wheel for sizes 10 inches (250 mm) and over, flanged.

C Ball valves installed in insulated lines shall have stem extensions compatible with up to 2" of insulation. Extensions shall be non-metallic equal to Nibco "nib-seal".

2.08 PLUG COCKS

A Up to 2 Inches: Bronze body, bronze tapered plug, non-lubricated, teflon packing, threaded ends, with one wrench operator for every ten plug cocks.

B Over 2 Inches: Cast iron body and plug, pressure lubricated, teflon packing, flanged ends, with wrench operator with set screw.

2.09 BUTTERFLY VALVES

A Iron body, aluminum bronze or stainless steel disc, resilient replaceable seat for service to 180 degrees F lug or grooved ends, extended neck, infinite position lever handle with memory stop. Valve shall be rated at full working pressure with downstream flange removed in either direction.

2.10 SWING CHECK VALVES

A Up to 2 Inches: Bronze 45 degree swing disc, threaded ends.

B Over 2 Inches Iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged or grooved ends.

2.11 SPRING LOADED CHECK VALVES

A Iron body, bronze trim, stainless steel spring, aluminum bronze disc, threaded, grooved, wafer or flanged ends.

2.12 RELIEF VALVES

A Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.

PART 3 - EXECUTION

3.01 PREPARATION

A Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B Remove scale and dirt on inside and outside before assembly.

C Prepare piping connections to equipment with flanges or unions.

D After completion, fill, clean, and treat systems.

E Provide extended necks for all vents, thermometer wells, pressure gauge wells, pet cocks and pete's plugs.

3.02 INSTALLATION

A Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.

B Install piping to conserve building space, and not interfere with use of space and other work.

C Group piping whenever practical at common elevations.

D Branch tap connections to piping mains shall be from the top of the pipe.

E Provide clearance for installation of insulation, and access to valves and fittings.

F Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08.

G Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

I Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09.

J Install valves with stems upright or horizontal, not inverted.

K All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer.

L Grooved manufacturer shall provide on-site training for contractor's field personnel by a factory trained representative in the proper use of grooving tools, application of groove, and the product installation. Factory trained representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

3.03 APPLICATION

A Use grooved mechanical couplings and fasteners only in mechanical rooms or cooling tower area.

B Install unions downstream of valves, and at equipment or apparatus connections.

C Provide non-conducting dielectric connections wherever joining dissimilar metals.

D Install brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.

E Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F Install plug valves for throttling, bypass, or manual flow control services.

G Provide spring loaded check valves on discharge of condenser and chilled water pumps.

H Use plug cocks for throttling service. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.

I Use only butterfly valves in condenser water systems for throttling and isolation service.

J Use lug end butterfly valves to isolate equipment.

K Provide chain operated butterfly valve for installations at 12 feet or higher.

L Provide 3/4-inch ball (drain) valves equal to Nibco T-585-70-HC at main shut-off valves, low points of piping, bases of vertical risers, and at equipment and pipe to nearest drain.

M Provide automatic air vents at all high points and air pockets in the system.

3.04 CONDENSATE DRAIN PIPING

A Drain piping from each unit shall be extended to the nearest floor drain or condensate drainage system. Drains shall be of the size indicated but not less than the full size of the drain pan connections.

B Use plugged tees in lieu of elbows.

C Slope all drain lines 1/8" per foot, minimum.

D Provide auxiliary drain pan on all AHU's above ceiling with auxiliary drain line routed to discharge in visually prominent area. Discharge location shall be coordinated with Architect.

3.05 PIPE FABRICATION AND INSTALLATION

A All pipes shall be cut accurately to measurements established at the site and shall be worked into place without springing or forcing.

B Piping layout and installation shall be made in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance from other work. Particular attention shall be given to piping in the vicinity of equipment; layout shall be made in such manner as to preserve maximum access to the various equipment parts for maintenance.

C All changes in directions shall be made with fittings; field bending and mitering of pipe is prohibited.

D Air vents and air chambers shall be installed as hereinafter specified.

3.06 OFFSETS AND FITTINGS

A Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, etc. which may be required. The Contractor shall carefully investigate structural and finish conditions affecting the Work, and shall take such steps as may be required to meet such conditions at no additional cost to the Owner.

B All piping shall be installed close to walls, ceilings and columns, (consistent with the proper space for covering, removal of pipe and special clearances), so as to occupy the minimum of space, and all offsets, fittings, etc., required shall be provided at no additional cost to the Owner.

3.07 SECURING AND SUPPORTING

A All piping shall be adequately supported to line and grade, with due provisions for expansion and contraction.

B Piping shall be supported on approved clevis type, split ring, or trapeze type hangers properly connected to the structural members of the building.

C All insulated piping shall be fitted with suitable steel protection saddles.

D Perforated bar hangers, straps, wire or chains will not be permitted.

3.08 ISOLATION VALVES

A All piping systems shall be provided with line size shut-off valves located at risers, at branch connections to mains, and at other locations as indicated and required.

3.09 TESTING OF PIPING SYSTEMS

A During the progress of the Work and upon completion, tests shall be made as specified herein and as required by Authorities Having Jurisdiction, including Inspectors, Owner or Engineer. The Engineer or duly authorized Construction Inspector shall be notified in writing at least 2 working days prior to each test or other Specification requirement which requires action on the part of the Construction Inspector.

B Tests shall be conducted as part of this Work and shall include all necessary instruments, equipment, apparatus, and service as required to perform the tests with qualified personnel. Submit proposed test procedures, recording forms, and test equipment for approval prior to the execution of testing.

C Tests shall be performed before piping of various systems have been covered or furred-in. For insulated piping systems, testing shall be accomplished prior to the application of any insulation.

D All piping systems shall be tested and proved absolutely tight for a period of not less than 24 hours at a pressure of 150 psi(g) or 150% of design pressure, whichever is greater. Tests shall be witnessed by the Engineer or an authorized representative and pronounced satisfactory before pressure is removed or any water drawn off.

E Leaks, damage or defects discovered or resulting from test shall be repaired or replaced to a like new condition. Leaking pipe joints, or defective pipe, shall be removed and replaced with acceptable materials. Test shall be repeated after repairs are completed and shall continue until such time as the entire test period expires without the discovery of any leaks, damage, or defects.

F Wherever conditions permit, each piping system shall thereafter be subjected to its normal operating pressure and temperature for a period of no less than five 5 days. During that period, it shall be kept under the most careful observation. The piping systems must demonstrate the propriety of their installation by remaining absolutely tight during this period.

3.10 PIPE CLEANING, FLUSHING AND PURGING REQUIREMENTS AND PROCEDURES

A The hydronic system shall be flushed and purged by contractor:

1. All mains, branches and zones shall be cleaned and treated per steps indicated below.
2. Owner/Engineer shall be given 72-hour notice prior to each step being performed.

B Pre-flush requirements: Purpose is to get system ready for flushing and purging:

1. Piping must pass all required pressure testing and visual inspection for leaks.
2. All pumps shall be tested for rotation and properly aligned and lubricated.

3. Chemicals planning on being used must have certificate of assurance and product cut sheets presented to the owner/engineer prior to being used. All chemicals must be approved by the state prior to being added to the system, FDA approved and meet ASTM D1384. Automotive grade chemicals are not allowed.

4. Bypass all coils and heat exchangers by connecting the supply and return piping together.

5. Fill entire system with clean fresh potable water.

C The flush requirements: Purpose is to completely remove all debris, dirt and air from hydronic system.

1. Add system cleaner that contains detergent and emulsifying agents to properly remove grease, grime and other debris for steel pipe. Volume of cleaner used shall be about 10% of total volume.

2. System shall be circulated for a minimum of 48 hours with water velocities of a minimum of 5 ft/sec or greater. After completed all strainers shall be removed and cleaned thoroughly. House pumps are acceptable to circulate water. House pumps or pump seals that are damaged during the flushing process shall be replaced at no cost to the Owner.

3. The system shall be entirely drained and flushed out to remove all of the cleaner from the system as quickly as possible after cleaning to prevent debris from settling. All strainers shall be removed and thoroughly cleaned after no more dirt and cleaner is visible in the flushing water as it leaves the system.

D Final fill:

1. All air vents shall be opened to allow air to escape during filling.

2. Reconnect all flex connections to equipment.

3. System shall be drained and filled with a local domestic/softened water mixture as required by chemical treatment supplier. System shall be filled with pressure reducing valve at the specified fill pressure.

E Purging: Purpose is to remove all air from the system:

1. System shall be circulated for a minimum of one hour with water velocities of a minimum of 5 ft/sec or greater until all visible air is removed.

F Final chemical addition: Purpose is to install chemicals during inhibitor as required:

1. After the above final fill and purging has been completed and accepted by the engineer/owner the final chemical addition can be done.

2. Chemical treatment shall be added to the system after thoroughly mixing water per the manufacturer's recommendations. Chemical treatment shall include inhibitors. Quantities and concentrations of inhibitor/chemicals should be applied per the manufacturer's specifications and approval submittals.

3. System water shall be tested for chemical inhibitor concentrations, reserve alkalinity and PH. Reports shall be submitted to engineer/owner.

4. All records and documentation shall be kept and given to the owner upon completion.

END OF SECTION 23 21 13

SECTION 23 31 13 - METAL DUCTWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A Low pressure ductwork.

B Exposed ductwork located indoors.

C Kitchen hood ductwork.

D Dishwasher/Shower/Locker room exhaust ductwork.

E Commercial dryer vent.

F Duct leakage testing.

G Duct system protection.

H Duct system cleaning.

1.02 RELATED SECTIONS

A Division 9 - Finishes: Weld priming, weather resistant, paint or coating.

B Section 23 02 00 - Basic Materials and Methods for HVAC

C Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

D Section 23 05 93 - Testing, Adjusting, And Balancing

E Section 23 07 13 - Duct Insulation

F Section 23 33 00 - Ductwork Accessories

G Section 23 37 13 - Air Distribution Devices

1.03 REFERENCES

A ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2023b.

B ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC System; 2021.

E NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

F SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

G UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

H SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual.

I ASHRAE (FUND) ASHRAE Handbook - Fundamentals; Chapter 21 - Duct Design.

J ASHRAE (HVACS) ASHRAE Handbook - HVAC Systems and Equipment; Chapter 19 - Duct Construction.

K ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings.

L NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

M NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

N ICC (IECC) - International Energy Conservation Code.

1.04 QUALITY ASSURANCE

A Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B Installer's Qualifications: Firms with least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

1.05 GENERAL DESCRIPTION

A Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

1.06 SUBMITTALS

A Submit shop drawings, duct fabrication standards and product data under provisions of Division One.

B Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration prior to start of work.

C The contract documents are schematic in nature and are to be used only for design intent. The contractor shall prepare sheet metal shop drawings, fully detailed and drawn to scale, indicating all structural conditions, all plumbing pipe and light fixture coordination, and all offsets and transitions as required to permit the duct to fit in the space allocated and built. All duct revisions required as a result of the contractor not preparing fully detailed shop drawings will be performed at no additional cost.

1.07 DEFINITIONS

A Duct Sizes: Inside clear dimensions. For lined ducts, maintain indicated clear size inside lining. Where offsets or transitions are required, the duct shall be the equivalent size based on constant friction rate.

B Low Pressure: Low pressure ductwork shall be rated for an operating pressure of 2". Low pressure ductwork shall be defined as all return, exhaust, and outside air ducts, all supply ductwork associated with constant volume air handling units with a scheduled external static pressure of less than 2", and all supply ductwork downstream of terminal units in variable volume systems.

C Medium Pressure: Medium pressure ductwork shall be rated for an operating pressure of 4". Medium pressure ductwork shall be defined as all supply ductwork extending from variable volume air handling units to terminal units in variable volume systems with air handling units having a scheduled external static pressure of less than 4". The supply ductwork of constant volume air handling units having a scheduled external static pressure greater than 2" and less than 4" shall be rated for medium pressure.

D High Pressure: High pressure ductwork shall be rated for an operating pressure of 6", or the scheduled external pressure of the equipment it is connected to, whichever is greater. The supply ductwork of air handling units having a scheduled external static pressure greater than 4" shall be high pressure.

1.08 DELIVERY, STORAGE, AND HANDLING

A Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings, use sheet metal end caps on any lined duct exposed to the weather.

B Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M.

C Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A480/A480M; Type 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A General: Non-combustible and conforming to UL 181, Class 1 air duct materials.

B Flexible Ducts: Flexmaster U.S.A., Inc. Type 5M, Thermaflex MKE, ATCO #036 or approved equal.

1. Flexible ducts shall be corrosive resistant galvanized steel formed and mechanically locked to inner fabric with minimum 1-1/2" thick, R-6 insulation. Flexible duct shall be rated up to at least 10 in.w.g. positive pressure and shall have reinforced metalized outer jacket to comply with UL 181, Class 1 air duct.

C Sealants: Hard-Cast “iron grip” or approved equal, non-hardening, water resistant, fire resistive and shall not be a solvent curing product. Sealants shall be compatible with mating materials, liquid used alone or with tape or heavy mastic.

D Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

1. For exposed stainless steel ductwork, provide matching stainless steel support materials.

2. For aluminum ductwork, provide aluminum support materials.

2.03 LOW PRESSURE DUCTWORK

A Fabricate and support in accordance with latest SMACNA (DCS) Standards and ASHRAE handbooks, except as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

B Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by approved shop drawings. Obtain engineer’s approval prior to using round duct in lieu of rectangular duct.

C Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.

D Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

E Use crimp joints with bead for joining round duct sizes 6 inch smaller with crimp in direction of airflow.

F Use double nuts and lock washers on threaded rod supports.

2.04 EXPOSED DUCTWORK LOCATED INDOORS

A Where ductwork is indicated to be exposed to view in occupied spaces, provide round or flat oval, double wall galvanized steel construction with spiral lockseam with perforated inner liner, United McGill Corporation model Acousti-k27 or approved equal.

2.05 KITCHEN HOOD EXHAUST DUCTWORK

A Fabricate in accordance with SMACNA (DCS) Standards, and NFPA 96.

B Construct of 16 gauge carbon steel or 18 gauge stainless steel, using continuous external welded joints.

C Slope all duct toward the kitchen hood or a grease reservoir so that grease cannot collect in any portion of duct per mechanical code.

2.06 DISHWASHER/SHOWER/LOCKER ROOM EXHAUST DUCTWORK

A All ductwork shall be stainless steel, one gauge heavier than that required for galvanized steel duct.

B Slope all duct to drain out grilles or provide drain line to floor drain.

2.07 CHLORINE STORAGE AREA DUCTWORK

A 18 gauge minimum galvanized steel.

B Three coat minimum, acid resistance, epoxy paint, minimum 6 mil dry film thickness total, inside of duct and outside of duct.

C Paint after fabrication including all taps and grilles.

2.08 COMMERCIAL DRYER VENT

A Construct of 18 gauge, Type 316 stainless steel.

B All welded construction.

C Provide hard duct connection to dryer.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A Obtain manufacturer's inspection and acceptance of fabrication and installation of ductwork at beginning of installation.

B Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

C Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

D Connect terminal units to medium or high pressure ducts with 18 inches maximum length of flexible duct. Do not use flexible duct to change direction.

E Connect diffusers or troffer boots to low pressure ducts with 5 feet maximum, 4 feet minimum, length of flexible duct. Hold in place with strap or clamp.

F During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

G The interior surface of all ductwork shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the ducts for any reason, except as specified to be so. All seams and joints shall be external.

H All ductwork located exposed on roof shall be "crowned" to prevent water from ponding. Ref: Insulation for additional requirements.

I Where ducts pass through non-rated floors, provide structural angles for duct support. Where ducts pass through non-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches. Where ducts pass through rated interior partitions, rated exterior walls, or rated floors, install fire dampers or smoke dampers as required. Provide sleeves for dampers not provided with factory sleeve. Refer to Section 23 33 00 - Ductwork Accessories for fire and smoke damper requirements.

J All angles shall be carried around all four sides of the duct or group of ducts. Angles shall overlap corners and be welded or riveted.

K All ductwork shall be fabricated in a manner to prevent the seams or joints being cut for the installation of grilles, registers, or ceiling outlets.

L All duct hangers shall be attached to building structure. Cutting slots in roof or floor decking for hanger straps to be cast in concrete is not acceptable.

3.02 INSTALLATION OF FLEXIBLE DUCTS

A Maximum Length: For any duct run using flexible ductwork, do not exceed 5'-0" extended length.

B Installation: Install in accordance with Section III of SMACNA (DCS).

3.03 REQUIREMENTS FOR KITCHEN HOOD EXHAUST DUCTWORK

A Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.

B Provide access openings in each change in direction, located on sides of duct 1½" minimum from bottom, and fitted with grease-tight covers of same material as duct

C Use stainless steel for ductwork exposed to view.

3.04 DUCTWORK APPLICATION SCHEDULE

A Ductwork materials shall be provided to comply with the following:

AIR SYSTEM	MATERIAL
Low Pressure Supply	Galvanized Steel, Aluminum
Buried Supply or Return	Concrete, Glass Fiber Reinforced Plastic
Medium and High Pressure Supply	Galvanized Steel
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Kitchen Hood Exhaust	Carbon Steel, Stainless Steel
Domestic Range Hood Exhaust	Galvanized Steel
Dishwasher/Shower/Locker Room/Dryer Vent/Paint Hood Exhaust	Stainless Steel
Fume Hood Exhaust	Stainless Steel
Chlorine Storage Supply and Exhaust	Galvanized Steel
Pool Room or Pool Equipment Room Supply, Return, and Exhaust	Galvanized Steel
Welding Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel
Combustion Air	Galvanized Steel
Emergency Generator Ventilation	Carbon Steel

3.05 DUCTWORK HANGERS AND SUPPORTS

A All ductwork shall be properly suspended or supported from the building structure. Hangers shall be galvanized steel straps or hot-dipped galvanized rod with threads pointed after installation. Strap hanger shall be attached to the bottom of the ductwork, provide a minimum of two screws one at the bottom and one in the side of each strap on metal ductwork. The spacing, size and installation of hangers shall be in accordance with the recommendations of the latest SMACNA edition.

B All duct risers shall be supported by angles or channels secured to the sides of the ducts at each floor with sheet metal screws or rivets. The floor supports may also be secured to ducts by rods, angles or flat bar to the duct joint or reinforcing. Structural steel supports for duct risers shall be provided under this Division.

3.06 AIR DUCT LEAKAGE: (FROM SMACNA DUCT STANDARDS LATEST EDITION) TEST ALL DUCTWORK (DESIGNED TO HANDLE OVER 1,000 CFM) AS FOLLOWS:

A Test apparatus

1. A source of high pressure air-a portable rotary blower or a tank type vacuum cleaner.

2. A flow measuring device consisting of straightening vanes and an orifice plate mounted in a straight tube with properly located pressure taps. Each orifice assembly shall be accurately calibrated with its own calibration curve. Pressure and flow readings shall be taken with U-tube manometers.

B Test Procedures

1. Test for audible leaks as follows:

2. Close off and seal all openings in the duct section to be tested. Connect the test apparatus to the duct by means of a section of flexible duct.

   a. Start the blower with its control damper closed.

   b. Gradually open the inlet damper until the duct pressure reaches 1.5 times the standard designed duct operating pressure.

   c. Survey all joints for audible leaks. Mark each leak and repair after shutting down blower. Do not apply a retest until sealants have set.

3. After all audible leaks have been sealed, the remaining leakage should be measured with the orifice section of the test apparatus as follows:

   a. Start blower and open damper until pressure in duct reaches 50% in excess of designed duct operating pressure.

   b. Read the pressure differential across the orifice on manometer No. 2. If there is no leakage, the pressure differential will be zero.

   c. Total allowable leakage shall not exceed one (1) percent of the total system design air flow rate. When partial sections of the duct system are tested, the summation of the leakage for all sections shall not exceed the total allowable leakage.

   d. Even though a system may pass the measured leakage test, a concentration of leakage at one point may result in a noisy leak which, must be corrected.

4. Testing Report

   a. Contractor shall provide a testing report for each air system to the engineer. The report shall indicate the completion of testing and compliance with testing specification.

   b. All duct testing reports shall be included in the final close out documents.

3.07 DUCT SYSTEM PROTECTION

A Provide temporary closures at the ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation; provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

B Provide temporary construction filters on air handling equipment and/or return air ductwork during construction to protect ductwork and equipment from dust.

C Any ductwork stored on site with observable dirt or debris inside shall be cleaned by a third party.

D If the air handling system has been operated without temporary construction filters or if the integrity of the temporary closures has been compromised, the contractor shall have the duct system cleaned per the following section.

3.08 DUCT SYSTEM CLEANING

A For renovation projects and HVAC retrofit applications wherein existing duct systems are scheduled to be re-used, or where required by the Duct System Protection section above, the contractor shall have the existing duct systems cleaned in accordance with the current published standards of ASHRAE, NADCA ACR and as indicated below.

B Duct system cleaning method used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

C All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.

D All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

E Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

F Duct cleaning method used shall not damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

G Replace the fiberglass material if there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating.

H Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

I Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

J Cleaning Report: Contractor shall provide a report to the Owner indicating the completion of duct cleaning per specification and areas of the duct system found to be damaged and/or in need of repair.

3.09 DUCT JOINTS AND SEAMS

A All ductwork shall be constructed to Seal Class A, as referenced in SMACNA (DCS).

B All non-welded joints and seams shall be sealed. This includes but is not limited to:

1. Transverse joints.
2. Longitudinal seams.
3. Duct wall penetrations.
4. Spin-ins, taps, and other branch connections.
5. Access doors, access panels, and duct connections to equipment.

C Openings for rotating shafts shall be sealed with bushings.

END OF SECTION 23 31 13

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A Volume control dampers.

B Round Duct Taps.

C Fire dampers.

D Back draft dampers.

E Air turning devices.

F Flexible duct connections.

G Duct access doors.

H Duct test holes.

1.02 RELATED WORK

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

C Section 23 31 13 - Metal Ductwork

1.03 REFERENCES

A NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

B SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

C UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

D UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A Submit shop drawings and product data under provisions of Division One.

B Provide shop drawings for shop fabricated assemblies indicated, including volume control dampers duct access doors duct test holes. Provide product data for hardware used.

C Submit manufacturer's installation instructions under provisions of Division 1, for fire dampers and combination fire and smoke dampers.

PART 2 - PRODUCTS

2.01 VOLUME CONTROL DAMPERS

A Fabricate in accordance with SMACNA (DCS), and as indicated.

B Fabricate splitter dampers of material same gauge as duct to 24 inches size in either direction, and two gauges heavier for sizes over 24 inches.

C Fabricate splitter dampers of double thickness sheet metal to streamline shape. Secure blade with continuous hinge or rod. Operate with minimum 1/2 inch diameter rod in self aligning, universal joint, action flanged bushing, with set screw.

D Fabricate single blade dampers for duct sizes to 9-1/2 x 24 inch.

E Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12 x 72 inch.

1. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

2. On outside air, return air, and all other dampers required to be low leakage type, provide galvanized blades and frames, seven inches wide maximum, with replaceable vinyl, EPDM, silicone rubber seals on blade edges and stainless steel side seals. Provide blades in a double sheet corrugated type construction for extra strength. Provide hat channel shape frames for strength and blade linkage enclosure to keep linkage out of the air stream. Construction leakage not to exceed 1/2%, based on 2,000 fpm and 4 inch static pressure.

F Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G Provide locking, indicating quadrant regulators on single and multi-blade dampers. Where rod lengths exceed 30 inches provide regulator at both ends.

H On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.02 ROUND DUCT TAPS

A Taps to trunk duct for round flexible duct shall be spin-in fitting with locking quadrant butterfly damper, model no. FLD-B03 by Flexmaster or approved equal.

2.03 ACCEPTABLE MANUFACTURERS - FIRE DAMPERS AND COMBINATION FIRE AND SMOKE DAMPERS

A Greenheck.

B Louvers and Dampers Inc.

C Ruskin.

D Nailor Industries.

E Pottorff.

2.04 FIRE DAMPERS

A Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

B Provide curtain type dampers of galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream. Provide factory sleeve for each damper.

C Fabricate multiple blade fire dampers per UL with 16 gauge minimum galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

D Fusible links, UL 33, shall separate at 165 degrees F. Provide adjustable link straps for combination fire/balancing dampers.

2.05 ACCEPTABLE MANUFACTURERS - BACKDRAFT DAMPERS

A Greenheck.

B American Warming and Vent.

C Louvers and Dampers Inc.

D Ruskin.

E Pottorff.

F Substitutions: Under provisions of Division One.

2.06 ACCEPTABLE MANUFACTURERS - AIR TURNING DEVICES

A Young Regulator.

B Titus.

C Tuttle and Bailey.

D Substitutions: Under provisions of Division One.

2.07 AIR TURNING DEVICES

A On duct sizes less than 12 x 12, multi-blade device with blades aligned in short dimension; steel or aluminum construction; with individually adjustable blades, mounting straps.

B Multi-blade device with radius blades attached to pivoting frame and bracket, steel or aluminum construction, with worm drive mechanism with 18 inch long removable key operator.

2.08 ACCEPTABLE MANUFACTURERS - FLEXIBLE DUCT CONNECTIONS

A Metaledge.

B Ventglass.

C Substitutions: Under provisions of Division One.

2.09 FLEXIBLE DUCT CONNECTIONS TO AIR MOVING EQUIPMENT

A Fabricate in accordance with SMACNA (DCS) and as indicated.

B UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz. per sq. yd., approximately 6 inches wide, crimped into metal edging strip.

2.10 ACCEPTABLE MANUFACTURERS - DUCT ACCESS DOORS

A Greenheck.

B American Warming and Vent.

C Ruskin.

D Titus.

E Substitutions: Under provisions of Division One.

2.11 DUCT ACCESS DOORS

A Fabricate in accordance with SMACNA (DCS) and as indicated.

B Review locations prior to fabrication.

C Fabricate rigid and close-fitting doors of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch thick insulation with sheet metal cover. Insulation shall be replaceable without field cutting or patching.

D Access doors smaller than 12 inches square may be secured with sash locks.

E Provide two hinges and two sash locks for sizes up to 18 inches square, three hinges and two compression latches with outside and inside handles for sizes up to 24 x 48 inches. Provide an additional hinge for larger sizes.

F Access doors with sheet metal screw fasteners are not acceptable.

2.12 DUCT TEST HOLES

A Cut or drill temporary test holes in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B Permanent test holes shall be factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install accessories in accordance with manufacturer's instructions.

B Balancing Dampers

1. Provide at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing. Use splitter dampers only where indicated.

2. All regulators mounted on externally insulated ductwork shall have 16 gauge elevated platforms at least 1/8 inch higher than the thickness of the insulation. Damper shaft shall have Ventlock No. 607 bearing mounted on ductwork within elevated platform. If duct is inaccessible the operating handle shall be extended and the regulator installed on the face of the wall or ceiling. Where regulators are exposed in finished parts of the building, they shall be flush type, Ventlock No. 666. All regulators shall be manufactured by Ventlock, or approved equal.

3. All dampers in lined ductwork shall have bushing to prevent damper damage to liner.

C Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

D Demonstrate re-setting of fire dampers to authorities having jurisdiction and Owner's representative.

E Provide gravity backdraft dampers or motorized shutoff dampers in accessible location nearest to exterior wall/roof penetrations and where indicated for all outdoor air intake and exhaust systems to automatically shut when the associated systems or spaces served are not in use.

F Provide flexible duct connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Provide at least one inch slack at all flexible duct connections.

G Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

H Provide duct access doors for inspection and maintenance of all fire dampers, smoke dampers, and combination fire/smoke dampers. Provide minimum 12 x 12 inch size access opening where duct size permits. All duct sizes that cannot accommodate a minimum 12 x 12 inch access opening shall be provided with a removable duct section to permit inspection and maintenance of the damper and its operating parts. Removable duct sections shall match the pressure class of the associated duct system, maintain 100 percent of the duct free area, and utilize gaskets and clamp type draw latches to allow removal and reinstallation without the use of tools.

I Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION 23 33 00

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Centrifugal roof ventilators

B Ceiling and inline ventilators

C Roof supply fans

D Utility fans

E Kitchen hood upblast roof exhaust fans

F Propeller wall axial ventilators and assemblies located in pool rooms

1.03 RELATED SECTIONS

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 230513

C Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D Section 23 05 93 - Testing, Adjusting, And Balancing

E Section 23 09 63 - Energy Management and Control System (EMCS)

F Section 23 33 00 - Ductwork Accessories

1.04 REFERENCES

A AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

B AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

C AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).

D AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

E AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

F AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.

G ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.

H ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

J FLA (FBC-B) - Florida Building Code: Building (8th Edition); 2023, with Supplement (2024).

K ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

N NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

O NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

P NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2024.

Q UL 705 - Power Ventilators; Current Edition, Including All Revisions.

R UL 705 Supplement SC - (Formerly UL-762) - Standard Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

S UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

A UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

B UL Compliance: Fans and components shall be UL listed and labeled.

C Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

D NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

E Electrical Component Standard: Components and installation shall comply with NFPA 70.

F Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA 300 Seal.

G Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

H Motors for fans that are not less than 1/12 hp (0.082 kW) and less than 1 hp (0.746 kW) shall be electronically commutated motors per ICC (IECC) and ASHRAE Std 90.1 I-P.

I High Wind models shall be analyzed and stamped by a state license P.E. to the ASCE 7-16 Standard which meets the ICC (IBC), FLA (FBC-B), and Miami (APD) codes.

J Each High Wind model is subject to be certified by a Nationally Recognized Testing Laboratory to ASTM E330/E330M.

1.06 SUBMITTALS

A General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B Product data for selected models, including specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.
2. Certified fan sound power ratings.
3. Motor ratings and electrical characteristics plus motor and fan accessories.
4. Materials, gages and finishes, include color charts.
5. Dampers, including housings, linkages, and operators.
6. Full color paint samples.

C Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.07 DELIVERY, STORAGE, AND HANDLING

A Fans shall be stored and handled in accordance with the unit manufacturer's instructions.

B Lift and support units with the manufacturer`s designated lifting or supporting points.

C Disassemble and reassemble units as required for movement into the final location following manufacturer`s written instructions.

D Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.08 ENVIRONMENTAL REQUIREMENTS

A Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.09 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Greenheck Fan Corporation

B Loren Cook Company

C Pennbarry

D ACME

E Twin City Fan and Blower

2.02 GENERAL DESCRIPTION

A Provide fans that are factory fabricated and assembled, factory tested, and factory finished with indicated capacities and characteristics.

B Fans and Shafts shall be statically and dynamically balanced and designed for continuous operation at the maximum rated fan speed and motor horsepower.

C Provide factory baked-enamel finish coat after assembly. Color for roof mounted fans shall be chosen by Architect during the submittal process.

2.03 CENTRIFUGAL ROOF VENTILATORS

A Fan shall be a spun aluminum, centrifugal, roof mounted, direct driven or belt driven as indicated.

B Fan shall be UL 705 listed. Fan shall bear the AMCA certified ratings seal for sound and air performance.

C The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure.

D The aluminum base shall have continuously welded curb cap corners for maximum leak protection. A discharge baffle conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections.

E The motor, bearings and drives shall be mounted on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in transit tested packaging.

F Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA 204, balance quality and vibration levels for fans.

G Motor shall be heavy duty type with permanently lubricated sealed ball bearings.

H Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty re-greaseable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

I Accessories: The following accessories are required.

1. Disconnect Switch: Non-fusible type, with thermal overload protection, mounted inside fan housing, factory-wired through an internal aluminum conduit.

2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.

4. Roof Curbs: Prefabricated, minimum 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base. Roof curb shall match roof slope so that the curb is level.

2.04 CEILING AND INLINE VENTILATORS

A Ceiling and inline ventilators shall be direct drive or belt drive as indicated, centrifugal blower type. Fan wheel shall be constructed of galvanized steel and shall be dynamically balanced. The housing shall be constructed of minimum 20 gauge corrosion resistant galvanized steel and acoustically insulated for quiet operation. Blower and motor assembly shall be easily removable from the housing without disturbing the ductwork. The motor shall be permanently lubricated with built-in thermal overload protection and shall be factory tested prior to shipment. The ceiling ventilators shall be furnished standard with a powder-painted white steel grille.

B Ventilators shall be certified and licensed to bear the AMCA Seal for Air and Sound Performance. Ventilator performance shall be based on tests and procedures performed in accordance with AMCA 211 and comply with the requirements of the AMCA Certified Ratings Program. Fan sound power level ratings shall be based on tests and procedures performed in accordance with AMCA 311 and comply with the requirements of the AMCA Certified Ratings Program. Ventilators shall be UL listed and CSA certified.

C Accessories: The following accessories are required.

1. Dampers:

   a. Aluminum backdraft damper.

   b. Motor-operated volume control damper.

   c. L listed ceiling radiation damper for ceiling fans comply with NFPA 90A rated for 3 hours

2. Disconnect Switch: Nonfusible type with thermal overload protection.

3. Speed Controls: Fan mounted, solid state speed controller.

2.05 ROOF SUPPLY FANS

A Roof-mounted, filtered air supply units are of the belt-driven, double width, double inlet (DWDI), forward curved centrifugal blower type. The unit's blower assembly shall be mounted on vibration isolators. Motor drives shall be machine cast iron and variable pitch and shall be factory set to the specified RPM. Belts shall be non-static and oil resistant. Both motor and blower bearings shall be permanently lubricated with sealed ball bearings. The blower housing shall be fabricated of heavy gauge painted steel.

B Fan shall be UL 705 listed and shall bear the AMCA certified rating seal for sound and air performance.

C Units housing shall be minimum 18 gauge extruded aluminum with a removable aluminum cover. The insulated cover shall be held in place with bolts for easy access to fan components.

D Filters shall be permanent, one inch, washable, aluminum type and shall be easily removed for cleaning. Units carry the AMCA Certified Ratings Seal for air performance with filters in place.

E Accessories: The following items are required.

1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside fan housing, factory-wired through an internal aluminum conduit.

2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

3. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.

4. Roof Curb: Prefabricated, minimum 12 inch high, heavy gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and fan base.

2.06 UTILITY FANS

A Fans shall be of the direct driven or belt driven utility fan type as indicated with a single width, single inlet housing in AMCA arrangement 10.

B The housing shall be constructed of minimum 14 gauge steel with continuously welded or lock formed seams permitting no air leakage. The housing shall be field rotatable to any of the eight standard discharge positions. Housing and bearing supports shall be constructed of minimum 10 gauge welded steel members to prevent vibration and rigidly support the shaft and bearings. Side access inspection port shall be provided for access to the motor compartments.

C The fan wheel shall be of the forward curved type C, non-overloading backward inclined, centrifugal fan type and constructed of heavy gauge steel.

D Wheels shall be statically and dynamically balanced. The wheel cone and fan inlet cone shall be carefully matched for maximum performance and operating efficiency.

E Motors shall be permanently lubricated, heavy duty, ball bearing type carefully matched to the fan load and furnished at the specified voltage, phase and enclosure. The fan shaft shall be ground and polished solid steel mounted in heavy duty, permanently sealed, pillow block ball bearings. Bearings shall be selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the fully machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulley shall be adjustable for final system balancing.

F Fan performance shall be based on tests conducted in accordance with AMCA 210. Fans shall be licensed to bear the AMCA Certified Ratings Seal for air performance.

2.07 KITCHEN HOOD UPBLAST ROOF EXHAUST FANS

A General Description

1. Discharge air up and away from the mounting surface.
2. Upblast fan shall be for roof mounted applications.
3. Maximum continuous operating temperature is 400°F.
4. Each fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number.

B Fan shall be direct-driven or belt-driven as indicated.

1. Fan Wheel
    a. Type: Non-overloading, backward inclined centrifugal.
    b. Material: Aluminum, statically and dynamically balanced in accordance to AMCA 204.
    c. The wheel cone and fan inlet will be matched and shall have precise running tolerances for maximum performance and operating efficiency
2. Housing
    a. Construct of heavy gauge aluminum including curb cap, windband, and motor compartment.
    b. Rigid internal support structure.
    c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
    d. Construct drive frame assembly of heavy gauge steel, mounted on vibration isolators.

e. Provide breather tube for fresh air motor cooling and wiring.

f. Provide an access opening on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades per NFPA 96. Access opening shall be a minimum 3 in. by 5 in. rectangular or minimum 4 in. diameter circular opening.

C Shafts and Bearings

1. Fan Shaft

a. Ground and polished steel with anti-corrosive coating.

b. First critical speed at least 25 percent over maximum cataloged operating speed.

2. Bearings

a. Permanently sealed or pillow block type.

b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

c. 100 percent factory tested.

D Drive Assembly

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.

2. Belts: Static free and oil resistant.

3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

4. The motor pulley shall be adjustable for final system balancing.

5. Readily accessible for maintenance.

E Roof Curb: Minimum 12-inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip. Curb heights shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Roof curb shall match roof slope so that the curb is level.

F Drain Trough: Allows for single-point drainage of water, grease, and other residues.

G Accessories: The following accessories are required.

1. Birdscreen

a. Provide aluminum construction.

b. Protects fan discharge.

2. Roof Curb Extension: Provide vented curb extension per NFPA 96. Verify curb height with extension has a minimum of 40 inches clearance from the discharge lip of the fan to the finished roof.

3. Drain Connection:

    a. Aluminum construction.

    b. Allows single-point drainage of grease, water, or other residues.

4. Grease Trap:

    a. Provide aluminum grease receptacle as required by NFPA 96.

    b. Includes drain connection.

    c. Collects grease residue.

5. Hinge Kit (factory Installed)

    a. Aluminum hinges.

    b. Hinges and restraint cables mounted to base (sleeve).

    c. Allows the fan to tilt away for access to wheel and ductwork for inspection and cleaning.

6. Heat Baffle:

    a. Provide 1-inch thick insulation shield that prevents heat from radiating into the motor compartment to meet requirements of UL 705 Supplement SC.

7. Variable Speed Control:

    a. Provide an electronically commutated motor or a premium efficiency AC induction paired with a variable frequency drive capable of variable speed control for demand-based ventilation sequencing as required by the kitchen hood ventilation controls.

2.08 PROPELLER WALL AXIAL VENTILATORS AND ASSEMBLIES LOCATED IN POOL ROOMS

A Unless noted otherwise, all materials shall be of noncorrosive aluminum or stainless steel.

B Ventilator and assembly shall consist of propeller wall axial ventilator section, motorized damper section and accessories as scheduled.

C Motorized Damper Section:

1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.

2. Blade edge seals shall be Ruskiprene type or equivalent, mechanically locked in extruded blade slots.

3. Linkage shall be stainless steel, mounted in frame.

4. Axles shall be square or hexagonal, stainless steel construction.

5. Bearings shall be non-corrosive molded synthetic.

6. Shaft shall be stainless steel.

7. Damper actuator shall be mounted inside NEMA 4 type enclosure, factory wired through an internal aluminum conduit.

D Gravity Damper Section:

1. Blades and frame shall be of aluminum construction with Air Dry Phenolic (Heresite VR-500) coating.

E Propeller Wall Axial Ventilator Section:

1. Fan motor shall be in TEFC type enclosure.

2. All steel fan components shall be coated with Air Dry Phenolic (Heresite VR-500) coating.

F Wall collar shall be of aluminum construction.

G Accessories: The following items are required.

1. Disconnect Switch: Non-fusible type, with thermal overload protection mounted inside NEMA 4 enclosure, factory-wired through an internal aluminum conduit.

2. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum or brass wire.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

D Refer to 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment for additional installation requirements.

E Flexible duct connections and shutoff dampers are prohibited from being installed in duct systems conveying grease laden exhaust air per NFPA 96 requirements.

END OF SECTION 23 34 00

SECTION 23 34 39 - HIGH-VOLUME, LOW-SPEED PROPELLER FANS

PART 1 - GENERAL

1.01 SUMMARY

A Section Includes

1. Powerfoil X4.0
2. Basic 6
3. Essence

B Summary of Work

1. Provide the ceiling-mounted, circulation fans with the models scheduled and with the capacities indicated. The fan shall be furnished with standard mounting hardware and variable speed control to provide cooling and destratification.
2. Installation of the fan, miscellaneous or structural metal work (if required), field electrical wiring, cable, conduit, fuses and disconnect switches, other than those addressed in the installation scope of work, shall be provided by others.

1.02 RELATED SECTIONS

A Section 21 00 00 - Fire Protection

B Section 23 02 00 - Basic Materials and Methods for HVAC

C Section 230513

D Section 23 05 53 - Identification for HVAC Piping and Equipment

E Section 26 02 00 - Basic Materials and Methods for Electrical

F Section 28 46 00 - Fire Alarm and Smoke Detection System

1.03 REFERENCES

A 10 CFR 430, Appendix U to Subpart B - Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans; Current Edition.

B AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022, with Editorial Revision (2023).

C AMCA 230 - Laboratory Methods Of Testing Air Circulating Fans For Rating And Certification; Current Edition.

D ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

E CSA C22.2 No. 113 - Fans and Ventilators; 2018.

F ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

G NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

J UL 507 - Electric Fans; Current Edition, Including All Revisions.

K ROHS - Restriction of Hazardous Substances

L NEMA - National Electrical Manufacturers Association

1.04 QUALITY ASSURANCE

A Certifications

1. The fan assembly, as a system, shall be Intertek/ETL-certified and built pursuant to the guidelines set forth by UL 507 and CSA standard 22.2 No. 113.

2. The fan shall be compliant with NFPA 13, NFPA 72 and NFPA 70.

3. Controllers shall comply with National Electrical Code (NEC) and Underwriters Laboratory (UL) standards and shall be labeled where required by code.

4. Fans shall be tested to meet the minimum efficiency requirements of 10 CFR 430, Appendix U to Subpart B.

5. Performance ratings shall conform to AMCA 211. Fans shall be tested in accordance with AMCA 230 for performance ratings.

B Manufacturer Qualifications

1. The fan and any accessories shall be supplied by a company that has a minimum of ten (10) years of product experience.

2. ISO 9001 - certified

1.05 SUBMITTALS

A Shop Drawings: Drawings detailing product dimensions, weight, and attachment methods.

B Product Data: Specification sheets on the ceiling-mounted fan, specifying electrical and installation requirements, features and benefits, and controller information.

C Revit Files: File provided for Contractor’s coordination drawings.

D Installation Guide: The manufacturer shall furnish a copy of all operating and maintenance instructions for the fan. All data is subject to change without notice.

1.06 DELIVERY, STORAGE, AND HANDLING

A Deliver product in original, undamaged packaging with identification labels intact. The fan shall be new, free from defects, and factory tested.

B The fan and its components must be stored in a safe, dry location until installation.

1.07 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

1.08 WARRANTY

A The manufacturer shall replace any products or components defective in material or workmanship for the customer free of charge including transportation charges in accordance to the following schedule:

1. HVLS fans scheduled as Powerfoil X4.0 Fans:
    a. Mechanical - 15 years
    b. Electrical - 7 years
    c. Labor - 1 year
2. HVLS fans scheduled as Basic 6 Fans:
    a. Mechanical - 7 years
    b. Electrical - 3 years
    c. Labor - 1 year
3. HVLS fans scheduled as Essence Fans:
    a. Mechanical - 10 years
    b. Electrical - 5 years
    c. Labor - 1 year

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Big Ass Fans

B Entrematic

C Macroair

D Greenheck

2.02 HIGH VOLUME, LOW SPEED FANS - BIG ASS FANS POWERFOIL X4.0

A Complete Unit

1. Regulatory Requirements:

   a. The entire fan assembly (with or without light kit) shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.

   b. The BAFCon controller shall be compliant with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) The device may not cause harmful interference, and (2) The device must accept any interference received, including interference that may cause undesirable operation.

2. Sustainability Characteristics:

   a. The fan shall be designed to move an effective amount of air for cooling and destratification in a variety of applications (including industrial and agricultural) over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.

   b. The BAFCon controller shall be designed to control Big Ass Fans and lighting systems from a secure, centralized location. The system shall be designed specifically for high volume, low speed Big Ass Fans to ensure maximum control. The system shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.

3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B Onboard Fan Control

1. The onboard fan controller shall be constructed using a variable frequency drive (VFD) that is pre-wired to the motor and factory-programmed to minimize the starting and braking torques for smooth and efficient operation. The onboard controller shall be prewired to the motor using a short run of flexible conduit with a dedicated ground conductor to minimize electromagnetic interference (EMI) and radio frequency interference (RFI). A 15-ft incoming power cord shall be pre-wired to the controller with one of the following plugs: NEMA L6-20P Twist-Lock Plug, NEMA L6-30P Twist-Lock Plug, NEMA L15-20P Twist Lock Plug, NEMA L16-20P Twist-Lock Plug.

2. As an option, the architect or owner may upgrade to the "harsh environment package," which includes a seal for the weather-resistant onboard VFD enclosure and a motor with IP55 NEMA classification.

3. For fans with single-phase input, conversion to three-phase output takes place at the VFD.

C Airfoil System

1. The fan shall be equipped with eight (8) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers.

2. The fan shall be equipped with eight (8) Powerfoil winglets (standard) or eight (8) Powerfoil Plus winglets (optional) on the ends of the airfoils and eight (8) AirFences® positioned on the airfoils at the optimum location for performance. Both the winglets and AirFences shall be molded of a polypropylene blend. The standard color of the winglet and AirFence shall be "Safety Yellow." Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

3. Airfoil Restraint System

   a. All 20- to 24-ft diameter fans shall be equipped with a patented airfoil restraint system to provide redundant safety between the ends of the airfoils and the fan hub. The airfoil restraint system shall be available as an option on smaller diameter fans.

   b. The airfoil restraint system shall be comprised of durable, lightweight nylon safety straps that shall extend from winglets through the airfoils and secure to the fan hub with 12-gauge stamped steel safety clips.

   c. The straps shall be made of 1 in. wide heavy-duty nylon webbing rated for 825 lb. The loops at the ends of the straps shall be secured in a double-stitch pattern for reinforced durability.

   d. The straps shall be precisely matched to each fan's diameter, eliminating the need for a tensioning mechanism and reducing opportunity for noise.

   e. The straps shall run along the inside of the airfoils for an uninterrupted look.

f. Safety clips are preattached to each winglet at the factory to comprise the outer anchor points and provide tension, while clips on the opposite end secure to threaded inserts incorporated in the fan hub.

D Motor

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200-240/400-480 VAC, 50/60 Hz, three-phase.

2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP44 NEMA classification. A NEMA 56C standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 32°F to 122°F ambient conditions.

3. The motor shall have a C-face attachment that shall enable technicians to detach the motor for easy field service. The C-face motor adapter shall be designed to work with the NitroSeal™ gearbox.

4. As an option, the architect or owner may upgrade to the "harsh environment package," which includes a motor with an IP55 NEMA classification. As part of the "harsh environment package," the onboard VFD enclosure is sealed for weather-resistant operation.

E Gearbox

1. The fan gearbox shall be a NitroSeal™ Drive designed specifically for the Powerfoil X series. The gearbox shall include a high-efficiency, hermetically sealed, nitrogen-filled, offset helical gear reducer with two-stage gearing, a hollow output shaft, cast iron housing, double lip seals, high quality SKF Explorer Series bearings with crowned cages for optimal lubrication flow, and precision machined gearing to maintain backlash less than 11 arc-minutes over the life of the unit. Lubrication shall be high-grade, low-foaming synthetic oil with extreme pressure additives and a wide temperature range, and shall be lubricated for the life of the product (no oil changes required).

2. The gearbox shall be equipped with a hollow shaft threaded to accept a ¾" NPT fitting in which wiring, piping, etc., can be routed to below the fan. A standard junction box can be affixed to this hollow shaft to allow for installing optional features such as lights or cameras. The inclusion of the hollow shaft shall be specified at the time of order.

F Mounting Post

1. The fan shall be equipped with a mounting post that provides a structural connection between the fan assembly and extension tube. The mounting post shall be formed from A36 steel, contain no critical welds, and be powder coated for corrosion resistance and appearance.

G Mounting System

1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.

2. The upper mount shall be of ASTM A-36 steel, welded construction, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.

3. All mounting bolts shall be SAE Grade 8 or equivalent.

H Hub

1. The fan hub shall be 19" in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, eight (8) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.

2. The hub shall be secured to the output shaft of the gearbox by means of (10) high strength bolts. The hub shall incorporate five (5) safety retaining clips made of 1/4" thick steel that shall restrain the hub/airfoil assembly.

I Safety Cables

1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of 3/8".

2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4".

3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf.

4. Field construction of safety cables is not permitted.

J Digital Variable Speed Wall Controller

1. The fan shall be equipped with a digital variable speed wall controller. The controller user interface shall be a wall-mounted, touch interface.

2. The controller shall be mounted to a standard rectangular or square outlet box.

3. A 150-ft CAT5 cable shall be provided for connecting the controller to the fan's VFD and to provide power to the controller.

4. The controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.

5. The controller shall have an IP65 rating.

6. The controller shall provide fan start/stop, speed, and direction control functions.

7. The controller shall provide diagnostic and fault history information for the connected fan, as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.

8. The controller interface shall be able to be secured with a passcode to prevent unauthorized access to fan controls and settings.

9. The controller shall operate out of the box without setup and upon connection to CAT5 cable.

K BAFCon Controller (Optional)

1. The fan shall have the option of operating with the BAFCon controller.

2. The digital controller user interface shall be a wall-mounted touchscreen with a 5-inch display and an 800 (RGB) x 480 pixel resolution.

3. The digital controller shall be mounted to a standard rectangular or square outlet box.

4. A 150-ft CAT5 cable shall be provided for connecting the digital controller to the fan's VFD, allowing for seamless communication between BAFCon and the VFD. The cable shall provide power to the digital controller.

5. The digital controller shall not require a 120 V power supply at the controller mounting location.

6. The digital controller mounting location shall meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.

7. The digital controller shall support up to eight Powerfoil D fans controlled as a group or individually.

8. The digital controller shall provide fan start/stop, speed, and direction control functions.

9. The digital controller shall provide diagnostic and fault history information for each connected fan as well as the ability to configure fan parameters with the assistance of Big Ass Fans Customer Service.

10. The digital controller shall include optional SmartSense functionality to maximize energy savings. SmartSense shall provide the capability to automatically control the speed of Big Ass Fans using information from user-determined settings and built-in temperature and humidity sensors.

11. The digital controller interface shall be able to be secured with user and admin passcodes to prevent unauthorized access to fan controls and settings.

12. The digital controller shall include Bluetooth® functionality for receiving firmware updates from a mobile app. The app shall be supported by iOS® and Android™ mobile devices. The digital controller's Bluetooth functionality can be disabled if not needed or permitted.

13. BAFCon Multi-Fan Accessory Kit (Optional)

    a. If multiple fans will be installed, the BAFCon Multi-Fan Accessory Kit shall be available.

    b. The kit shall include a two-screw RJ45 terminal block, a ¼ Watt, 120 Ohm termination resistor, RJ45 pass through splitters, and split-gland cord grips for connecting multiple fans to the controller.

    c. The accessory kit shall include a two-screw RJ45 terminal block, a ¼ Watt, 120 Ohm termination resistor, RJ45 pass through splitters, and split-gland cord grips for daisy chaining multiple fans to the controller.

L Fire Alarm Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

M Guy Wires

1. Included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

2.03 HIGH VOLUME, LOW SPEED FANS - BIG ASS FANS BASIC 6

A Complete Unit

1. Regulatory Requirements: The entire fan assembly shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.

2. Sustainability Characteristics: The fan shall be designed to move an effective amount of air for cooling and destratification in industrial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 55 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.

3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B Airfoil System

1. The fan shall be equipped with six (6) Powerfoil airfoils of precision extruded aluminum alloy. The airfoils shall be connected by means of two (2) high strength locking bolts per airfoil. The airfoils shall be connected to the hub and interlocked with zinc plated steel retainers.

2. The fan shall be equipped with six (6) Powerfoil winglets on the ends of the airfoils. The winglets shall be molded of a polypropylene blend. The standard color of the winglet shall be "Safety Yellow." Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

C Motor

1. The fan motor shall be an AC induction type inverter rated at 1725 RPM, 200-240/460-480 VAC, 60 Hz, three-phase.

2. The motor shall be totally enclosed, fan cooled (TEFC) with an IP56. A B5 standard frame shall be provided for ease of service. The motor shall be manufactured with a double baked Class F insulation and be capable of continuous operation in 5degreesF to 104 degreesF ambient conditions.

D Gearbox

1. The gearbox shall be a helical gear reducer, precision finished from hardened steel for low noise and long service life with double lip seals to retain oil and prevent contamination. The gearbox shall be lubricated for life. The gear reducer shall have a standard backlash of less than 25 arc minutes and be equipped with a 17-4 stainless steel shaft of 1-1/4" diameter.

E Motor Frame

1. The motor frame and mount shall be constructed of steel and powder coated for corrosion resistance and appearance.

F Mounting System

1. The fan mounting system shall be designed for quick and secure installation on a variety of structural supports. The design of the upper mount shall provide two axes of rotation. This design shall allow for adjustments to be made after the mount is installed to the mounting structure to ensure the fan will hang level from the structure.

2. The upper mount shall be of ASTM A36/A36M steel, welded construction, at least 3/16" thick, and powder coated for appearance and corrosion resistance. No mounting hardware or parts substitutions, including cast aluminum, are acceptable.

3. All mounting bolts shall be SAE Grade 8 or equivalent.

G Hub

1. The fan hub shall be 19” in diameter and shall be made of precision cut aluminum for high strength and light weight. The hub shall consist of two (2) aluminum plates, six (6) aluminum spars, and one (1) aluminum spacer fastened with a pin and collar rivet system. The overall design shall provide a flexible assembly such that force loads experienced by the hub assembly shall be distributed over a large area to reduce the fatigue experienced at the attachment point for the fan blade.

2. The hub shall be secured to the output shaft of the gearbox by means of a steel coupling interface. The hub shall incorporate three (3) safety retaining clips made of 1/4” thick steel that shall restrain the hub/airfoil assembly.

H Safety Cables

1. The fan shall be equipped with an upper safety cable that provides an additional means of securing the fan assembly to the building structure. The upper safety cable shall have a diameter of 3/8”.

2. The fan shall be equipped with two lower safety cables pre-attached to the fan hub that shall provide an additional means of securing the fan to the extension tube. The lower safety cables shall have a diameter of 1/4”.

3. The safety cables shall be fabricated out of 7 x 19 galvanized steel cable. The end loops shall be secured with swaged Nicopress® sleeves, pre-loaded and tested to 3,200 lbf.

4. Field construction of safety cables is not permitted.

I Variable Frequency Drive

1. The Variable Frequency Drive (VFD) shall be a NEMA 4X VFD that is factory programmed to minimize starting and braking torques. The VFD shall have touchpad controls and an LED display for controlling the fan’s direction, operation, speed, and programming. The VFD may be equipped with an EMI/RFI filter to limit interference with other electronic equipment and a rotary switch disconnect for lock-out/tag-out requirements.

2. Onboard Variable Frequency Drive: The VFD may be mounted on the fan motor frame. A wall-mounted remote keypad equipped with touchpad controls and an LED display shall be provided for such installations, allowing access to all VFD functions.

3. Wall-Mounted Variable Frequency Drive: The VFD may be wall-mounted for ease of access.

J Fire Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

K Guy Wires

1. Included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

2.04 HIGH VOLUME, LOW SPEED FANS - FANS SCHEDULED AS BIG ASS FANS ESSENCE

A Complete Unit

1. Regulatory Requirements: The entire fan assembly shall be Intertek/ETL-certified and built pursuant to the construction guidelines set forth by UL 507 and CSA C22.2 No. 113.

2. Sustainability Characteristics: The fan shall be designed to move an effective amount of air for cooling and destratification of conditioned commercial applications over an extended life. The fan components shall be designed specifically for high volume, low speed fans to ensure lower operational noise. Sound levels from the fan operating at maximum speed measured in a laboratory setting shall not exceed 40 dBA. Actual results of sound measurements in the field may vary due to sound reflective surfaces and environmental conditions.

3. Good workmanship shall be evident in all aspects of construction. Field balancing of the airfoils shall not be necessary.

B Controls

1. The fan controller shall be incorporated into the fan assembly and housed in an enclosure independent of the motor to prevent overheating or electrical interference. The fan controller shall be factory programmed to minimize starting and braking torques and shall be equipped with a simple diagnostic program and an LED light to identify and relay faults in the system.

C Airfoil System

1. The fan shall be equipped with eight (8) high volume, low speed airfoils of precision extruded, anodized aluminum alloy. Each airfoil shall be of the high-performance Mini-Elipto design. The airfoils shall be connected to the hub and interlocked with eight (8) stainless steel retainers and two (2) sets of stainless steel bolts and lock washers per airfoil.

2. The fan shall be equipped with eight (8) upswept winglets designed to redirect outward airflow downward, thereby enhancing efficiency. The winglets shall be molded of high strength polymer and shall be attached at the tip of each airfoil with a stainless steel screw. The standard color of the winglets shall be silver or black. Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

3. As an option, the fan shall be equipped with eight (8) plug-style airfoil tips, molded of high strength polymer, in place of the eight (8) upswept winglets. The airfoil tips shall be attached at the tip of each airfoil with a stainless steel screw. The standard color of the airfoil tips shall be black. Color shall be as scheduled and shall be coordinated with the architect and owner prior to ordering.

D Motor

1. The motor shall be a permanent magnet brushless motor rated for continuous operation at maximum speed with the capability of modulating the fan speed from 0-100% without the use of a gearbox or other mechanical means of control.

2. The motor shall operate from any voltage ranging from 100-120 VAC or 200-240 VAC, single phase, and 60Hz, without requiring adapters or customer selection. The motor shall be a non-ventilated, heat sink design with the capability of continuous operation in -4°F to 131°F ambient condition.

3. The motor shall be rated IP43.

4. The standard color of the motor unit shall be white with silver trim or silver with black trim.

E Mounting System

1. The fan mounting system shall be designed for quick and secure installation from a variety of structural supports. All components in the mounting system shall be of formed metal design using low-carbon steel no less than 3/16" thick and containing no critical welds. The mounting system shall be powder coated for appearance and resistance to corrosion. All mounting bolts shall be metric stainless steel or equivalent. No mounting hardware substitutions, including cast aluminum, are acceptable.

2. The fan extension tube shall be a round, extruded aluminum tube. The extension tube shall include a chrome plate with forward and reverse controls and a fan status indicator light that is visible from the floor.

F Hub

1. The fan hub shall be constructed of zinc plated steel for high strength and durability. The hub shall be precision machined to achieve a well-balanced and solid rotating assembly.

G Safety Cable

1. The fan shall be equipped with a safety cable that provides an additional means of securing the fan assembly to the building structure. The safety cable shall be 3/16" diameter and fabricated out of 7 x 19 stranded galvanized steel, pre-loaded and tested to 3,200 lbf.

2. Field construction of safety cables is not permitted.

H Wall Control

1. Wired (standard). The fan shall be equipped with a low-voltage wired remote wall control providing control of all fan functions. The wall control shall be capable of mounting to a standard electrical box or directly to a wall surface. The wall control shall include a rotary-style dial for controlling the fan's power and speed and an LED light to identify and relay faults in the system. Communication with the fan drive and controller shall be by a standard, commercially available CAT5 (or higher) Ethernet cable that is field installed and provided by the installer.

2. Wireless (optional). As an option, the fan shall be equipped with an optional radio frequency (RF) remote wall control in place of the wired wall control. The wall control shall provide control of all fan functions. The wall control shall be capable of mounting to a standard electrical box with an owner-supplied wall plate and shall include a capacitive touch display for controlling the fan's power and speed. Communication with the fan drive and controller shall be wireless.

I Fire Control Panel Integration

1. Includes a 10-30 VDC pilot relay for seamless fire control panel integration. The pilot relay can be wired Normally Open or Normally Closed in the field.

J Guy Wires

1. Guy wires shall be included for installations with extension tubes 4 ft or longer to limit the potential for lateral movement.

PART 3 - EXECUTION

3.01 PREPARATION

A Fan location must have a typical bar joist or existing I-beam structure from which to mount the fan. Additional mounting options may be available.

B Mounting structure must be able to support weight and operational torque of fan. Consult structural engineer if necessary.

C Fan location must be free from obstacles such as lights, cables, or other building components.

D Check fan location for proper electrical requirements. Consult installation guide for appropriate circuit requirements.

E Each fan requires dedicated branch circuit protection.

F Before the BAFCon controller is installed, the fan system shall be installed by a factory-certified installer according to the instructions in the fan Installation Guide.

G Install a rectangular or square outlet box at the BAFCon controller mounting location.

H If the BAFCon controller will be mounted more than 250 ft from the fan or if multiple fans will be daisy chained, ensure the optional BAFCon Accessory Kit is included. The accessory kit shall be installed by a factory- certified installer according to the instructions included with the kit.

3.02 INSTALLATION

A The fan and BAFCon controller shall be installed by a factory-certified installer according to the manufacturer's Installation Guide, which includes acceptable structural dimensions and proper sizing and placement of angle iron for bar joist applications. Contractor shall consult a structural engineer for installation methods outside the manufacturer's recommendation and a certification, in the form of a stamped print or letter, submitted prior to installation.

B Minimum Distances

1. Airfoils must be installed at a minimum distance above the floor as recommended by the fan manufacturer.

2. Installation area must be free of obstructions such as lights, cables, sprinklers or other building structures with the airfoils at least 2 ft clear of all obstructions.

3. The structure the fan is attached to shall be capable of supporting the operational torque load indicated by the fan manufacturer.

C The fan shall not be located where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters.

D In buildings equipped with sprinklers, including ESFR sprinklers, fan installation shall comply with all of the following:

1. The maximum fan diameter shall be 24 ft.

2. The HVLS fan shall be centered approximately between four adjacent sprinklers.

3. The vertical clearance from the HVLS fan to the sprinkler deflector shall be a minimum of 3 ft.

4. All HVLS fans shall be interlocked to shut down immediately upon receiving a waterflow signal from the alarm system in accordance with the requirements of NFPA 72.

E Mount the BAFCon controller to a flat, readily accessible surface that is free from vibration and away from foreign objects and moving equipment. The controller mounting location must meet the requirements of OSHA standard 29 CFR 1910.303(g) for accessibility minimum clearances.

F If the SmartSense feature will be used, the BAFCon controller must not be mounted adjacent to or above a radiant heat source, near HVAC ventilation intakes/exhausts, on a poorly insulated exterior wall, or in a different temperature/humidity environment than the fans it will control. Additional mounting guidelines can be found in the Installation Guide.

END OF SECTION 23 34 39

SECTION 23 37 13 - AIR DISTRIBUTION DEVICES

PART 1 - GENERAL

1.01 WORK INCLUDED

A Ceiling air diffusers.

B Wall registers and grilles.

C Louvers.

D Other air devices indicated on drawings and schedules.

1.02 RELATED SECTIONS

A Section 08 91 00 - Louvers

B Section 23 02 00 - Basic Materials and Methods for HVAC

C Section 23 05 93 - Testing, Adjusting, And Balancing

D Section 23 07 13 - Duct Insulation

E Section 23 31 13 - Metal Ductwork

F Section 23 33 00 - Ductwork Accessories

1.03 REFERENCES

A AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017 (Reaffirmed 2023).

B AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2023.

C AMCA 540 - Test Method for Louvers Impacted by Wind Borne Debris; 2013.

D AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers; 2022.

E ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets; 2023.

F ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

G ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

H ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

I ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

J ASTM D870 - Standard Practice for Testing Water Resistance of Coatings Using Water Immersion; 2015.

K ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.04 QUALITY ASSURANCE

A Manufacturer's Qualifications: Firms regularly engaged in manufacture of air distribution devices of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B Codes and Standards:

1. AHRI Compliance: Test and rate air distribution devices in accordance with AHRI 880 (I-P).
2. ASHRAE Compliance: Test and rate air distribution devices in accordance with ASHRAE Std 70.
3. AMCA Compliance: Test and rate louvers in accordance with AMCA 500-L.
4. AMCA 540 - Test Methods for Louvers Impacted by Wind Borne Debris with Enhanced Protection Approval.
5. AMCA 550 - Test Method for High Velocity Wind Driven Rain Resistant Louvers.
6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air distribution devices in accordance with NFPA 90A - Standard for the Installation of Air Conditioning and Ventilating Systems.
8. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
9. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
10. IBC - International Building Code.
11. IMC - International Mechanical Code.
12. UMC - Uniform Mechanical Code.

1.05 DEFINITIONS

A Hurricane-prone regions:

1. The U.S. Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed for Risk Category II Buildings is greater than 115 mph;
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

B Wind-borne debris region: Areas within hurricane-prone regions located:

1. Within 1 mile of the coastal mean high water line where the ultimate design wind speed is 130 mph or greater; or

2. In areas where the ultimate design wind speed is 140 mph or greater. For Risk Category II buildings and structures and Risk Category III building and structures, except health care facilities, the wind-borne debris region shall be based on Figure 1609.3(1). For Risk Category IV buildings and structures and Risk Category III health care facilities, the wind-borne debris region shall be based on Figure 1609.3(2).

C Ultimate design wind speed - The ultimate design wind speed for the determination of the wind loads shall be determined by Figures 1609.3(1), 1609.3(2) and 1609.3(3) of ICC (IBC).

1.06 SUBMITTALS

A Product Data: Submit manufacturer's technical product data for the following:

1. Air Distribution Devices

   a. Schedule of air distribution devices indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

   b. Data sheet for each type of air distribution devices, and accessory furnished; indicating construction, finish, and mounting details.

   c. Performance data for each type of air distribution devices furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

2. Louvers

   a. Manufacturer's product data including performance data.

   b. Preparation instructions and recommendations.

   c. Storage and handling requirements and recommendations.

   d. Installation methods.

B Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air distribution device and louver, indicating materials, construction, dimensions, accessories, and installation details.

C Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 1.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A Deliver air distribution devices wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B Store air distribution devices and louvers in original cartons and protect from weather and construction work traffic in accordance with manufacturer's instructions. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

C Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 WARRANTY

A Warrant the installation of the work specified herein for one year against becoming unserviceable or causing an objectionable appearance resulting from defective or nonconforming workmanship.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS - AIR DEVICES

A Titus Company

B Metalaire Industries, Inc.

C Nailor Industries

D Krueger

E Price

2.02 AIR DEVICES

A Unless otherwise indicated, provide manufacturer's standard air devices when shown of size, shape, capacity, type and accessories indicated on drawings and schedules, constructed of materials and components as indicated and as required for complete installation and proper air distribution.

B Provide air devices that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer's current data.

C Unless noted otherwise on drawings, the finish shall be #26 white. The finish shall be an anodic acrylic paint, baked at 315°F for 30 minutes. The pencil hardness must be HB to H. The paint must pass a 100-hour ASTM B117 Corrosive Environments Salt Spray Test without creepage, blistering, or deterioration of film. The paint must pass a 250-hour ASTM D870 Immersion Test. The paint must also pass the ASTM D2794 Reverse Impact Cracking Test with a 50 inch-pound force applied.

D Provide air device with border styles that are compatible with adjacent ceiling or wall system, and that are specially manufactured to fit into the wall construction or ceiling module with accurate fit and adequate support. Refer to architectural construction drawings and specifications for types of wall construction and ceiling systems.

E Provide integral volume damper with roll formed steel blades where indicated on drawings or schedules. Dampers shall be opposed blade design with a screwdriver slot or a concealed lever operator for adjustment through the face of the air device.

F Air devices designated for fire rated systems shall be pre-assembled with UL classified radiation damper and thermal blanket. Fire rated air devices shall be shipped completely assembled, one assembly per carton; each assembly shall be enclosed in plastic shrink wrap with installation instructions.

2.03 ACCEPTABLE MANUFACTURERS - LOUVERS

A Ruskin Manufacturing Company

B Greenheck Company

C Louvers and Dampers, Inc.

D Pottorff

E Arrow

2.04 LOUVERS

A Louvers not located in hurricane-prone regions or wind-borne debris regions shall meet the requirements of AMCA 500-L for Laboratory Methods of Testing Louvers for Rating and be drainable stationary type louvers.

B Louvers located in hurricane-prone regions shall meet the requirements of AMCA 550 for High Velocity Wind Driven Rain without the use of a control damper.

C Louvers located in wind-borne debris regions within 30 feet of grade shall meet the requirements of AMCA 540 for Large Missile Impact.

D Provide louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

E Provide louvers that have minimum free area and maximum pressure drop as indicated on drawings.

F Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to architectural construction drawings and specifications for types of substrate.

G Coordinate with Architect for finish and color.

H Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

PART 3 - EXECUTION

3.01 INSTALLATION

A All interior surfaces of all air devices shall be painted flat black.

B See floor plans for type, neck size and CFM of air for all air distribution devices.

C Install all air distribution devices as detailed on plans and in accordance with manufacturer's recommendations.

D The backside of all air devices shall be insulated with taped and sealed external duct wrap to match the insulation thickness and R-value of the ductwork connecting to the air device. Refer to 23 07 13 - Duct Insulation.

E Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

F If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

G Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

H Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

I Touch-up, repair or replace any damaged products prior to substantial completion.

END OF SECTION 23 37 13

SECTION 23 37 23 - HVAC GRAVITY VENTILATORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Hooded gravity ventilators.

B Louvered penthouse gravity ventilators.

1.03 RELATED SECTIONS

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 23 05 93 - Testing, Adjusting, And Balancing

C Section 23 33 00 - Ductwork Accessories

1.04 REFERENCES

A ASCE 7-10 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2010.

B ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; 2016.

C ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

E FLA (FBC-B) - Florida Building Code: Building (8th Edition); 2023, with Supplement (2024).

F ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

I Miami (APD) - Approved Products Directory; Miami-Dade County; Current Edition.

J NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.05 QUALITY ASSURANCE

A Approved ISO 9001 compliant manufacturer listed in this section with minimum 10 years' experience in manufacture of similar products in successful use in similar applications.

B Nationally Recognized Testing Laboratory Compliance (NRTL): Components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

C High Wind models shall be analyzed and stamped by a state license P.E. to the ASCE 7-16 Standard which meets the ICC (IBC), FLA (FBC-B) and Miami (APD) codes.

D Each High Wind model is subject to be certified by a Nationally Recognized Testing Laboratory to ASTM E330/E330M.

E Shutoff dampers shall be provided as required by ASHRAE Std 90.1 I-P and ICC (IECC).

1.06 SUBMITTALS

A General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B Product data for selected models, including specialties, accessories, and the following:

1. Dimensional drawings and product data on each ventilator.
2. Materials, gages and finishes, include color charts.
3. Dampers, including housings, linkages, and operators.
4. Full color paint samples.

C Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D Coordination drawings, in accordance with Division 23, Section "Basic Materials and Methods", for roof penetration requirements and for reflected ceiling plans drawn accurately to scale and coordinating penetrations and units mounted above ceiling. Show the following:

1. Roof framing and support members relative to duct penetrations.
2. Ceiling suspension members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.

E Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

F Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

G Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

H Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.07 DELIVERY, STORAGE, AND HANDLING

A Fans shall be stored and handled in accordance with the unit manufacturer's instructions.

B Lift and support units with the manufacturer`s designated lifting or supporting points.

C Disassemble and reassemble units as required for movement into the final location following manufacturer`s written instructions.

D Deliver fan units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.08 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Greenheck Fan Corporation

B Loren Cook Company

C Pennbarry

D ACME

E Twin City Fan and Blower

2.02 HOODED GRAVITY VENTILATORS

A Hooded gravity ventilators shall be aluminum construction unless noted otherwise.

B Hood shall be constructed of precision formed, arched panels with interlocking seams.

C Vertical end panels shall be fully locked into hood end panels.

D The aluminum base shall have continuously welded curb cap corners for maximum leak protection.

E Internal reinforcement and bracing shall be provided as required.

F Accessories: The following accessories are required.

1. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum wire.

2. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.

3. Roof Curbs: Prefabricated, minimum 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb height shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and ventilator base. Roof curb shall match roof slope so that the curb is level.

2.03 LOUVERED PENTHOUSE GRAVITY VENTILATORS

A Louvered penthouse gravity ventilators shall be aluminum construction unless noted otherwise.

B Ventilators shall be fabricated of extruded aluminum louvers with double rain-snow baffles, and cross-broke, removable, aluminum hood.

C The aluminum base shall have continuously welded curb cap corners for maximum leak protection.

D The ventilator cap shall be sloped with a minimum pitch of at least 1/8” per foot to prevent water from standing or pooling.

E Internal reinforcement and bracing shall be provided as required.

F Accessories: The following accessories are required.

1. Bird Screens: Removable ½ inch mesh, 16 gauge, aluminum wire.

2. Dampers: Gravity backdraft damper or motorized shutoff damper mounted in accessible location. Refer to 23 33 00 - Ductwork Accessories.

3. Roof Curbs: Prefabricated, minimum 12 inch high, heavy-gauge, galvanized steel; mitered and welded corners; 2 inch thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks; and 2 inch wood nailer. Curb height shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Size as required to suit roof opening and ventilator base. Roof curb shall match roof slope so that the curb is level.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C All items required for a complete and proper installation are not necessarily indicated on the plans or in the specifications. Provide all items required as per manufacturer's requirements.

D Ensure roof openings are square, accurately aligned, correctly located, and in tolerance prior to installation.

E Install the roof curb as required by the job conditions and as recommended by the manufacturer and install proper flashing and counterflashing. See details on the Drawings.

F Set ventilators in place, taking care to protect the adjacent roofing, and make all ductwork connections.

G Ventilator installation shall comply with NFPA 90A requirements.

END OF SECTION 23 37 23

SECTION 23 41 00 - AIR FILTERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC are included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for owner's use.

1.03 REFERENCES

A ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

PART 2 - PRODUCTS

2.01 FILTERS

A Air filters shall be high efficiency ASHRAE pleated panels consisting of synthetic media, welded wire media support grid, and beverage board enclosing frame, AAF PREpleat M13, 2-inch thick or approved equal.

B APPROVED MANUFACTURERS

1. American Air Filter.
2. Camfil.
3. Airguard Industries, Inc.
4. Cambridge.
5. Filtration Group

2.02 LOW VELOCITY FILTER SECTION

A Filters shall be of the throwaway cartridge type in 2-inch frames. When installing multiple filters into slide-in frames tape adjacent filters together with duct tape to prevent bypassing of air around the filter. Media shall be rated at 500 feet per minute.

B Filtering media shall be formed of non-woven reinforced synthetic type filtering media bonded to 96% open area media support grid folded into a non-creased radial pleat design. The filter pack shall be bonded to the enclosing frame to prevent air bypass. Minimum Efficiency Reporting Value of MERV 13 when evaluated under the guidelines of ASHRAE Std 52.2. Initial resistance shall not exceed 0.30 inches water gauge at 500 fpm face velocity.

PART 3 - EXECUTION

3.01 INSTALLATION

A Filters shall be provided upstream of all cooling coils or other devices with wetted surfaces through which air is supplied to occupiable spaces per ASHRAE Std 62.1.

B Install differential pressure switch to activate "Filter Dirty" light when pressure difference across filters reaches 0.5 inches w.g. (adjustable). Locate "filter dirty" lights in mechanical rooms with identifying label.

C Refer to Section 23 02 00 for additional filter information.

END OF SECTION 23 41 00

SECTION 23 55 00 - FUEL FIRED UNIT HEATERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A Gas fired unit heaters.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A Section 23 09 63 - Energy Management and Control System (EMCS): Installation of thermostats and other controls components.

B Section 26 29 26 - Miscellaneous Electrical Controls and Wiring: Installation and wiring of thermostats and other controls components.

1.03 RELATED SECTIONS

A Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping.23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

B Section 23 07 13 - Duct Insulation

1.04 REFERENCES

A ANSI Z223.1 - National Fuel Gas Code; 2024.

B ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2022.

C NFPA 31 - Standard for the Installation of Oil-Burning Equipment; 2024.

D NFPA 54 - National Fuel Gas Code; 2024.

E NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

G NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.

H ANSI/NEMA MG 1 - Motors and Generators.

1.05 SUBMITTALS

A Submit under provisions of Division 1.

B Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

C Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.06 OPERATION AND MAINTENANCE DATA

A Submit operation data under provisions of Division 1.

B Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

1.07 WARRANTY

A Provide (1) one year warranty under provisions of Division 1.

B Warranty: Include coverage for (5) five year, non-prorated warranty for heat exchangers and draft diverters.

PART 2 - PRODUCTS

2.01 UNIT HEATERS

A Acceptable Manufacturers

1. Reznor
2. Sterling HVAC
3. Modine Manufacturing Company

B Units: Self- contained, packaged, factory assembled, pre- wired unit consisting of cabinet, supply fan, heat exchanger, burner or heater, controls, air filter.

C Performance Ratings: Seasonal efficiency to ASHRAE Std 103.

D Venting System

1. Provide aluminized or type 409 stainless steel draft diverter assembly.
2. Provide horizontal vent connection.

E Refer to Schedule. Gas heating capacities are sea level ratings.

F Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

G Heat Exchanger: Aluminized steel welded construction.

H Combustion Chamber: welded stainless steel

I Supply Fan: Propeller type with direct drive.

J Burner:

1. Gas Burner: Atmospheric type with adjustable combustion air supply, combination gas valve and pressure regulator incorporating manual shut- off, pilot valve, automatic 100 percent shut- off and thermo- couple pilot safety device, electronic pilot ignition, automatic vent damper,] and draft diverter.

2. Gas Burner Safety Controls: Thermo- couple sensor prevents opening of solenoid gas valve until pilot flame is proven and stops gas flow on ignition failure.

K Burner Operating Controls:

1. Room thermostat: Cycles burner to maintain room temperature setting.

2. High Limit Control: Fixed stop at maximum permissible setting, de- energizes burner on high bonnet temperature and re- energizes when temperature drops to lower value.

3. Fan Control: Bonnet thermostat independent of burner controls, cycles supply fan, with manual switch for continuous fan operation.

L Operating Controls:

1. Room Thermostat: Low voltage, to control burner operation, to maintain temperature setting. Include fan control switch (auto-on).

M Accessories:

1. Discharge Louvers: Individually adjustable horizontal and vertical louvers to match cabinet finish.

2. Downturn Nozzle: 60 degree nozzle to match outlet and cabinet finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B Verify that proper power supply is available.

C Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A Install in accordance with manufacturer's instructions.

B Install to NFPA 90A and NFPA 90B.

C Install gas fired units to ANSI Z223.1 (NFPA 54).

D Install oil fired units to NFPA 31.

E Provide vent connections to NFPA 211.

F Install heaters with vibration isolation. Refer to Section 23 05 48.

END OF SECTION 23 55 00

SECTION 23 62 13 - AIR COOLED CONDENSING UNITS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC is included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.03 REFERENCES

A AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B AHRI 340/360 (I-P) - Standard for Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment; 2022.

C ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

D ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 QUALITY ASSURANCE

A Unit shall be factory tested, shall be UL-labeled and rated in accordance with AHRI 340/360 (I-P).

B Unit construction shall comply with ASHRAE Std 15.

C Unit wiring shall comply with NFPA 70.

D Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

1.05 SUBMITTALS

A Submit Shop drawings and product data under provisions of Division One.

B Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and accessories required for complete system.

C Product data shall include rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D Submit manufacturer's installation instructions.

E For roof mounted units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.06 OPERATION AND MAINTENANCE DATA

A Submit operation data.

B Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C Submit maintenance data.

1.07 DELIVERY, STORAGE AND HANDLING

A Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B Accept products on site and inspect for damage.

C Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.08 WARRANTY

A Provide the entire condensing unit with parts and labor warranty by the equipment manufacturer for one year from start-up or 18 months from date received on site.

B Provide all components of the refrigeration circuit with parts and labor warranty by the equipment manufacturer for five years.

1.09 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.

5. Most likely failure modes, causes and corrections.

6. On site demonstration.

PART 2 - PRODUCTS

2.01 AIR-COOLED CONDENSING UNITS

A Air-cooled condensing unit shall be designed for use with split system having a remote direct-expansion (DX) cooling coil mounted in evaporator fan unit and rated in accordance with either AHRI 210/240 or AHRI 340/360 (I-P). Capacity shall be as called for on the Drawings when matched to the appropriate evaporator coil.

B Condensing unit shall consist of high-efficiency hermetic compressor, air-cooled condenser with quiet fan, factory wired controls, R410A or R407C refrigerant and refrigeration circuit and valves.

C Cabinet shall be heavy-gauge galvanized steel with bonding primer and baked-enamel finish coat. The entire cabinet shall be protected from rust.

D Compressor shall be protected from excessive current and temperatures and shall be provided with a thermostatically controlled crankcase heater to operate only when needed for protection of the compressor. Compressor shall be mounted on resilient rubber isolators. Compressor shall be located in compartment isolated from condenser fan and coil. Provide a high-capacity dryer in the system to remove moisture and dirt.

E Condenser fan shall be directly connected to a weather-protected, quiet, high-efficiency motor. Fan guard shall be provided and shall be protected from rust by PVC finish. Condenser coil shall be aluminum fin with copper tube.

F Connections for refrigerant suction and liquid lines shall be extended outside the cabinet and provided with service valves with gauge connections.

G Power connections shall be made to the connectors located inside the electrical connection box.

H Standard operating and safety controls shall include high-pressure switch, low pressure switch, compressor overload service, and solid-state timed-off control.

2.02 AUXILIARY EQUIPMENT

A Auxiliary equipment shall consist of refrigerant lines prepared for the unit involved. These lines shall be cleaned, dried, and pressurized at the factory.

B Low ambient kit to allow operation at outside temperature below 35 deg. F (2 deg. C) shall be provided.

C Expansion valve shall be provided with the evaporator coil.

D Provide thermostat to match the requirements of the job. Thermostat shall provide subbase with Heat-Cool-Off and Fan On-Auto switch. See section on controls for other related requirements.

E Provide polyethylene structural base designed for that service, and intended to support the unit and eliminate vibration transmission.

F Provide hard-start kit with unit.

G Provide guards for condenser coils.

2.03 ACCEPTABLE MANUFACTURERS

A Carrier

B Trane

C Daikin

PART 3 - EXECUTION

3.01 INSTALLATION

A All HVAC equipment shall be installed as per manufacturer's printed installation instructions.

B Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C All items required for a complete and proper installation are not necessarily indicated on the Drawings or in the Specifications. Provide all items required as per manufacturer's requirements.

D Install the condensing unit on proper foundation as shown on the Drawings, and in location that will not restrict the air entry or discharge from the unit.

E Install refrigerant lines as recommended by the manufacturer, taking care not to lose the refrigerant charge contained in the lines, or allow air to enter the lines or equipment. Locate the lines in such a way as to not obstruct access to the condensing unit or other equipment. Lines located underground or under concrete shall be installed in a PVC sleeve for protection.

F Provide electrical connections as required by the applicable codes. Provide control wiring required. All power wiring and control wiring shall be in conduit and located so as not to obstruct access to the unit or other equipment.

3.02 TESTING

A Operate the condensing unit and the system to assure that unit is operating properly and without excessive noise and vibration.

B Read and record the power draw and the refrigeration suction and liquid pressures as required by Section 23 05 93 - Testing, Adjusting, And Balancing.

END OF SECTION 23 62 13

SECTION 23 74 16 - ROOFTOP HEATING AND COOLING UNITS (ELECTRIC COOLING - GAS HEATING)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 SCOPE

A Scope of the Work shall include the furnishing and complete installation of the equipment covered by this Section, with all auxiliaries, ready for Owner's use.

1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A Section 23 09 63 - Energy Management and Control System (EMCS)

1.04 RELATED SECTIONS

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 230513

C Section 230526

D Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

E Section 23 05 93 - Testing, Adjusting, And Balancing

F Section 23 33 00 - Ductwork Accessories

G Section 23 41 00 - Air Filters

1.05 REFERENCES

A AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015, with Addendum (2016).

C AHRI 340/360 - Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment; 2019.

D AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addenda (2011).

E AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

F AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

G ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2022, with Addendum (2024).

H ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

1.06 QUALITY ASSURANCE

A Unit shall be factory-charged and tested, shall be UL-labeled and certified by AHRI 210/240 or AHRI 340/360 and shall be AGA-certified.

B Unit shall comply with ASHRAE Std 15.

C Unit shall meet or exceed minimum efficiency requirements in accordance with ICC (IECC) and ASHRAE Std 90.1 I-P.

D Unit shall be rated for sound performance in accordance with AHRI 270 and AMCA 300.

E Coil performance shall be certified in accordance with AHRI 410.

F Insulation and insulation adhesive shall comply with NFPA 90A requirements or flame spread and smoke generation.

1.07 SUBMITTALS

A Submit Shop drawings and product data under provisions of Division One.

B Shop drawings shall indicate components, dimensions, weights, required service clearances, and location and sizes of field connections. Indicate equipment, piping and connections and valves required for complete system.

C Product data shall include rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

D Provide fan curves with specified operating point clearly identified.

E Submit manufacturer's installation instructions.

F Provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.08 OPERATION AND MAINTENANCE DATA

A Submit operation data.

B Include start-up instructions, maintenance data, controls, and accessories. Include trouble-shooting guide.

C Submit maintenance data.

1.09 DELIVERY, STORAGE AND HANDLING

A Deliver, store, protect and handle products to site. Comply with manufacturer's installation instructions for rigging, unloading and transporting units.

B Accept products on site and inspect for damage.

C Protect units from physical damage. Factory shipping covers and skids shall be kept in place until installation. Store in a clean dry place and protect from weather and construction traffic.

1.10 WARRANTY

A Provide a full parts and labor warranty by the equipment manufacturer for one year from start-up or 18 months from shipment, whichever occurs first.

B Provide five-year warranty by the equipment manufacturer for compressors parts and labor.

1.11 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ROOFTOP UNITS

A Rooftop unit shall be packaged and include electric cooling and gas-fired heat, with capacity and modulating cooling and heating as shown on the drawings.

B Unit casing shall be heavy-gauge galvanized steel or heavy-gauge aluminum with protective coat of baked enamel. Weatherproof access panels shall be provided for access to all parts requiring service.

C Compressor(s) shall be hermetic scroll type and shall be resiliently mounted to avoid vibration and noise. Compressor shall be provided with anti-slugging protection, crankcase heater, and time delay on recycling of the compressor. Two internal compressor motor thermal cutouts and a hot gas cutout shall protect the compressor in addition to high-pressure and low-pressure safeties. Standard controls shall permit operation down to 35 deg. F (2 deg. C), and compressor shall be locked out below this temperature.

D Condenser fan(s) shall be direct-driven and shall be designed for operation exposed to the weather.

E Condenser coils shall have a sub-cooling section.

F Refrigerant circuit shall include filter dryer, moisture indicator, sight glass, and gauge ports.

G Filter rack shall be provided for filters 2 in. thick and shall filter both outdoor air and return air. See Section 23 41 00 - Air Filters for type of filters, and the number of filter changes to be furnished with the equipment.

H Evaporator fan shall be quiet-type centrifugal blower, directly connected to an adjustable-speed motor or belt driven with an adjustable-pitch pulley on the motor.

I Heat exchanger shall be aluminized steel, designed for long life and quiet operation. Burner shall provide dependable and quiet ignition in the stages as called for.

J Gas burner controls shall provide automatic safety pilot, dual automatic gas valves, manual gas cock, and pressure regulator. Ignition shall be electric for the intermittent pilot with 100% shutoff when the unit is off.

K Induced draft blower shall provide pre-purge and shall be provided with a proving switch to prevent burner operation if venter is not in operation.

L Provide fan switch and limit control to delay the fan until heat is available and to continue fan operation until heat is dispersed. Limit switch shall shut the burner down in case of failure of operating controls.

M The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Std 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection.

2.02 ELECTRICAL

A Unit wiring shall comply with NFPA 70 requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. Unit shall have a minimum short circuit current rating (SCCR) of 10,000 AIC. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

2.03 ACCESSORY EQUIPMENT

A Unit shall be provided with hot gas reheat option for dehumidification. Hot gas reheat coil shall be located on the leaving air side of the evaporator coil and fully piped and circuited at the factory.

B Condenser coil hail guards shall be provided.

C A prefabricated heavy gauge galvanized steel, mounting curb shall be provided for field assembly on the roof decking prior to unit shipment. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Curb height shall be increased as required to maintain a minimum height of 8 inches above adjacent roofing surface. Gasket shall be provided for field mounting between the unit base and roof curb.

D Provide economizer dampers and controls to provide "free cooling" from 0 to 100% outdoor air (OA) when the outside air humidity and temperature are acceptable. Provide OA, return air, and relief air dampers in a factory-provided enclosure. All air shall be filtered and bird screen shall be installed. Dampers shall have an air leakage rate not greater than 4 cfm/ft^2 of damper surface area at 1.0 in.w.g. and shall be labeled by an approved agency when tested in accordance with AMCA 500-D for such purpose.

E A solid-state enthalpy changeover control shall determine the capability of the outside air to provide free cooling. The control package shall include a differential enthalpy sensor in the return air duct to compare the enthalpy of the outside air and return air and use the air with the lowest enthalpy for free cooling or assisting the mechanical cooling. The cooling control sequence is as follows:

1. The changeover control determines if the outdoor air is suitable for free cooling.

2. The space thermostat determines if cooling is needed in the building. If so,

3. The actuator modulates the outdoor air and return air dampers to maintain the desired mixed air temperature.

4. The second cooling stage of the space thermostat energizes the compressor to assist the economizer if required.

5. If the outdoor air is not suitable for free cooling, the outdoor air damper remains in the minimum ventilation position and the compressor is energized when space cooling is required.

F Provide a warm-up thermostat to prevent the OA dampers from opening if the return air temperature is below the set point (65 deg. F) (18 deg. C).

G Provide necessary controls for operation of the compressor below the normal temperature of the compressor cutout. Operation shall be permitted down to temperature specified on Drawings.

H Provide factory-trained service person to check out the system, calibrate the controls, and see that the RTU is operating properly. The service person making the settings shall make a written report to the Engineer and the Owner with all set points listed for future reference.

I Rooftop units mounted on slabs or other fixed locations shall be provided with adapters for end discharge and return to the unit.

J Provide programmable combination thermostat/humidistat and other controls required to produce the control functions called for.

K Manufacturer shall provide BACnet interface card for communication with EMCS.

2.04 ACCEPTABLE MANUFACTURERS

A Carrier

B Lennox

C Trane

D York

E Aaon

F Daikin

PART 3 - EXECUTION

3.01 INSTALLATION

A Install the curb as required by the job conditions and as recommended by the manufacturer, and install proper flashing and counterflashing. See details on the Drawings.

B Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

C Set the unit in place, taking care to protect the adjacent roofing, and connect the supply and return ductwork.

D Make electrical and gas line connections, taking care that these do not block access to any part of the equipment requiring service.

E Unit wiring shall comply with NFPA 70 and all applicable UL standards.

F Connect full size condensate drain pipe to roof top unit and extend to nearest drain.

G Unit installation shall comply with NFPA 90A requirements.

3.02 MANUFACTURER START-UP SERVICES

A Provide authorized representative of the manufacturer to inspect the assembly and installation of each unit. Perform no start-up, tests, or adjustments on a unit until the representative determines that the unit has been properly assembled and installed.

B The representative shall start-up, test, and adjust units. The representative shall perform operational checks to make certain that all equipment and controls of the systems are operating properly. If defects or improper adjustments are found, they shall be corrected and tests repeated.

C The representative shall prepare and provide a written start-up report to include any measurements taken, test results obtained, or corrective actions required.

D In addition to start-up, the manufacturer's representative shall attend a separate meeting on-site with the EMCS contractor to coordinate and execute programming between the packaged equipment controls and the EMCS.

3.03 BALANCING AND TEST

A Operate the roof top unit and check for proper supply air quantity, noise, and proper operation.

B Report the airflow, static pressure, voltage and current draw of each item, refrigerant pressure readings, etc., as required by Section 23 05 93 - Testing, Adjusting, And Balancing. This system is not complete until these readings have been made, submitted to the engineer, and accepted.

END OF SECTION 23 74 16

SECTION 23 81 26 - SPLIT SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

1.02 WORK INCLUDED

A Indoor air conditioning units with microprocessor-based controls.

B Outdoor remote mounted air-cooled condensing units

C The system shall have a total cooling capacity and a sensible cooling capacity as indicated in the Mechanical Schedules.

D The unit is to be supplied for operation on a power supply as indicated in the Mechanical Schedules and the Electrical drawings.

1.03 RELATED SECTIONS

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 23 05 29 - Hangers and Supports for Piping and Equipment - HVAC

C Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

D Section 23 07 19 - HVAC Piping Insulation

E Section 23 41 00 - Air Filters

F Section 23 05 93 - Testing, Adjusting, And Balancing

G Section 23 21 13 - Above Ground Hydronic Piping

1.04 REFERENCES

A AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016, with Errata (2018).

C AMCA 300 - Reverberation Room Methods of Sound Testing of Fans; 2024.

D AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2022.

E ISO 9001 - Quality Management Systems — Requirements; 2015, with Amendment (2024).

F NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

H NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

I UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

J UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.05 QUALITY ASSURANCE

A The unit shall be approved and listed by Underwriters' Laboratories, Inc. Unit performance shall be certified in accordance with AHRI 210/240.

B The specified system shall be factory-tested before shipment. Testing shall include, but shall not be limited to: Quality Control Checks, "Hi-Pot" Test (two times rated voltage plus 1000 volts, per NRTL agency requirements), and Metering Calibration Tests. The system shall be designed and manufactured according to world-class quality standards. The manufacturer shall be ISO 9001 certified.

C System shall be supplied with CSA Certification to the harmonized U.S. and Canadian product safety standard CSA C22.2 No 236/UL 1995 for "Heating and Cooling Equipment" and marked with the CSA c-us logo (60Hz only).

D UL Compliance: Fans shall be designed, manufactured, and tested in accordance with UL 705.

E UL Compliance: Fans and components shall be UL listed and labeled.

F Nationally Recognized Testing Laboratory Compliance (NRTL): Fans and components shall be NRTL listed and labeled. The term "NRTL" shall be as defined in OSHA Regulation 1910.7.

G NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

H Electrical Component Standard: Components and installation shall comply with NFPA 70.

I Sound Power Level Ratings: Comply with AMCA 301. Test fans in accordance with AMCA 300. Fans shall be licensed to bear the AMCA Certified Sound Ratings Seal.

J Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings in accordance with AMCA 210.

1.06 SUBMITTALS

A General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections:

B Product data for selected models, including specialties, accessories, and the following:

1. Certified fan performance curves with system operating conditions indicated.

2. Certified fan sound power ratings.

3. Motor ratings and electrical characteristics plus motor and fan accessories.

4. Materials, gages and finishes, include color charts.

C Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.

D Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer installed wiring and field installed wiring.

E Product certificates, signed by manufacturer, certifying that their products comply with specified requirements.

F Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 and Division 23, Section "Basic Materials and Methods".

G For roof mounted outdoor units provide delegated design submittal for equipment anchorage as required in specification 23 02 00 – Part 1.

1.07 DELIVERY, STORAGE, AND HANDLING

A Equipment shall be stored and handled in accordance with the unit manufacturer’s instructions.

B Lift and support units with the manufacturer's designated lifting or supporting points.

C Disassemble and reassemble units as required for movement into the final location following manufacturer's written instructions.

D Deliver units as a factory-assembled unit to the extent allowable by shipping limitations, with protective crating and covering.

1.08 ENVIRONMENTAL REQUIREMENTS

A Do not operate units for any purpose, temporary or permanent, until filters are in place, bearings lubricated, refrigeration piping has been tested and charged and fan has been test run under observation.

1.09 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.

2. Principle of how the equipment works.

3. Important parts and assemblies.

4. How the equipment achieves its purpose and necessary operating conditions.

5. Most likely failure modes, causes and corrections.

6. On site demonstration.

1.10 WARRANTY

A Provide a full parts, labor, and refrigerant warranty by the equipment manufacturer for one year from start-up or 18 months from shipment, whichever occurs first.

B Provide a full parts warranty by the equipment manufacturer for five years, effective from date of factory start-up and certification.

C Provide a compressor parts warranty by the equipment manufacturer for seven years, effective from date of factory start-up and certification.

PART 2 - PRODUCTS

2.01 GENERAL

A Provide an indoor wall-mounted, factory assembled, pre-charged, pre-wired, tested and ready to operate air conditioning unit.

2.02 APPROVED MANUFACTURERS

A Daikin

B Trane/Mitsubishi

C York/JCI

2.03 WALL-MOUNTED INDOOR UNIT

A GENERAL

1. The unit shall be a wall-mounted style indoor unit with outlet vane and return inlet grille. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, electronic modulating linear expansion device, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function, a test run switch, and the ability to adjust airflow patterns. Indoor unit and refrigerant pipes shall be charged with dehydrated air before shipment from the factory.

B UNIT CABINET

1. The cabinet shall be formed from high strength molded high impact, non-metallic material with smooth finish, flat front panel design with access for filter. Cabinet color shall be white. The unit shall be wall mounted by means of a factory supplied, pre-drilled, mounting plate.

2. The cabinet shall be designed so all components are easily accessible for service and maintenance through either the front or rear of the unit. Units that are not fully accessible from front and rear or not serviceable in place shall be unacceptable.

C FAN AND AIR DISTRIBUTION

1. The air distribution system shall be constructed with a quiet, cross flow direct-drive fan assembly. The single fan motor shall be high-efficiency type, equipped with permanently lubricated bearings. The fan shall be capable of a minimum of three speeds for airflow modulation (High, Med, Low) and Sleep. Dehumidification shall utilize the lower fan speed.

2. Unit shall be provided with an integral, motorized, multi-position, air sweep vane to provide uniform, adjustable vertical air distribution. Air sweep vane operation shall be user selectable using the unit controller.

3. Unit shall be provided with a manually adjustable guide vane for horizontal air distribution.

D FILTER

1. The filter shall be an integral part of the system, located within the cabinet and serviceable from the front. The filters shall be half-inch thick, washable type.

E COIL

1. The indoor coil shall be of nonferrous construction with smooth plate fins on copper tubing.

2. The tubing shall have inner grooves for high efficiency heat exchange.

3. All tube joints shall be brazed with phos-copper or silver alloy.

4. The coils shall be pressure tested at the factory.

5. A condensate pan and drain shall be provided under the coil.

6. The unit shall be provided with an integral condensate lift mechanism that will be able to raise drain water 33 inches above the condensate pan.

7. Both refrigerant lines to the indoor units shall be insulated.

F ELECTRICAL

1. The unit electrical power shall be 208/230 volts, 1-phase, 60 hertz.

2. The system shall be equipped to allow the indoor unit to be powered directly from the associated outdoor unit using 3-wire, 14 gauge AWG connections plus ground.

2.04 MICROPROCESSOR CONTROL

A The control system shall be microprocessor-based, factory-wired into the system and tested prior to shipment. The wall-mounted control enclosure shall be 4.75" x 4.75" and white in color with include a light-blue LCD providing continuous display of operating status and alarm condition. There shall be a built-in weekly schedule with up to 5 scheduled event settings per day.

B A 5-key membrane keypad for setpoint/program control, increase/decrease temperature set point, fan speed selection and unit operation mode shall be located below the display. The controller shall have a built-in temperature sensor. Temperature shall be displayed in either Fahrenheit (°F) or Celsius (°C), and Temperature changes shall be by increments of ±3.6°F (±2°C).

C The control display shall be field-wired to the control board using factory-supplied thermostat wire with plugs. The control voltage from the wired controller to the indoor unit shall be 12 volts, DC. Field wiring shall run directly from the indoor unit to the wall mounted controller with no splices. Communication cable can be extended to a maximum of 164 feet, between controller and indoor unit.

D The control shall be able to be programmed for a temperature set point between 64 - 86°F (18 - 30°C) with a sensitivity of ±3.6°F (±2°C).

E The control system shall prevent compressor short-cycling by a 3-minute timer from compressor stop to the next start.

F For startup after power failure, the system shall provide automatic restart with a programmable (up to 9.9 minutes in 6-second increments) time delay. Programming can be performed at the wall mounted controller.

G The control system shall monitor unit operation and activate a visual alarm in the event of an alarm condition.

H Unit controls shall be capable of interfacing the EMCS via BACnet communication protocol. If BACnet protocol is not a native communication protocol to the factory controls, then a separate gateway shall be provided as required.

2.05 OUTDOOR AIR-COOLED PROP FAN CONDENSING UNIT

A Condensing unit components shall include a condenser coil, a brush-less digitally controlled variable propeller-type fan, an inverter driven twin rotary compressor, electronic expansion valve, 4-way reversing valve.

B All components shall be factory-assembled, charged with R-410A refrigerant and sealed. No internal piping, brazing, dehydration or charging shall be required.

C The condenser coil shall be constructed of copper tubes and aluminum fins.

D The condensing unit shall be designed to operate at a sound level less than 57 dBA.

E The casing shall be constructed from galvanized steel plate, finished with a white electrostatically applied, thermally fused acrylic or polyester powder coating for corrosion protection. Mounting feet shall be provided and shall be welded to the base of the cabinet and be of sufficient size to afford reliable equipment mount and stability. Easy access shall be afforded to all serviceable parts by means of removable panel sections. The fan grill shall be constructed of polypropylene.

F The condensing unit shall be furnished with a single DC fan motor. The fan blade shall be of aerodynamic design for quiet operation, and the fan motor bearings shall be permanently lubricated. The outdoor unit shall have horizontal discharge airflow. The fan shall be mounted in front of the coil, pulling air across it from the rear and dispelling it through the front. The fan shall be provided with a raised guard to prevent external contact with moving parts.

G The condensing unit coil shall be of copper tubing with louvered aluminum fins. The coil shall be protected with an integral metal guard. The coil shall have an anti-corrosive coating designed to prevent natural surface corrosion of the aluminum fins, maintaining heat transfer properties of the coil and extending service life. Refrigerant flow from the condenser shall be controlled by means of an electronic expansion valve (EEV) metering device. The EEV shall be controlled by a microprocessor step motor.

H The compressor shall be a DC twin-rotor rotary compressor with Variable Speed Inverter Drive Technology. The compressor shall be driven by inverter circuit to control compressor speed. The compressor speed shall dynamically vary to match the room load for significantly increasing the efficiency of the system which shall result in significant energy savings. To prevent liquid from accumulating in the compressor during the off cycle, a minimal amount of current shall be automatically, intermittently applied to the compressor motor windings to maintain sufficient heat to vaporize any refrigerant. No crankcase heater is to be used. The outdoor unit shall have an accumulator and high-pressure safety switch. The compressor shall be mounted to avoid the transmission of vibration.

2.06 ACCESSORIES

A The unit shall be provided with a wind baffle low ambient operation kit. The wind baffle shall be constructed on 20 gauge sheet metal and painted to prevent corrosion. Unit shall be able to provide 100% capacity when operating at 0ºF outdoor air temperature and a wind baffle is used.

B The unit shall be provided with a cooling coil condensate pump. The condensate pump shall be complete with integral float switch, pump, motor assembly and reservoir.

C The unit shall be provided with a BACnet gateway for integration with the EMCS.

PART 3 - EXECUTION

3.01 INSTALLATION OF AIR CONDITIONING UNIT

A General

1. Install air conditioning unit in accordance with manufacturer's installation instructions. Install unit plumb and level, firmly anchored in location indicated, and maintain manufacturer’s recommended clearances.

2. Refer to specification 23 02 00 – Part 1 for anchorage requirements for roof mounted equipment.

3. Install unit and all field mounted accessories in accordance with NFPA 90A and NFPA 90B.

B Electrical Wiring

1. Install and connect electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s electrical connection diagram submittal to electrical contractor. Install and wire per local and national codes.

C Piping Connections

1. Install and connect devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer’s piping connection diagram submittal to piping contractor.

D Drain Water Piping

1. Connect drain line to air conditioning unit. Unit drain shall be trapped internally.

E Field-Supplied Pan

1. A field-supplied pan with drain shall be installed beneath cooling units installed above a ceiling and heat pumps.

3.02 FIELD QUALITY CONTROL

A Startup air conditioning unit in accordance with manufacturer’s startup instructions. Test controls and demonstrate compliance with requirements. Provide system start-up services by manufacturer’s authorized service representative confirming all system equipment and components have been installed in accordance with the manufacturer’s written instructions. Provide formal report for engineer and owner review and approval.

END OF SECTION 23 81 26

SECTION 23 82 39 - ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A Electric unit heaters.

1.02 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Section 23 02 00 - Basic Materials and Methods for HVAC shall be included as a part of this Section as though written in full in this document.

C The scope of the work shall include the furnishing and complete installation of the equipment covered by this section, with all auxiliaries, ready for owner's use.

1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A Section 23 09 63 - Energy Management and Control System (EMCS): Installation of thermostats and other controls components.

B Section 26 29 26 - Miscellaneous Electrical Controls and Wiring: Installation and wiring of thermostats and other controls components.

1.04 RELATED SECTIONS

A Section 23 02 00 - Basic Materials and Methods for HVAC

B Section 230513

1.05 REFERENCES

A NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2024.

C UL 1278 - Movable and Wall- or Ceiling-Hung Electric Room Heaters; 2014.

D UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

E UL 2021 - Fixed and Location Dedicated Electric Room Heaters; Current Edition, Including All Revisions.

1.06 QUALITY ASSURANCE

A Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL 1995, UL 1278, and UL 2021 as applicable), Intertek (ETL), or other third-party national recognized testing laboratory acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

1.07 DELIVERY, STORAGE AND HANDLING

A Unit shall be stored and handled per unit manufacturer’s recommendations.

1.08 SUBMITTALS

A Submit shop drawings and product data under provisions of Division One.

B Submit shop drawings indicating components, assembly, dimensions, weights, and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and electronic valves required for complete system.

C Submit product data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

D Manufacturer's Installation Instructions: Indicate rigging, assembly, and installation instructions.

1.09 WARRANTY

A Provide manufacturer’s warranty one-year parts and labor warranty.

1.10 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Q-mark

B Reznor

C Modine Manufacturing Company

D TPI Corporation (Markel, Raywall, Redd-i)

2.02 CABINET

A Construct casing of 18 gage steel and threaded pipe connections for hanger rods.

B The control enclosure compartment factory installed to the bottom of heater shall be provided with hinged and latched access door that opens from bottom to simplify wiring installation and maintenance.

C Provide discharge louvers which are adjustable in both horizontal and vertical directions. Provide baked enamel finish to louvers.

2.03 FAN

A Manufacture fan blades from anodized aluminum.

B Provide quiet, propeller-blade fan, connected directly to drive motor.

C Statically and dynamically balanced fans and equip with substantial fan guard.

D Horizontal models with permanently lubricated sleeve bearings.

E Vertical models with grease lubricated ball bearings.

2.04 MOTOR

A Motors shall be totally enclosed, permanently lubricated, and thermally protected.

B Motor shall be factory wired to control enclosure compartment.

C Both motor and fan blade shall be factory installed within heater casing on rubber isolators to minimize vibration and noise.

2.05 ELECTRIC HEATING ELEMENTS

A Element shall consist of a nickel-chromium resistance wire surrounded with magnesium oxide and sheathed in steel spiral-finned tubes.

B Elements shall have kilowatt rating as scheduled in drawings.

2.06 THERMAL OVERLOAD PROTECTION

A Equip heaters with auto reset thermal overloads that are sealed to prevent moisture to enclosure.

B Thermal overload protection shall shut down element and motor if safe operating temperatures are exceeded.

2.07 CONTROLS

A Provide heaters with 24-volt transformer and control circuit, NEC required fusing, power-on indicator, thermostat with stainless steel capillary sensor and three position switch factory-installed and wired in the control enclosure compartment to the terminal block for ease of wiring.

B Thermostat shall be field adjustable from 40 to 70°F.

2.08 MOUNTING HARDWARE

A Provide with universal mounting bracket and all necessary accessory hardware.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify that space is ready for installation of units as indicated on shop drawings.

B Verify that proper power supply is available.

3.02 INSTALLATION

A Install unit heaters in accordance with manufacturer's instructions.

B Install unit heaters in accordance with NFPA 70 and NFPA 90B.

END OF SECTION 23 82 39

SECTION 26 02 00 - BASIC MATERIALS AND METHODS FOR ELECTRICAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.02 SCOPE OF WORK

A The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning electrical system shall be considered a part of the overall "Scope".

H The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.03 RELATED SECTIONS

A General Conditions

B Supplementary Conditions

C Division One

1.04 COOPERATION WITH TRADES

A Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.05 REFERENCES

A National Electrical Code (NEC)

B American Society for Testing and Materials (ASTM)

C Underwriter's Laboratories, Inc. (UL)

D Insulated Cable Engineer's Association (ICEA).

E National Electrical Manufacturer's Association (NEMA).

F Institute of Electrical and Electronic's Engineers (IEEE).

G American National Standards Institute (ANSI).

H National Fire Protection Association (NFPA).

I International Energy Conservation Code (IECC).

1.06 COMPLETE FUNCTIONING OF WORK

A All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.

2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.07 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.08 CONTRACTOR'S QUALIFICATIONS

A An approved contractor for the work under this division shall be:

1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.

2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.09 DATE OF FINAL ACCEPTANCE

A The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.

2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.

6. Identification of each item of material or equipment matching that indicated on the Drawings.

7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.

8. Additional information as required in other Sections of this Division.

9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B Refer to Division 1 for additional information on shop drawings and submittals.

C Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H Furnish detailed shop drawings, descriptive literature, table of contents listing all items being submitted at the beginning of each submittal package, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

1. Distribution Panelboards

2. Panelboards

3. Wiring Gutters

4. Heavy Duty Disconnect Switches

5. Lighting Fixtures

6. Lighting Contactors
7. Time Clocks
8. Lighting Control System
9. Photocells
10. Wiring Devices and Plates
11. Conduit and Fittings
12. Wire
13. Emergency Generator
14. Automatic Transfer Switches
15. Fire Alarm System
16. Surge Protection Devices (SPD)
17. Lightning Protection

I Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

    a. Wall and type locations.

    b. Clearances for installing and maintaining insulation.

    c. Locations of light fixtures and sprinkler heads.

    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

    e. Equipment connections and support details.

    f. Exterior wall and foundation penetrations.

    g. Routing of storm and sanitary sewer piping.

    h. Fire-rated wall and floor penetrations.

    i. Sizes and location of required concrete pads and bases.

    j. Valve stem movement.

    k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26.

B The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY: _____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY: _____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in “D ring type” binders by National model no. 79-883 or equal, binders shall be large enough to allow 1/4” of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and ed for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.

2. Fault Current calculations and Coordination Study.

3. Reviewed shop drawing submittals with exceptions noted compliance letter.

4. Fabrication drawings.

5. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.

6. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

7. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.

8. Equipment name plate data.

9. Wiring diagrams.

10. Exploded parts views and parts lists for all equipment and devices.

11. Color coding charts for all painted equipment and conduit.

12. Location and listing of all spare parts and special keys and tools furnished to the Owner.

13. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner’s risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney’s fees arising out of or resulting thereof.

B Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data’s creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C When transferring documents in electronic media format, Engineer makes no representations as to the long-term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D Any reuse or modifications will be Contractor’s sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect’s written consent.

1. It is agreed that “MEP” hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for “record purposes”, then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD’s. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner’s request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a “.rvt” or “.dwg” format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.

2. Alternate equipment must be equal from the standpoint of materials, construction and performance.

3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.02 PRODUCT LISTING

A Products used on this project shall be listed by Underwriters' Laboratories.

2.03 ACCESS DOORS

A Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.

2. Ceramic Tile Surfaces: Milcor Style M.

3. Drywall Surfaces: Milcor Style DW.

4. Install panels only in locations approved by the Architect.

2.04 EQUIPMENT PADS

A Provide 4-inch-high concrete pads for indoor floor mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Top and sides of pads shall be troweled to a smooth finish, equivalent to the floor. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

B Provide 6-inch-high concrete pads for all exterior mounted equipment. Pads shall conform to the shape of the equipment with a minimum of 6 inch beyond the equipment. Provide a 4-foot monolithic extension to the pad in front of the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.) Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise.

C Provide a minimum 6-inch-high, steel reinforced concrete pad for generators. Pads shall be sized 6” larger that the outside perimeter dimensions. Provide a 4-foot monolithic extension to the pad around the equipment for service when mounted on a non-finished area (i.e. landscape, gravel, clay, etc.). Refer to structural details. Top and sides of pads shall be troweled to a smooth finish. External corners shall be bullnosed to a 3/4" radius, unless shown otherwise. The generator shall be bolted to the concrete pad per the manufacturers details.

D Provide steel reinforced concrete pad for utility transformers. Pads shall comply with Utility Company Standards.

2.05 ESCUTCHEONS

A Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.06 SPACE LIMITATIONS

A Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.07 PAINTING

A All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.08 ELECTRICAL SYSTEM IDENTIFICATION

A Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Indicate voltage for that raceway. Locate markers at ends of conduit runs, on pull boxes, on junction boxes, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors, or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit. Switch-leg conduit and short branches for power connections do not have to be marked, except where conduit is larger than ¾ inch. Branch circuit conduits, junction boxes and pull boxes shall be marked with a permanent marker indicating panel name and branch circuit numbers.

B Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way. Provide black back plate with white letters and numbers for normal equipment. Provide red back plate with white letters and numbers for optional emergency equipment. Provide yellow back plate with white letters and numbers for Life safety equipment.

2. A black-white-black laminated plastic engraved identifying nameplate shall be secured by stainless steel screws to each automatic transfer switch, switchboard, distribution panel, motor control center, motor starter panels and panelboards.

    a. Identifying nameplates shall have ¼ inch high engraved letters and shall contain the following information:

        1) Name

        2) Voltage

3) Phase

4) "3" or "4" wire, and

5) Where it is fed from.

b. An example of a panelboard nameplate is:

Center Panel – 1HB

480/277 volt, 3 phase, 4 wire

Center Fed from DP2

c. An example of an automatic transfer switch nameplate is:

Center ATS #2

480/277 volt, 3 phase, 4 wire, 4 pole

Center Fed from MSB and DPE

3. Each feeder device in a switchboard, distribution panel, and motor control center device shall have a nameplate showing the load served in ½ inch high engraved letters.

4. A black-white-black laminated plastic engraved identifying nameplate shall be secured by screws to each transformer, safety switch, disconnect switch, individual motor starter, enclosed circuit breaker, wireway, and terminal cabinet.

a. Identifying nameplates shall have 1/4 inch high engraved letters and shall indicate the equipment served.

b. An example of a disconnect switch is: AHU-1.

5. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.

6. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.

7. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed. Tags shall convey the message, example: "DO NOT OPEN THIS SWITCH WHEN BURNER IS OPERATING."

D Identification of Wiring Devices

1. Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the inside face of the coverplate for all recessed mounted devices and on the outside face of the coverplate on all surface mounted devices.

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING

A Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.02 WORKMANSHIP AND CONCEALMENT

A The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.

2. Where exposure is necessary to the proper function.

3.03 SLEEVES, CUTTING AND PATCHING

A This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B Contractor shall install underground raceways including but not limited to feeders, service laterals, branch circuit and telecommunications. Contractor shall saw cut existing hard surfaces, when required for installation. Contractor shall patch surface to match existing conditions. Contractor shall replace all landscaping material when raceways are installed in these areas. Submit proposed method for patching for review.

C All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

D All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by "3M" or approved equal.

E Refer to 26 05 33 for additional requirements.

3.04 ELECTRICAL GEAR

A Install all electrical equipment in accordance with the National Electrical Code and as shown on the drawings.

B Lighting contactors, time clocks, fire alarm equipment, security equipment disconnect switches, etc. mounted in mechanical/electrical rooms shall be mounted at a working height not requiring a ladder, when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

C Fire retardant back boards secured to drywall studs may be used for contactors, time clocks, fire alarm equipment, security equipment, and disconnect switches 60 amp or smaller. All other wall mounted devices shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

3.05 CLEANING

A Clean lighting fixtures and equipment.

B Touch-up and refinish scratches and marred surfaces on panels, switches, starters, and transformers.

3.06 CORROSIVE AREAS

A In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.07 TESTS AND INSPECTIONS

A Tests and inspection requirements shall be coordinated with Division I.

B Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E Final Inspection:

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.

2. Panelboards, switches, fixtures, etc., shall be cleaned and in operating condition.

3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.

4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.

5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

F The contractor shall provide a thermographic test using an independent testing laboratory using an infrared scanning device. This test shall include but not limited to all switchboards, distribution panelboards, panelboards, automatic transfer switches and other electrical distribution devices. This test shall be conducted to locate high temperature levels. This test shall be conducted between 3 to 8 months after occupancy, but not beyond the one year warranty period. Submit test to the architect and engineer using test reporting forms. All unacceptable conditions shall be corrected prior to the end of the warranty period.

END OF SECTION 26 02 00

SECTION 26 02 01 - COORDINATION DRAWINGS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions 01 31 00 and Supplementary Conditions apply to all Work herein.

1.02 COORDINATION DRAWINGS

A The Contractor shall take the lead in coordinating the Mechanical, Electrical, Plumbing, Communications, Electronic Safety/Security and Fire Protection systems within the building.

B The Contractor shall coordinate a three-dimensional (3D) model of the building which includes the Mechanical, Electrical, Plumbing, and Fire Protection systems. The Mechanical, Electrical, Plumbing, and Fire Protection Contractors shall prepare their work and generate 3D models which will be given to the Contractor for coordination. The Contractor will be provided with the REVIT model that was used to generate the contract documents, this file may be used as the background file. The Contractor shall replace the systems drawn with the actual shop drawing models. The Contractor is not limited to using REVIT, but may use any 3-D software in generating and combining the coordination model.

C Submitting the contract drawings as coordination drawings will not be acceptable.

D The model shall include detailed and accurate representations of all equipment to be installed based upon the reviewed equipment submittals.

E The Contractor shall hold a 3-D coordination meeting with all sub-contractors present to review the model and discuss coordination of the installation of the building systems.

F Upon completion of the coordination meeting, the Contractor shall submit the 3-D model and 1/4" scale drawings for review.

G The model shall detail major elements, components, and systems in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

    a. Wall and type locations.

    b. Clearances for installing and maintaining insulation.

    c. Locations of light fixtures and sprinkler heads.

    d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

e. Equipment connections and support details.

f. Exterior wall and foundation penetrations.

g. Routing of storm and sanitary sewer piping.

h. Fire-rated wall and floor penetrations.

i. Sizes and location of required concrete pads and bases.

j. Valve stem movement.

k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

H Sequence of Coordination

1. Below is hierarchy of model elements and the sequencing by which the models will be coordinated:

a. Structural and Architectural model

b. Miscellaneous steel

c. Perform preliminary space allocation

d. Identify hard constraints (locations of access panels, lights, A/V space requirements, etc.)

e. Main and medium pressure ducts from the shaft out

f. Main graded plumbing lines and vents

g. Sprinkler mains and branches

h. Cold and hot water mains and branches

i. Lighting fixtures and plumbing fixtures

j. Smaller sized ducts and flex ducts

k. Smaller size cold water and hot water piping, flex ducts, etc.

I The Contractor shall not install any item until the coordination has been completed and reviewed by the Construction Manager, Owner, and A/E team.

J This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

K By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

END OF SECTION 26 02 01

SECTION 26 05 19 - WIRE, CABLE AND RELATED MATERIALS

PART 1 - GENERAL

1.01 SCOPE

A Provide 600 volt building wire, cable and connectors and 300 volt wire, cable and connectors.

B WORK INCLUDED: Include the following Work in addition to items normally part of this Section.

1. Wiring for lighting, dimming controls and power.
2. Automatic Control Wiring.
3. Connection of equipment shown.
4. Fire Alarm System.

C WORK SPECIFIED ELSEWHERE:

1. Heating, ventilating, and air conditioning equipment.
2. Structured cabling system.
3. Coaxial cables

1.02 REFERENCE STANDARDS

A UL 83 - Thermoplastic-Insulated Wires and Cables

B ASTM B3 - Standard Specification for Soft or Annealed Copper Wire

C NFPA 70 - National Electrical Code

D All wire cable and connectors shall be UL approved.

E NEMA

F NEMA Bulletin 119

1.03 ACCEPTABLE MANUFACTURERS

A 600 VOLT WIRE AND CABLE

1. Southwire
2. Encore
3. Cerro

B 300 VOLT WIRE AND CABLE

1. Westpenn
2. Beldon

3. Alpha

4. Tappan - Southwire

C FLEXIBLE CABLE SYSTEMS

1. AFC Modular Cable Systems

2. Kaf-Tech

D CONNECTORS

1. Ilsco

2. Cooper

3. AMP - TYCO

4. Burndy

5. Ideal

6. 3M

7. O.Z. Gedney

8. Thomas & Betts

9. Buchanan

1.04 SUBMITTALS

A Shop drawings shall include, but not limited to:

1. Cutsheets of wire, cable and connectors to indicate the performance, fabrication procedures, product variations, and accessories.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH:

A National Electrical Code.

B Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 WIRING

A All wire shall be new and continuous without weld, splice, or joints throughout its length. It must be uniform in cross-section, free from flaws, scales and other imperfections.

B WIRE MATERIAL: Conductors shall be soft drawn, annealed copper. Aluminum wiring is not acceptable unless otherwise noted on drawings.

C TYPES:

1. Provide type “THHN/THWN-2” insulation for all buried feeders and service entrance conductors.

2. Provide type “THHN/THWN-2” insulation for all branch circuits and above grade feeders.

3. All wire No. 8 and larger shall be stranded. All wire No. 10 and smaller shall be stranded or solid.

4. Provide type "XHHW" or other 90 degrees insulation wiring for branch circuit wiring installed through continuous rows of fixture bodies.

5. All 300-volt cable including but not limited to telephone, fire alarm, data, CATV and security shall be UL listed for use in return air plenums.

6. All dimming conductors shall be 300 volt, 75 C plenum rated. Dimming conductors shall be solid. Stranded conductors are not acceptable.

D CONDUCTOR SIZES

1. Feeder conductors shall be sized for a maximum of 2% drop in rated voltage at scheduled load.

2. Branch circuit conductors shall be sized for a maximum 3% drop in the rated voltage to the longest outlet on the circuit.

3. Minimum wire shall be 12 AWG, unless otherwise shown on Drawings or required by Code.

4. Minimum wire size for 0-10v dimming controls shall be 18 AWG for conductors not exceeding 300 feet circuit length (one-way) and 16 AWG for those exceeding 300 feet (one-way).

E COLOR CODING: No. 6 or larger shall use tape for color coding. No. 8 and smaller wire shall be color coded in accordance with the governing authority requirements or as follows:

120/208 Volt

Neutral: White

Phase A: Black

Phase B: Red

Phase C: Blue

Ground: Green

0-10 Volt dimming conductors

Purple (source)

Pink (common)

2.02 GROUNDING

A Permanently connect all conduit work, motors, starters, and other electrical equipment to grounding system in accordance with NFPA 70.

PART 3 - EXECUTION

3.01 WIRE

A Do not pull wire into conduit until Work of an injurious nature is completed. Where two or more circuits run to a single outlet box, each circuit shall be properly tagged. Wyreze or approved equal may be used as a lubricant where necessary.

B Splices shall be fully made up in outlet boxes with compression crimp-on type splice connectors.

C Joints and splices will not be permitted in service entrance or in feeders. Joints in branch circuits will be permitted where branch circuits divide, and then shall consist of one through-circuit to which the branch shall be spliced. Joints shall not be left for the fixture hanger to make. Connect joints and splices with Buchanan Series "2000" solderless connectors complete with insulating caps or properly sized twist on wire nuts. “Wago” push-in connectors are not acceptable.

D All stranded conductors shall be furnished with lugs or connectors.

E Connectors furnished with circuit breakers or switches shall be suitable for copper wire termination.

F “Sta-Cons” shall be used to terminate stranded conductors on all switches and receptacles.

G All stranded #10 and small conductors shall be terminated with an approved solderless terminal if the device or light fixture does not have provisions for clamp type securing of the conductor.

H The jacket for all travelers used on 3-way and 4-way switches shall be pink.

I Route conductors for 480Y/277 systems in a separate raceway. Do not combine with 208Y/120 volt or 120/240 volt systems.

J Emergency circuits shall not be routed with normal conductors.

3.02 BALANCING SYSTEM

A The load on each distribution and lighting panel shall be balanced to within 10% by proper arrangement of branch circuits on the different phase legs. Provide written documentation showing results. Submit with O & M manuals.

3.03 LOW VOLTAGE WIRING

A Low voltage wiring, including dimming conductors, shall be plenum rated. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

B Low voltage wiring shall be routed in separate raceways from power wiring systems.

C Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.

E Provide a junction box to make up all joints and splices.

F Provide dimming conductors for all lighting circuits located in spaces with dimmer switches and theatrical lighting as indicated on the drawings and as specified.

3.04 CABLE SUPPORTS

A Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

3.05 DEFECTS

A Defects shall include, but are not to limited to, the following:

1. Tripping circuit breakers under normal operation.
2. Improperly connected equipment.
3. Damaged, torn, or skinned insulation.

END OF SECTION 26 05 19

SECTION 26 05 26 – GROUNDING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A WORK COMBINED WITH OTHER SECTIONS: Combine the work specified herein with the following Sections to form a single responsibility for the Work:

1. Electrical.
2. Basic materials and methods.

B Provide electrical service, equipment and wiring device grounding as shown, scheduled and as specified.

C The types of grounding include, but not limited to, the grounding bonding of all equipment devices, building steel piping, and as required by the National Electrical Code, Local Inspection Department and Power Company.

1.03 STANDARDS

A National Electrical Code (NFPA-70)

B Local municipal and State codes that have jurisdiction.

C NECA

1.04 ACCEPTABLE MANUFACTURES

A Provide grounding products manufactured by Copperweld and Cadweld.

1.05 SUBMITTALS

A Shop drawings shall include, but not limited to the following:

1. Cut sheets of ground rods, clamps and connectors.
2. Grounding system diagram.

PART 2 - PRODUCTS

2.01 GENERAL

A Provide all materials required to construct a complete grounded electrical system.

B GROUND RODS: Ground rods shall be 3/4" inch diameter by 10 feet long construction with copper jacket and a steel core.

C CLAMPS: Ground clamps shall be copper except for steel or iron pipes in which the clamps shall be galvanized iron.

D CONDUCTORS: Conductors shall be connected by means of an approved pressure connector or clamp.

PART 3 - EXECUTION

3.01 INSTALLATION

A GENERAL: Install grounding system as shown and specified to ensure a properly grounded system.

B SERVICE ENTRANCE GROUNDING SYSTEM: Provide a main bonding jumper between the neutral and ground bus of each switchboard. Route a separate grounding electrode conductor in conduit from each main gutter to the ground rod grid, incoming cold water piping system, and to the "lightning protection system" (250 - 106 of NEC) under ground bonding loop. Provide a bonding jumper around water meter. The grounding electrode conductor shall be stranded copper, 98% conductivity and shall be run continuous without splices or joints and installed at least 12" below grade.

C BUILDING STEEL AND PIPING SYSTEM: Install a bonding jumper between building steel and metallic piping systems to bond them to the electrical grounding system.

D NEUTRAL: The neutral shall be grounded only at the service entrance and other separately derived systems. The neutral shall be kept separate from the grounding system and shall not be used as a ground.

E GROUNDING SEPARATELY DERIVED ALTERNATING CURRENT SYSTEM

1. STANDBY EMERGENCY GENERATOR: The generator neutral shall be bonded to the generator when a 4-pole switched neutral automatic transfer switch is specified.

F GROUNDING CONDUCTOR: A grounding conductor and metallic conduit system shall bond all equipment served by the electrical system. Provide a flexible bonding jumper for isolated metallic piping and ductwork and around expansion fittings and joints.

G CONDUIT GROUNDING BUSHING: Conduit terminating in equipment that has a ground bus such as switchboards, panelboards, etc., shall have grounding bushings installed. Ground each conduit by means of a grounding bushing and to the ground bus in the equipment.

H MOTORS: The frame of all motors shall be grounded.

I SPECIAL GROUNDING: Provide a #6 AWG copper grounding conductor for each telephone board, television system, etc. Terminate the grounding conductor on ground bus and to the building electrical grounding system. Refer to 800-40(d) and 820-40(d) of the NEC.

J REMOTE PANELBOARDS: Provide a grounding electrode conductor all remote panels as required by the NEC and shown on drawings.

K LIGHTING FIXTURES: Flexible fixture whips containing a green grounding conductor shall be used to connect light fixtures. Flexible fixture whips shall not exceed ten feet.

L RECEPTACLES: All receptacles shall be grounded using the branch circuit grounding conductor. Receptacles shall use an approved grounding yoke.

3.02 TESTING

A Perform a ground resistance test using a biddle analog or digital portable earth/ground resistance tester. The system resistance shall not exceed 5 Ohms. Provide additional electrodes as required (refer to 250-84 and 250-56 of the most current edition NEC). Test shall not be conducted following wet weather. Provide personal instruments to conduct these tests and submit certified test for review. Test shall be verified by Engineer.

END OF SECTION 26 05 26

SECTION 26 05 33 – RACEWAYS

PART 1 - GENERAL

1.01 SCOPE

A Provide electrical raceways and fittings as shown, scheduled and specified.

B The types of raceways and fittings required are as follows:

1. Rigid hot-dipped galvanized steel conduit (GRC) (RMC)
2. Intermediate hot-dipped galvanized steel conduit (IMC)
3. Electrical metallic tubing (EMT)
4. PVC (Sch. 40 & 80)
5. Flexible metal conduit (FMC)
6. Liquid-tight flexible metal conduit (LFMC)
7. PVC coated rigid galvanized steel conduit (GRCC)
8. Rigid Aluminum Conduit (RAC)

1.02 REFERENCE STANDARDS

A ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.

B ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.

C ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.

D NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

F UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

G UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.

H UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.

I UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

J UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

K UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

L NEMA FB-1

M NEMA TC3

1.03 ACCEPTABLE MANUFACTURERS

A Raceways

1. Allied
2. Republic
3. Prime Conduit (Carlon)
4. Wheatland Tube
5. Cantex
6. Western Tube
7. Robroy Industries

B Fittings

1. Appleton
2. Crouse Hinds
3. Steel City
4. O.Z. Gedney
5. Carlon
6. Raco, Inc.
7. Bridgeport

C Boxes

1. RACO
2. Thomas and Betts
3. EATON
4. Crouse-Hinds
5. Appleton

D Surface

1. Hubbell
2. Wiremold

1.04 SUBMITTALS

A Product data shall include but not be limited to:

1. Cutsheets for raceways, fitting, solvents, primers, etc.

1.05 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A NFPA 70

B Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 CONDUIT AND FITTINGS

A Rigid Galvanized Steel Conduit (GRC/RMC)

1. Construction, Materials, Codes, Standards:

   a. Article 344 - NFPA 70.

   b. Hot-dip galvanized rigid steel conduit, galvanized after fabrication. Products shall comply with UL 6 and ANSI C80.1. All threads shall be galvanized after cutting. A uniform zinc coating shall be applied to the inner and outer walls.

   c. Fittings shall be threaded and shipped with thread protectors. Set Screw are not acceptable. Die Cast Fittings are not acceptable.

2. Permitted for use in the following locations:

   a. Outdoor or Exterior (Exposed)

   b. Indoors, Conditioned Spaces

   c. Unconditioned Spaces

   d. Underslab (Void Form Slab): where not in contact with earth – only permitted where indicated on plan.

   e. Underslab (Suspended Slab): Permitted – only where indicated on plan.

3. Prohibited Locations: Underground, Corrosive environments, Underslab (Slab on Grade), Foundation penetrations.

4. Specific Uses: Exposed Exterior installations, where within or attached to masonry or concrete, where subject to damage.

B Intermediate Metal Conduit (IMC)

1. Construction, Materials, Codes, Standards:

   a. Article 342 - NFPA 70.

   b. Conduit shall be similar to rigid steel conduit except thinner wall.

c. Fittings shall be threaded hot-dipped galvanized and shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable

d. Products shall comply with UL 1242.

2. Permitted for use in the following locations:

a. Outdoor or Exterior (Exposed)

b. Indoors, Conditioned Spaces

c. Unconditioned Spaces

d. Underslab (Void Form Slab): not in contact with earth only as indicated on plan.

e. Underslab (Suspended Slab): only where indicated on plan.

3. Prohibited Locations: Corrosive Environment, Underground, Underslab (Slab on Grade), Foundation Penetrations

4. Specific Uses: Exposed exterior locations, Rooftops exposed to sunlight

C Electrical Metallic Tubing (EMT)

1. Construction, Materials, Codes, Standards:

a. Article 358 - NFPA 70.

b. EMT shall be made of hot-dip galvanized strip steel. The interior shall be coated with a corrosion-resistant lubricant for ease of wiring pulling.

c. Shall utilize steel insulated throat, set-screw connectors and steel set-screw couplings in all indoor conditioned spaces.

d. Shall utilize steel insulated throat, threadless, watertight compression type connectors and steel threadless watertight compression type coupling in all non-conditioned spaces and in grout filled CMU walls.

e. Products shall comply with UL 797 and ANSI C80.3.

2. Permitted for use in the following locations:

a. Indoors, Conditioned Spaces

b. Unconditioned Spaces

3. Prohibited Locations: Corrosive Environment, Underground, Underslab (all types), Wet or Damp Locations, Exteriors, Within Concrete, foundation penetrations.

4. Specific Uses: Primary use conduit for indoor spaces, where conditioned. Unconditioned locations shall require use of insulated throat water tight fittings.

D Rigid Nonmetallic Conduit (PVC Schedule 40 & 80)

1. Construction, Materials, Codes, Standards:

a. Article 352 and 300.6 - NFPA 70.

b. Conduit shall be schedule 40 or 80 polyvinyl chloride (PVC), UV stabilized, rated for 90°C conductors.

c. Fittings shall be solvent weld socket type.

d. Products shall comply with UL 651.

2. Permitted for use in the following locations:

a. Underground (Earth, outside foundation perimeter)

b. Underslab (Slab on Grade): only where indicated on plan.

c. Under Driveways, roadways, or vehicular crossings, and where required by Utility Company: PVC Schedule 80

1) PVC Schedule 40 allowed where concrete encased.

3. Prohibited Locations: return air Plenums, interstitial spaces, Outdoor or Exterior (Exposed), Unconditioned spaces, corrosive environments, underslab (suspended or void form), foundation penetrations.

4. Specific Uses: For use underground or underslab (Slab on grade). Underground use is approved for all locations where transiting a project site, not underneath any foundation. For locations under the footprint of building/foundation, use only authorized where indicated on drawings.

E Flexible Metal Conduit (FMC/Greenfield)

1. Construction, Materials, Codes, Standards:

a. Article 348 - NFPA 70.

b. Spirally wound continuously interlocked zinc coated strip steel.

c. Fittings shall be one screw for smaller than 1-1/2-inch, two screw for 1-1/2-inch and larger, double clamp steel or malleable iron, either cadmium plated or hot-dip galvanized.

d. Products shall comply with UL 360.

2. Permitted for use in the following locations:

a. Indoors, Conditioned Spaces.

3. Prohibited Locations: outdoors/Exterior, unconditioned spaces, Corrosive, Wet, Concrete, underslab(all types), underground, foundation penetrations.

4. Specific Uses and Applications: For use in connection to rotating equipment within conditioned spaces, including plenums. Also permitted for use with empty raceways in walls for use with Low Voltage, AV, telecom cabling.

F Liquid-Tight Flexible Steel Conduit (LFMC/Seal Tite)

1. Construction, Materials, Codes, Standards

   a. Article 350 - NFPA 70.

   b. Spirally wound continuously interlocked zinc coated strip steel with a UV stabilized polyvinyl chloride (PVC) outer jacket bonded to the conduit.

   c. Fittings shall be compression type, malleable iron, with insulated throat, either cadmium plated or hot-dip galvanized. Plastic is not acceptable.

2. Permitted for use in the following locations:

   a. Outdoor or Exterior (Exposed)

   b. Indoors, Conditioned Spaces

   c. Unconditioned Spaces

3. Prohibited Locations: Concrete, corrosive, underground, underslab (all types), foundation penetrations.

4. Specific Uses and Applications: Primary use is connection to rotating equipment at unconditioned spaces. Transformer Primaries and Secondaries (excluding service transformer).

G PVC Coated Rigid Galvanized Steel Conduit (GRCC/Plastibond)

1. Construction, Materials, Codes, Standards:

   a. Article 344 and 300.6 - NFPA 70.

   b. Conduit shall be same as rigid metal conduit with a factory-applied 40-mil-thick covering of polyvinyl chloride (PVC) bonded to the metal, coated inside and outside.

2. Permitted for use in the following locations:

   a. Outdoor or Exterior (Exposed): except for stub-ups and penetrations.

   b. Corrosive Environment: required throughout

      1) Where corrosive environments exist, such as pools, pool pump room, corrosive chemical storage, GRCC shall be provided throughout, up to the point of sealed penetration into a non-corrosive environment.

   c. Underground (Earth, outside foundation perimeter): Required at bends of 15° or greater, Penetrations through concrete, Stub-ups through foundation or grade at concrete.

   d. Foundation Penetrations

3. Prohibited Locations: extended runs exposed to sunlight, Plenums, Underslab except for penetrations (all foundation types).

4. Specific Uses: For use at Cooling Towers, Pools, Pool Decks, Pool pump rooms, chemical storage, corrosive environments.

H Rigid Aluminum Conduit (RAC)

1. Construction, Materials, Codes, Standards:

a. Article 344 - NFPA 70.

b. Rigid aluminum (alloy 6063-T1) conduit shall be manufactured using 6063 Alloy in temper designation T-1.

c. Fittings for rigid aluminum conduit shall be threaded aluminum shipped with thread protectors. Set Screw or Die Cast Fittings are not acceptable

d. Products shall comply with UL 6A and ANSI C80.5.

2. Permitted for use in the following locations:

a. Outdoor or Exterior (Exposed)

b. Indoors, Conditioned Spaces

c. Unconditioned Spaces

3. Prohibited Locations: Corrosive environments, underground, within concrete, underslab (all types), foundation penetrations.

4. Specific Uses and Applications: Exposed Exterior such as rooftops or canopies.

2.02 PULL BOXES

A Exterior in-ground pull boxes shall be concrete or polymer as manufactured by Brooks, Dalworth, Hubbell Quazite, or approved equivalent. Covers shall include identification of systems contained.

B Where located in Roadways, Parking Lots, or Traffic zones, Pullboxes shall be rated to accept a minimum 22,500 lb. load per ANSI/SCTE 77.

C All Pullboxes shall be sized based on NEC wire-bending requirements at each individual location.

D Covers shall include identification of systems contained, such as:

1. Electrical

2. Telecom

3. Communications

4. Others, as required.

E Pull boxes in pole bases shall be as manufactured by Carlon.

F Pullboxes shall be provided in all raceway systems upon exceeding the following conditions:

1. The equivalent of 270° in conduit bends, or after (3) 90° bends.

2. Any 400ft of linear conduit or duct bank continuous segments.

3. Where required to make transitions to prevent the damaging of conductor insulation.

2.03 WIREWAYS

A Wireways shall be made of not less than 16-gauge sheet steel for 4 inch and 6 inch square sizes and 14 gauge steel for 8 inch and 12 inch square sizes. Couplings end plates, and knockouts shall be furnished as required. Each section of wireways shall be rigidly supported.

B The finish shall be ANSI-49 gray epoxy paint applied by a cathodic electrode position paint process over a corrosion resistant phosphate preparation for NEMA 1 wireways. Provide galvanized steel for NEMA 3R wireways. NEMA 3R wireways and auxiliary gutters are for horizontal mounting only.

2.04 BUSHINGS

A Provide nylon bushing on end of all low voltage cabling system conduits (sleeves, rough-ins, etc.).

B Provide Grounding Bushing as required in 26 05 26 - Grounding.

PART 3 - EXECUTION

3.01 PROVIDE CONDUIT AS FOLLOWS:

A GENERAL: The Drawings are diagrammatic and are intended to show the general location of outlets, devices, fixtures, and arrangement and control of circuits. The Contractor shall determine exact locations by actual measurement of the building or by reference to the Architectural Drawings.

B Raceways shall not be routed below or within slab-on-grade, foundations, or below grade of suspended slab structures, unless specifically noted or indicated otherwise on plan.

C EMT in sizes up to 4 inches when concealed or not exposed to damage and located indoors only. (EMT is not acceptable in wet and damp location.)

D MINIMUM SIZE: 3/4 inch.

E Flexible conduit of any type shall not be used except for connections to rotating or vibrating equipment, or where use for low voltage raceways. All conduit shall be provided as a rigid type conduit for homeruns, runs between termination boxes, outlets, etc.

F Fixture whips: Refer to 26 51 19 for additional information.

G Of such size, and so installed that conductors may be drawn in without injury or excessive strain.

H Where entering panels, pull boxes, junction boxes, or outlet boxes, shall be secured in place with lock nuts inside and outside, and insulated bushings inside.

I Have Red seal type VCC or approved equal cable supports in risers, as required by NFPA 70.

J Have ends reamed after cutting and application of die.

K Keep conduit corked and dry during construction and swab out before conductors are pulled.

L Have bends and offsets made with approved tools. Bends or offsets in which the pipe is crushed or deformed shall not be installed.

M Have O.Z. Gedney or approved equal expansion fittings where crossing building expansion joints.

N Fixtures in finished areas having suspended acoustical ceilings shall be connected to outlet boxes of lighting grid by flexible metal conduit; length not to exceed ten feet (six feet if using 3/8" manufactured fixture "whips").

O Outlet boxes in partitions shall never be set back-to-back. They shall be offset to prevent undue noise transmission from room to room.

P Each entire conduit system shall be installed complete before any conductors are drawn in. Every run of conduit shall be finished before covering up to guard against obstructions and omissions.

Q Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams, for the passage of conduits. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel with a minimum thickness of 1.07MM and set to extend 4" above slab.

R All pipe penetrations through walls and concrete floors shall be fire rated by applying USG Thermafiber in the space between the concrete and the pipe. The fire rating shall be additionally sealed by using 3M brand model CP 25 or 303 fire barrier caulk and putty. All fire rating material shall be installed in accordance with manufacturer`s printed instructions.

S All conduit shall be cleaned and swabbed to remove all foreign matter and moisture prior to pulling wire and cable. All boxes in which conduits terminate shall be cleaned of all concrete mortar and other foreign matter.

T Provide #30 nylon pulling line in all conduits in which permanent wiring is not installed.

U All conduit shall be securely fastened and supported using hot galvanized malleable iron one-hole pipe straps, clamps, hanger or other means approved by the engineer. Supports shall be as required per NEC. Tie wire shall not be used as support or securing means. Support conduit independently of ceiling hanger wire. Use all thread rods to support outlet boxes, junction boxes and conduit.

V Contact the Architect and Engineer for an installation review before covering any below grade or above grade conduit.

W All new outlets shall be flush mounted. In remodeled areas where wall construction prohibits flush mounting, provide Hubbell 2400 series, unless noted otherwise. Verify exact location and routing with architect before installation.

X Contractor shall not penetrate waterproof barriers without using proper fitting to maintain barriers. This shall include exterior walls and slabs. Coordinate with Architect for proper methods.

3.02 CONDUIT ROUTING

A Conduit shall be concealed and by using the shortest practicable route between outlets, including where located on CMU walls.

B Conduit may be exposed in electrical and mechanical rooms, and central plants, or other industrial type facilities such as warehouses or production plants.

C Install risers, drops, offsets to avoid ductwork and structural components. Ductwork and structural systems shall take precedence to conduit.

D Any exposed and visible conduit shall be parallel and perpendicular based on the lines of the building (such as ceiling lines, wall blocking lines, or architectural feature lines) using structural systems to conceal conduit visibility at all opportunities.

E Concealed conduit shall be run in as direct manner as possible, using long bends. All bend radii shall be 12x conduit diameter. Condulets in lieu of elbows where ease of installation and appearance warrant their use – confirmation with architect is required for this use.

F Conduit shall be continuous, with no more than (4) quarter bends between terminals, cabinets, boxes, or pullboxes is acceptable. Contractor is expected to provide wireway or boxes at appropriate intervals, in accordance with NFPA 70 for wire bending space. All conduit shall be electrically continuous throughout, including across boxes and cabinets. Terminals of all conduit shall be provided with double lock nuts and bushing, or terminated on conduit hubs. Use of Running Threads prohibited.

3.03 CONDUIT CORROSION PROTECTION

A Branch circuit conduits installed in concrete slabs on fill or grade shall be positioned in a manner to ensure complete concrete cover. In no case shall such conduits be exposed below or above the slab surfaces, or penetrate the waterproof membrane.

B At locations where metallic conduits pass through slabs on grade or transitions below grade, PVC coated rigid galvanized conduit shall be used.

C Conduit installed in the air gap between the water-resistant barrier and finish brick shall not exceed 2-ft. in length.

3.04 EXPANSION JOINTS

A Install approved expansion fitting in all conduit runs in excess of 150 feet or when crossing building expansion joints.

3.05 OUTLET AND JUNCTION BOXES

A Provide an approved galvanized outlet box with adequate volume for number of conductors installed.

B Provide standard galvanized switch boxes of the required number of gangs. Switch boxes where conduit is exposed shall be handy boxes or approved equal.

C Outlet boxes for receptacles shall be similar to Universal 52151 with suitable raised cover. Receptacle boxes where conduit is exposed shall be handy boxes or approved equal.

D Weatherproof boxes shall be FS or FD. Provide these boxes in all non-conditioned areas, exterior areas and natatoriums.

E Outdoor boxes shall be NEMA 3R, with conduit connections made by Myers Hubs.

F See notes and details on Drawings for special box requirements.

G Provide junction boxes required to facilitate installation of the various conduit systems. Provide support boxes required for risers, each complete with approved cable supports as described elsewhere in this Division.

H Outlet boxes for drywall shall be standard galvanized 4" square boxes with the appropriate device cover. Secure all outlet boxes with a backing brace connected to two adjacent studs. Mounting brackets with a single ear to rest against the backing sheet rock are not acceptable.

I Provide floor outlet fittings for telephone to match fittings for duplex floor receptacles.

J Provide 3-1/2” deep gangable masonry boxes in all masonry wall (CMU). Steel City GW-135-G or approved equal.

K Provide shallow 4”x4” boxes in all demountable partitions.

L Metallic boxes located in fire rated walls or partitions shall be separated by a minimum horizontal distance of 24 in. This minimum separation distance between metallic boxes may be reduced when “ Wall Opening Protective Materials” (CLIV) are installed according to the requirements of their Classification. Metallic boxes shall not be installed on opposite side of walls or partitions of staggered stud construction unless “Wall Opening Protective Materials” are installed with the metallic boxes in accordance with Classification requirements for the protective materials.

M Junction, pull boxes, condulets, gutters, disconnects, contactors, etc., above 2-foot x 2-foot grid ceilings shall be mounted within 18-inches of ceiling grid. Above 2-foot x 4-foot grid ceiling they shall be mounted within 30-inches of ceiling grid. All junction box, pull box, gutter openings shall be side or bottom accessible.

N Junction boxes are prohibited above drywall or plaster ceilings except for lighting; and those must be mounted directly over light fixture opening. Route power, PA, fire alarm conduits to nearest lay-in ceiling.

3.06 THRU-WALL SEALS

A Provide O.Z. Gedney "Thru-wall" seals for all conduits passing through concrete structure below grade, above grade, and floor penetrations below grade. These prevent moisture from entering the building.

B Straight sleeves are not acceptable.

3.07 PULL BOXES

A Interior Pull boxes shall be provided for conduit systems as required and shall be constructed of galvanized steel of not less than gauge and size specified by National Electrical Code. Size pull boxes per Article 314.28 - NFPA 70.

B Where two or more feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and panel designation.

C Exterior in-ground pull boxes shall have open bottoms with sand and rock beds below box for drainage of water. Provide closed bottom boxes where specified. Closed bottom boxes shall be provided with sumps for portable pump to allow for extracting water. Refer to details on the drawings.

D Pull boxes mounted in pole bases shall be coordinated with the pour of the pole base and shall be flush with finished footing.

3.08 WIREWAYS

A Wireways shall be installed as indicated or required and locations shall be coordinated with architect.

B Wiring in wireways shall be neatly bundled, tied and suitably tagged.

END OF SECTION 26 05 33

SECTION 26 05 73 - SHORT CIRCUIT COORDINATION STUDY ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 SCOPE

A The Contractor shall furnish short-circuit and protective device coordination studies for the electrical power system, including all existing and newly installed electrical equipment. The analysis and study shall include all distribution branches, and begin at the main overcurrent protective device.

B Provide a complete short circuit study, equipment interrupting or withstand evaluation, and protective device coordination study for the power distribution system. Normal operating method, alternate operation, and operations which could result in maximum fault conditions shall be thoroughly addressed in the study. The study shall assume all motors operating at rated voltage and speed. Electrical equipment bus impedance shall be assumed as zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchboard busses and motor control centers (where installed).

C A protective device coordination study shall be performed to determine appropriate relay settings. The study shall include all distribution switchboards, motor control centers (where installed, and panel board main circuit breakers. Panel board branch circuit devices need not be considered. The phase over current and ground fault protection shall be included as well as setting for all other adjustable protective devices.

D An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.

E Any problem areas or inadequacies shall be promptly brought to the ENGINEERS attention.

F The Contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.5 and Annex D.

1.02 REFERENCES

A Institute of Electrical and Electronics Engineers, Inc. (IEEE):

1. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems

2. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems

3. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis

4. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings

5. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems.

6. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations

B American National Standards Institute (ANSI):

1. ANSI C57.12.00 – Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers

2. ANSI C37.13 – Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

3. ANSI C37.010 – Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis

4. ANSI C37.41 – Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories.

C The National Fire Protection Association (NFPA)

1. NFPA 70 - National Electrical Code, latest edition

2. NFPA 70E - Standard for Electrical Safety in the Workplace

1.03 SUBMITTALS FOR REVIEW/APPROVAL

A The short-circuit and protective device coordination studies shall be submitted to the design Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing. If formal completion of the studies may cause delay in equipment manufacturing, approval from the Engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.04 SUBMITTALS FOR CONSTRUCTION

A The results of the short-circuit, protective device coordination and arc flash hazard analysis studies shall be summarized in a final report. No more than five (5) bound copies of the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer printout of the short-circuit input and output data. Additional copies, where required, shall be provided on CD in PDF format.

B The report shall include the following sections:

1. One-line diagram

2. Descriptions, purpose, basis and scope of the study

3. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties

4. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip unit settings, fuse selection

5. Fault current calculations including a definition of terms and guide for interpretation of the computer printout

6. Incident energy and flash protection boundary calculations

7. Recommendations for system improvements, where needed

8. Executive Summary.

9. Equipment manufacturer's information used to prepare study

10. Assumptions made during study.

1.05 QUALIFICATIONS

A The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be a full-time employee of the Engineering Services Organization.

PART 2 - PRODUCT

2.01 DATA COLLECTION

A The Contractor shall furnish all data as required by the power system studies. The Engineer performing the short-circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to the release of the equipment for manufacturing.

B Source combination may include present and future motors and generators.

C Load data utilized may include existing and proposed loads obtained from Contract Documents provided by Owner or Contractor.

D Include fault contribution of existing motors in the study, with motors <100 hp grouped together. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.02 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

A Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE 141.

B Transformer design impedances shall be used when test impedances are not available.

C Provide the following:

1. Calculation methods and assumptions
2. Selected base per unit quantities
3. One-line diagram of the system being evaluated
4. Source impedance data, including electric utility system and motor fault contribution characteristics
5. Typical calculations
6. Tabulations of calculated quantities
7. Results, conclusions, and recommendations.

D Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each:

1. Electric utility's supply termination point
2. Incoming switchgear
3. Low voltage switchgear
4. Motor control centers
5. Branch circuit panelboards
6. Other significant locations throughout the system.

E For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

F Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short circuit ratings
2. Adequacy of switchgear, motor control centers, and panelboard bus bars to withstand short-circuit stresses
3. Adequacy of transformer windings to withstand short-circuit stresses
4. Cable and busway sizes for ability to withstand short-circuit heating
5. Notify Owner in writing of any new or existing circuit protective devices improperly rated for the calculated available fault current.

2.03 PROTECTIVE DEVICE COORDINATION STUDY

A Proposed protective device coordination time-current curves shall be graphically displayed on log-log scale paper.

B Include on each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered.

C Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

D Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.

E Plot the following characteristics on the curve sheets, where applicable for this project:

1. Electric utility's protective device
2. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
3. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
4. Transformer full-load current, magnetizing inrush current, and ANSI transformer withstand parameters
5. Conductor damage curves
6. Ground fault protective devices, as applicable
7. Pertinent motor starting characteristics and motor damage points
8. Other system load protective devices for the largest branch circuit and the largest feeder circuit breaker in each motor control center.

F Provide adequate time margins between device characteristics such that selective operation is provided, while providing proper protection.

2.04 ARC FLASH HAZARD ANALYSIS

A The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA 70E, Annex D.

B When appropriate, the short circuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short-circuit and coordination study model. Alternative methods shall be presented in the proposal.

C The flash protection boundary and the incident energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

D The Arc-Flash Hazard Analysis shall include all significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 75 kVA.

E Safe working distances shall be specified for calculated fault locations based upon the calculated arc flash boundary considering an incident energy of 1.2 cal/cm2.

F The Arc Flash Hazard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

G Arc flash computation shall include both line and load side of main breaker calculations, where necessary.

H Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2.

2.05 REPORT SECTIONS

A Input Data:

1. Short-circuit reactance of rotating machines
2. Cable and conduit materials
3. Transformers
4. Circuit resistance and reactive values.

B Short-Circuit Data:

1. Source fault impedance and generator contributions
2. X to R ratios
3. Asymmetry factors
4. Motor contributions
5. Short circuit kVA
6. Symmetrical and asymmetrical fault currents.

C Recommended Protective Device Settings:

1. Phase and Ground Relays:
    a. Current transformer ratio
    b. Current setting
    c. Time setting
    d. Instantaneous setting
    e. Specialty non-overcurrent device settings
    f. Recommendations on improved relaying systems, if applicable
2. Circuit Breakers:

a. Adjustable pickups and time delays (long time, short time, ground)

b. Adjustable time-current characteristic

c. Adjustable instantaneous pickup

d. Recommendations on improved trip systems, if applicable.

D Incident energy and flash protection boundary calculations

1. Arcing fault magnitude

2. Device clearing time

3. Duration of arc

4. Arc flash boundary

5. Working distance

6. Incident energy

7. Hazard Risk Category

8. Recommendations for arc flash energy reduction

PART 3 - EXECUTION

3.01 FIELD ADJUSTMENT

A The Contractor shall adjust relay and protective device settings according to the recommended settings table provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B Make minor modifications to equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C Notify Owner in writing of any required major equipment modifications.

D Following completion of all studies, acceptance testing and startup by the field engineering service division of the equipment manufacturer, a 2-year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.02 ARC FLASH WARNING LABELS

A The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.

B The label shall have an orange header with the wording, “WARNING, ARC FLASH HAZARD”, and shall include the following information:

1. Location designation

2. Nominal voltage

3. Flash protection boundary

4. Hazard risk category

5. Incident energy

6. Working distance

7. Engineering report number, revision number and issue date.

C Labels shall be machine printed, with no field markings.

D Arc flash labels shall be provided in the following manner and all labels shall be based on recommended overcurrent device settings.

1. For each 600, 480 and applicable 208 volt panelboards, one arc flash label shall be provided.

2. For each motor control center, one arc flash label shall be provided.

3. For each low voltage switchboard, one arc flash label shall be provided.

E Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.03 ARC FLASH TRAINING

A The equipment vendor shall train personnel of the potential arc flash hazards associated with working on energized equipment (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E shall be provided in the equipment manuals. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION 26 05 73

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and Division 01 Specifications, apply to this section.

1.02 RELATED SECTIONS

A Section 01 91 00 - General Commissioning Requirements

B Section 23 09 63 - Energy Management and Control System (EMCS)

1.03 SUMMARY

A The commissioning of the lighting system and associated controls as well as the service and distribution equipment shall be performed by an impartial technical firm hired by the owner or shall be performed by the installing contractor if the owner has not hired a commissioning firm. The commissioning provider shall be certified under one or more of the following certifications:

1. CxA - Certified Commissioning Authority - ACG
2. CBCP - Certified Building Commissioning Professional - AEE
3. CCP - Certified Commissioning Professional - BCA
4. CPMP - Certified Process Management Professional - ASHRAE
5. BSC - Building System Commissioning Certification - NEBB

B The commissioning provider (Commissioning authority) shall be responsible for leading the entire construction team through the commissioning process including, but not limited to, conducting the commissioning kick-off meeting, preparing the commissioning plan, preparing pre-functional checklists, preparing functional test scripts, participation in functional testing and preparation of required documentation and reports.

1.04 RESPONSIBILITIES

A Contractor: Responsibilities of the Contractor as relate to Commissioning Process include, but are not limited to the following:

1. Facilitate coordination of Commissioning work by Commissioning authority.
2. Attend Commissioning meetings or other meetings called by Commissioning authority to facilitate the Commissioning Process.
3. Review Functional Performance Test procedures for feasibility, safety, and impact on warranty, and provide Commissioning authority with written comment on same.
4. Provide all documentation relating to manufacturer’s recommended performance testing of equipment and systems.

5. Provide Operations & Maintenance data to Commissioning authority for preparation of checklists and training manuals.

6. Provide As-built drawings and documentation to facilitate Testing.

7. Assure and facilitate participation and cooperation of Sub Contractors and equipment suppliers as required for the Commissioning Process.

8. Certify to Commissioning authority that installation work listed in Pre-Functional Checklists has been completed.

9. Install systems and equipment in strict conformance with project specifications, manufacturer's recommended installation procedures, and Pre-Functional Checklists.

10. Provide data concerning performance, installation, and start-up of systems.

11. Provide copy of manufacturers filled-out start-up forms for equipment and systems.

12. Ensure systems have been started and fully checked for proper operation prior to arranging for Testing with Commissioning authority. Prepare and submit to Commissioning authority **written** certification that each piece of equipment and/or system has been started according to manufacturer's recommended procedure, and that system has been tested for compliance with operational requirements.

    a. Contractor shall carry out manufacturer's recommended start-up and testing procedures, regardless of whether or not they are specifically listed in Pre-Functional Checklists.

    b. Contractor is not relieved of obligation for systems/equipment demonstration where performance testing is required by specifications, but a Functional Performance Test is not specifically designated by Commissioning authority.

13. Coordinate with Commissioning authority to determine mutually acceptable date of Functional Performance Tests.

14. Provide qualified personnel to assist and participate in Commissioning.

15. Provide test instruments and communications devices, as prescribed by Commissioning authority, required for carrying out Testing of systems.

16. Proprietary test equipment required by the manufacturer, whether specified or not, shall be provided by the manufacturer of the equipment. Manufacturer shall provide the test equipment, demonstrate its use, and assist in the commissioning process. Proprietary test equipment shall become the property of the Owner upon completion of commissioning.

17. Ensure deficiencies found in the Commissioning Issues Log are corrected within the time schedule shown in the Commissioning Plan.

18. Provide Commissioning authority with all submittals, start-up instructions manuals, operating parameters, and other pertinent information related to Commissioning Process. This information shall be routed through Architect.

19. Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

20. Prepare and submit to Commissioning authority proposed Training Program outline for each system.

21. Coordinate and provide training of Owner's personnel.

22. Prepare Operation & Maintenance Manuals and As-Built drawings in accordance with specifications; submit copy to Commissioning authority in addition to other contractually required submissions. Revise and resubmit manuals in accordance with Design Professionals and Commissioning authority's comments.

23. Commissioning requires participation of this Division Subcontractors to ensure that systems are operating in manner consistent with Contract Documents. All costs associated with the participation of Contractor, Sub-Contractors, Design Professionals, and Equipment Vendors in the Commissioning Process shall be included as part of the Construction Contract.

B Subcontractors and vendors shall prepare and submit to Commissioning Agent proposed Startup procedures to demonstrate proper installation of systems, according to these specifications and checklists prepared by Commissioning authority.

C Electrical contractor shall provide a letter certifying the installed lighting controls meet documented performance criteria specified in the commissioning plan within 90 days of substantial completion.

1.05 COMMISSIONING PLAN

A Commissioning Process tasks and activities:

1. Commissioning kick-off meeting: Conducted by commissioning authority and attended by construction team and design team.

2. Pre-functional checklists: Prepared by the commissioning authority and filled out by subcontractors performing the work that is applicable.

3. Site visits to review installation of applicable systems and progress of checklist documentation performed and reported by commissioning authority.

4. Functional testing: Commissioning authority shall conduct functional testing with assistance of applicable subcontractors and document successful results as well as deficiencies (issues). Functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing in accordance with plans and specifications.

5. Preliminary commissioning report: Commissioning authority shall issue a preliminary commissioning report to the owner that has results of the first round of functional testing including deficiencies discovered.

6. Systems manual: Commissioning authority shall compile the systems manual using submittal data provided by the general contractor and applicable subcontractors.

7. Final commissioning report: Commissioning authority shall issue final commissioning report documenting the entire process and final results of functional testing. Report shall include final testing and balancing report.

B Electrical System Equipment to be tested

1. Occupancy sensors.

2. Time switch controls

3. Daylighting controls.

4. Electrical Service and Distribution System.

C Testing functions and conditions

1. Daylighting control devices

   a. Verify the devices have been calibrated, properly located and adjusted.

   b. Loads adjust to light level set points in response to daylight.

   c. Location of calibration equipment is accessible to authorized personnel only.

2. Time switches

   a. Verify schedule, time, date and programming is accurate.

   b. Verify override time limit is set, battery is installed and switch operates the lights that are specified in the design documents.

   c. All specified lights can be turned on and off by area control switch.

   d. Manual override switch allows only the lights in the space where the switch is located turn on or remain on until next scheduled shut off.

3. Occupant sensors:

   a. Certify the sensor has been located and aimed in accordance with manufacturer recommendations.

   b. For projects with fewer than seven sensors, each sensor shall be tested.

   c. Fore projects with more than seven occupant sensors, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each combination are provided not less than 10 percent shall be tested.

   d. Verify correct operation of status indicators.

   e. Controlled lights turn off or down to the permitted level with in the required time.

f. For auto-on sensor, the lights turn-on to the permitted level when an occupant enters space.

g. Verify the lights are not incorrectly turned-on by movement in adjacent areas or by HVAC operation.

4. Electrical Service and Distribution System

a. Document the ground resistance testing performed by contractors.

b. Document electrical subcontractor has adjusted breakers to setting recommended by coordination study.

c. Document that any required infrared studies are performed.

d. Document testing of transformer insulation and voltage drop.

e. Document any other testing requirements have been fulfilled as required within specifications.

D Performance criteria

1. Daylighting controls shall maintain specified light levels within 5% of design.

2. All time switches shall be accurate to time on cellular network devices.

PART 2 - PRODUCTS

2.01 NO PRODUCTS SUPPLIED

PART 3 - EXECUTION

3.01 GENERAL

A This Division has startup responsibilities and are required to complete sub-systems so COMPLETE SYSTEMS are fully functional. Insuring they meet design requirements of Contract Documents. Commissioning procedures and testing do not relieve or lessen this responsibility or shift this responsibility, in whole or in part, to Commissioning Agent or Owner.

B Coordinate with other Sub-Contractors and equipment vendors to set aside adequate time to address Pre-Functional Checklists, Functional Performance Tests, Operations & Maintenance Manual creation, Owner Training, and associated coordination meetings.

C Commissioning authority will also conduct site inspections at critical times and issue Cx Field Reports with observations on installation deficiencies so that they may be issued by Architect as deemed appropriate.

3.02 WORK PRIOR TO COMMISSIONING

A Complete all phases of the work so the systems can be started, adjusted, balanced and otherwise tested.

B See pertinent specification sections in this Division, which outline responsibilities for start-up of equipment with obligations to complete systems, including all sub-systems so that they are fully functional.

C Assist Commissioning Agent with all information pertaining to actual equipment and installation as required complete the full commissioning scope.

D Contractor shall prepare startup procedures to demonstrate compliance with pre-functional checklists, and coordinate scheduling for completion of these checklists.

E A minimum of seven (7) days prior to date of system startup, submit to Commissioning Agent for review, detailed description of equipment start-up procedures which contractor proposes to perform to demonstrate conformance of systems to specifications and Checklists.

3.03 PARTICIPATION IN COMMISSIONING

A Attend meetings related to the Commissioning Process; arrange for attendance by personnel and vendors directly involved in the project, prior to testing of their systems.

B Provide skilled technicians to startup and test all systems, and place systems in complete and fully functioning service in accordance with Contract Documents.

C Provide skilled technicians, experienced and familiar with systems being commissioned, to assist Commissioning authority in commissioning process.

3.04 WORK TO RESOLVE DEFICIENCIES

A Complete corrective work in a timely manner to allow expeditious completion of Commissioning Process. If deadlines pass without resolution of identified problems, Owner reserves the right to obtain supplementary services and/or equipment to resolve the problem. Costs thus incurred will be Contractor's responsibility.

3.05 PRE-FUNCTIONAL CHECKLISTS (PFC)

A Contractor shall complete Pre-Functional Checklists to validate compliance with Contract Documents installation and start-up requirements, for this Division's systems.

B Refer to commissioning plan for detailed list of equipment to be commissioned.

3.06 FUNCTIONAL PERFORMANCE TESTING (FPT)

A Contractor, in cooperation with Commissioning Agent, shall conduct Functional Performance Testing to validate compliance with Contract Documents.

B Refer to commissioning plan for detailed list of equipment to be commissioned.

C Provide commissioning authority with a certificate of readiness to show systems are ready to schedule functional testing.

D Assist Commissioning authority in Functional Testing by removing equipment covers, opening access panels, etc. Furnish ladders, flashlights, meters, gauges, or other inspection equipment as necessary.

E Sampling

1. Multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy.

2. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in pre-functional checklist execution.

3. A common sampling strategy is the "xx% Sampling - yy% Failure Rule", defined by the following example.

   a. xx = the percent of the group of identical equipment to be included in each sample.

   b. yy = the percent of the sample that if failing, will require another sample to be tested.

   c. The example below describes a 20% Sampling - 10% Failure Rule.

   d. Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

   e. If 10% (yy) of the units in the first sample fail the functional tests, test another 20% of the group (the second sample).

   f. If 10% of the units in the second sample fail, test all remaining units in the whole group.

   g. If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CxA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

F Re-Testing And Failure To Remedy Deficiencies

1. Despite Contractor's best efforts to ensure systems are problem-free, it is expected that some deficiencies will be found during initial inspection of Pre-functional Checklist, and during initial Functional Testing; such deficiencies are expected to be minimal.

2. It is Contractor's responsibility to remedy identified deficiencies, both in Pre-functional Checklist and in Functional Testing phases of work, in a timely and thorough manner.

3. It is Contractor's responsibility to ensure that all deficiencies are corrected prior to requesting a re-inspection or re-test of systems and equipment. Do not request re-inspection or re-test until deficiencies are corrected.

a. At his discretion, CxA may agree to re-testing systems or equipment where deficiencies remain which are beyond Contractor's control to resolve expeditiously.

b. Typically such re-testing of incomplete systems and equipment will take place only if remaining deficiencies are minor in scope and nature, and are of such nature that they cannot be resolved in a timely manner (such as those due to difficulties in obtaining parts, or where Owner has requested a change that has delayed work, etc.)

4. CxA will carry out a second re-inspection or re-test of systems and equipment subsequent to receiving Contractor's request.

a. If CxA finds deficiencies identified in initial inspection or test have not been remedied (with exception of un-resolvable deficiencies in 3.b. above), and such remaining deficiencies are significant enough to require additional inspection or re-testing, Contractor will be back-charged for CxA's expenses, and time at a rate of $150.00 per hour and $100.00 expenses, for a third and any subsequent re-inspections and re-tests.

G Deferred Testing

1. "Seasonal Commissioning" pertains to testing during peak heating or cooling seasons when HVAC equipment is operating at full-load or heavy-load conditions. Initial commissioning will be done as soon as contract work is completed, regardless of season. Seasonal Commissioning under full- or heavy-load conditions other than the current season will be handled at later time by GC and CxA.

2. If adequate load may be artificially placed upon heating or cooling equipment, CxA, at his discretion, may perform functional testing during non-peak load periods.

3. GC is to provide services of personnel and participate in seasonal testing process in the same manner as he would in non-seasonal testing.

4. Until off-season commissioning can be accomplished, Owner may retain an amount from GC's payment sufficient to cover the cost of off-season testing.

5. Unforeseen Deferred Tests: If any check or test cannot be completed due to building structure, required occupancy condition, or other reason, execution of checklists and functional testing may be delayed upon approval of Owner. Tests shall be conducted in same manner as seasonal tests, as soon as possible. Services of required parties will be negotiated. Make final adjustments to Operation and Maintenance Manuals and record drawings due to unforeseen deferred tests.

6. GC is to provide services of personnel and participate in deferred testing in the same manner as he would for normal commissioning.

3.07 TRAINING

A The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B Contractor shall be responsible for training coordination and scheduling, and ultimately to ensure that training is completed.

C The training agenda (plan) shall include, at a minimum, the following elements:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

D Commissioning Agent shall be responsible for overseeing and approving content and adequacy of training of Owner personnel for all installed systems. Provide Commissioning Agent with training plan two weeks before planned training.

3.08 OPERATIONS & MAINTENANCE MANUALS

A The following requirements are in addition to Operations & Maintenance requirements specified elsewhere in this specifications manual.

B Contractor shall compile and prepare documentation for equipment and systems specified in this Division, and shall deliver documentation to Contractor for inclusion in Operation & Maintenance Manuals, in accordance with requirements of Division 01, prior to training Owner personnel.

C Provide Commissioning authority with a single, electronic copy of Operation & Maintenance Manuals for review. Commissioning authority's copy of O&M manuals shall be submitted through Architect.

D Operation and maintenance manuals shall include, service agency contact information, maintenance requirements, controls system settings and a narrative of how each system is intended to operate, including set points.

3.09 DOCUMENTATION

A Commissioning authority shall provide documentation of process as follows:

1. Preliminary commissioning report including test procedures, results of testing, itemization of deficiencies, deferred tests and climatic conditions required for performance of deferred tests. Preliminary commissioning report shall be issued to owner to demonstrate the first pass of testing has occurred and to demonstrate compliance with applicable codes.

2. Final commissioning report shall include the final test and balance report, final results of functional testing, disposition of deficiencies discovered during testing, including the details of corrective measures used and functional testing procedures used for repeatability of testing in the future.

END OF SECTION 26 08 00

SECTION 26 09 43 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.01 SCOPE

A Contractor shall provide complete networked lighting control system that controls designated interior and exterior lighting fixtures, including emergency fixtures. It is the contractor's responsibility to provide and install a complete and functional system, including, but not limited to all room controllers, occupancy sensors, low voltage control stations, emergency bypass controllers, and network bridges, low voltage control cable and lighting network equipment, even if not specifically called out on the plans.

B To Establish equivalent performance, all references in this specification are to products manufacturered by Wattstopper. Other Manufacturers are acceptable as listed below.

1.02 SUMMARY

A Section Includes:

1. Digital Occupancy and Daylighting Sensor Control
2. Emergency Lighting Control
3. Control Intent - Control Intent includes, but is not limited to:
    a. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
    b. Initial sensor and switching zones
    c. Initial time switch settings
    d. Task lighting and receptacle controls
    e. Emergency Lighting control

1.03 RELATED SECTIONS

A Drawings and general provision of the Contact, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section

B Section 26 02 00 - Basic Materials and Methods for Electrical

C Section 26 05 19 - Wire, Cable and Related Materials

D Section 26 27 26 - Wiring Devices

E Section 26 29 26 - Miscellaneous Electrical Controls and Wiring

F Section 26 51 19 - Lighting Fixtures - Light Emitting Diode (LED)

G Section 25000 - Integrated Automation Building integrator shall provide integration of the lighting control system with Building Automation Systems.

1.04 REFERENCES

A ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.05 SYSTEM DESCRIPTION & OPERATION

A The Lighting Control and Automation system as defined under this section covers the following equipment:

1. Digital Room Controllers - Self-configuring, digitally addressable one, two or three relays controllers with integral current thyristor, 0-10 volt control for ballasts (if applicable).

2. Digital Occupancy Sensors - Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.

3. Digital Switches - Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.

4. Digital Photosensors - Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications can provide switching or dimming control for daylight harvesting.

5. Configuration Tools - Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Computer software also customizes room settings.

6. Handheld remotes for personal control - One-button dimming, two-button on/off, or five-button scene remotes provide control using infrared communications. Remote may be configured in the field to control selected loads or scenes without special tools.

7. Digital Lighting Management (DLM) local network - Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

8. Network Bridge - provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS).

9. Segment Manager - provides web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.

10. Emergency Lighting Control Unit (ELCU) - allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

11. System shall conform to requirements of NFPA 70.

1.06 SUBMITTALS

A Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).

2. Scale drawing for each area showing exact location of each sensor, room controller, and digital switch.

C Product Data: Catalog sheets, specifications and installation instructions.

D Include data for each device which:

1. Indicates where sensor is proposed to be installed.

2. Prove that the sensor is suitable for the proposed application.

1.07 QUALITY ASSURANCE

A Manufacturer: Minimum10 years experience in manufacture of lighting controls.

B Lighting controls shall meet the minimum requirements of ICC (IECC) and ASHRAE Std 90.1 I-P as applicable.

1.08 PROJECT CONDITIONS

A Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: 0° to 40° C (32° to 104° F).

2. Relative humidity: Maximum 90 percent, non-condensing.

1.09 WARRANTY

A Provide a five year complete manufacturer's warranty on all products to be free of manufacturers' defects.

1.10 MAINTENANCE

A Spare Parts:

1. Provide 1 spare LMSM-603. Provide 5 spares of each product listed below to be used for maintenance. Electrical contractor deliver items to maintenance department within 30 days of substantial completion.

    a. Room Controllers

    b. Occupancy Sensors

    c. Emergency Bypass controllers

    d. Low voltage switches

    e. Daylighting harvesting photocells

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A WattStopper

B Acuity Brands

C Cooper/Eaton/Greengate

2.02 WALL SWITCH OCCUPANCY SENSORS

A Type DW: Manual-ON, Automatic-OFF dual technology (passive infrared and ultrasonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled; WattStopper LMDW-101 or LMDW-102

2.03 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A Ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters. Passive infrared only sensors shall not be used for classroom applications.

B Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

1. Digital calibration and pushbutton programming for the following variables:

    a. Sensitivity - 0-100% in 10% increments

    b. Time delay - 1-30 minutes in 1 minute increments

    c. Test mode - Five second time delay

d. Detection technology - PIR, Ultrasonic or Dual Technology activation and/or re-activation.

e. Walk-through mode

f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2. One or two RJ-45 port(s) for connection to DLM local network.

3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

4. Device Status LEDs including:

a. PIR Detection

b. Ultrasonic detection

c. Configuration mode

d. Load binding

5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

6. Manual override of controlled loads.

C Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

D All devices shall be hard wired. No wireless devices shall be permitted.

E WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.04 DIGITAL WALL SWITCHES

A Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.

B Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

3. Red configuration LED on each switch that blinks to indicate data transmission.

4. Blue Load/Scene Status LED on each switch button with the following characteristics:

a. Bi-level LED

b. Dim locator level indicates power to switch

c. Bright status level indicates that load or scene is active

5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

C Two RJ-45 ports for connection to DLM local network.

D Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

E The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2. Individual button function may be configured to Toggle, On only or Off only.

3. Individual scenes may be locked to prevent unauthorized change.

4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

5. Ramp rate may be adjusted for each dimmer switch.

6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

F WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101.

2.05 ROOM CONTROLLERS

A Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special configuration.

B The control units will include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2. Simple replacement - Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

3. Device Status LEDs to indicate:

a. Data transmission

b. Device has power

c. Status for each load

d. Configuration status

4. Quick installation features including:

a. Standard junction box mounting

b. Quick low voltage connections using standard RJ-45 patch cable

5. Plenum rated

6. Manual override and LED indication for each load

7. Dual voltage (120/277 VAC, 60 Hz)

8. Zero cross circuitry for each load.

C On/Off/Dimming enhanced Room Controllers shall include:

1. Real time current monitoring

2. One, two or three relay configuration

3. Efficient 250 mA switching power supply

4. Four RJ-45 DLM local network ports.

5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.

6. The following dimming attributes may be changed or selected using a wireless configuration tool:

a. Establish preset level for each load from 0-100%

b. Set high and low trim for each load

c. Set lamp burn in time for each load up to 100 hours

7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.

a. One relay configuration only

b. Automatic-ON/OFF configuration

8. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC- 221, LMRC-222, LMPL-201

2.06 DIGITAL PHOTOSENSORS

A Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in the space and control a single lighting zone. Open loop photosensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B Digital photosensors include the following features:

1. An internal photodiode that measures only within the visible spectrum, and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2. Sensor light level range shall be from 1-10,000 footcandles (fc).

3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).

4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.

5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.

6. Optional programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise and lower lighting levels for a selected period of time or cycle of occupancy.

7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

8. Red configuration LED that blinks to indicate data transmission.

9. Blue status LED indicates test mode, override mode and load binding.

10. Recessed switch to turn controlled load(s) ON and OFF.

11. One RJ-45 port for connection to DLM local network.

12. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

C Closed loop digital photosensors include the following additional features:

1. An internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from bright sources outside of this cone.

2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.

3. Automatically establishes setpoints following self-calibration.

4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.

5. WattStopper Product Number: LMLS-400.

D Open loop digital photosensors include the following additional features:

1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.

3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.

4. WattStopper Product Number: LMLS-500.

2.07 EMERGENCY LIGHTING

A Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

1. 120/277 volts, 50/60 Hz., 20 amp ballast rating

2. Push to test button

3. Auxiliary contact for remote test.

B WattStopper Product Numbers: ELCU-100, ELCU-200.

2.08 ROOM NETWORK (DLM LOCAL NETWORK)

A The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building. Digital room devices connect to the network using CAT 5e cables with RJ-45 connectors which provide both data and power to room devices. Features of the DLM local network include:

1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.

3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.09 BACNET BASED DIGITAL COMMUNICATIONS

A The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 master/slave token passing-based using the BACnet® protocol.

B The panel shall have provision for an individual BACnet device ID. The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

C The panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

D Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property

E Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.

F The 99 channel groups associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

G Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

1. Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.

2. Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.

3. Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.

4. Analog value objects in the instance range of 1 - 64 (one per relay) shall assign relays to channel groups in the range of 1 - 99.

5. Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute gracetime period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

6. Analog value objects in the instance range of 201 - 299 (one per channel) shall assign an after hours time delay value to the channel in the range of 1 - 240 minutes.

7. Multi-state value objects in the instance range of 1 - 99 (one per channel) shall provide the state of the relays assigned to the channel. Valid states shall be ALL ON, MIXED, BLINK, and ALL OFF.

H The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

I The BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add- 135-2010aa.pdf)

J Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

K Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

L Lighting control accessory devices connected to the panel shall be represented via BACnet objects including but not limited to the following:

1. Digital occupancy sensor detection states shall be readable as BI objects ranging from BI1-96.

2. Digital occupancy sensor configuration parameters shall each be accessible as BACnet objects when applicable to a given product.

    a. Occupancy sensor time delay in minutes shall be writeable via AV101- 196.

    b. Occupancy sensor passive infrared (PIR) sensitivity percentage shall be writeable via AV201-296.

    c. Occupancy sensor ultrasonic (US) sensitivity percentage shall be writeable via AV301-396.

3. Digital switch buttons shall be readable and writeable as BI objects ranging from BI101 - 9608.

4. Digital daylight sensors foot-candle readings shall be readable as follows:

    a. Analog 0-5V/0-10V sensors connected to a digital input module shall be represented as AI1-96.

    b. Digital closed loop sensors shall be represented as AI4001-4096.

    c. Digital open loop sensors shall be represented as AI5001-5096.

    d. Digital dual loop sensors shall be represented as follows:

        1) The upward facing open loop sensor shall be represented as AI6001-6096.

        2) The downward facing closed loop sensor shall be represented as AI6101-6196.

5. Digital daylight sensor configuration shall be exposed as BACnet objects as follows:

    a. Digital closed loop sensors shall be represented as follows:

        1) Daylight Sensor Day Setpoint (ftcd) AV4201-4296.

        2) Daylight Sensor Night Setpoint (ftcd) AV4301-4396.

        3) Daylight Sensor Off Setpoint Delay (minutes) AV4401-4496.

        4) Daylight Sensor On Setpoint (ftcd) AV4501-4596.

        5) Daylight Sensor Off Setpoint (ftcd) AV4601-4696.

2.10 USER INTERFACE

A Each lighting control panel system shall be supplied with at least (1) handheld IR remote programming interface consisting of a keypad and associated OLED display screen. The user interface shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following functions as a minimum:

B Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.

C Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.

D Program up to 254 separate scheduled events. Events shall occur on seven (7) day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.

E Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven (7) day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.

F Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.

G Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.

H An additional handheld IR remote may optionally be specified to be permanently mounted to the panel interior via a retractable anti-theft lanyard to allow for convenient programming of the panel while assuring that the handheld programmer is always present at that panel. An unlimited number of handheld IR remotes may also be purchased for facilities staff as seen fit by the end user's representative.

2.11 CONFIGURATIONS TOOLS

A A configuration tool facilitates optional customization of DLM local networks and is used to setup open loop daylighting sensors. A wireless configuration tool features infrared communications, while PC software connects to each local network via a USB interface.

B Features and functionality of the wireless configuration tool shall include:

1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.

4. Save up to nine occupancy sensor setting profiles, and apply profiles to selected sensors.

5. Temporarily adjust light level of any load(s)on the local network, and incorporate those levels in scene setting.

6. Adjust or fine-tune daylighting settings established during auto-commissioning, and input light level data to complete commissioning of open loop daylighting controls.

C WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.12 NETWORK BRIDGE

A The network bridge connects a DLM local network to a BACnet-compliant network for communication between rooms, panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication. Closed or proprietary network communication shall not be acceptable.

1. The network bridge may be incorporated directly into the room controller hardware (LMRC-3xx Room Controllers) or be provided as a separate module connected on the local network through an available RJ-45 port.

2. Provide Plug n' Go operation to automatically discover all room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.

3. The network bridge shall automatically create standard BACnet objects for selected room device parameters to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM room devices on each local network. Standard BACnet objects shall be provided as follows:

    a. Read/write the normal or after-hours schedule state for the room

    b. Read the detection state of the occupancy sensor

    c. Read/write the On/Off state of loads

    d. Read/write the dimmed light level of loads

    e. Read the button states of switches

    f. Read total current in amps, and total power in watts through the room controller

    g. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings

    h. Activate a preset scene for the room

    i. Read/write daylight sensor fade time and say and night setpoints

    j. Read the current light level, in footcandles, from interior and exterior photosensors and photocells

    k. Set daylight sensor operating mode

    l. Read/write wall switch lock status

4. WattStopper product numbers: LMBC-300

2.13 SEGMENT MANAGER

A The Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall serve up a graphical user interface via a standard web browser. Each segment manager shall have support for one, two or three segment networks as required and allow for control of a maximum of 40 local networks (rooms) and/or lighting control panels per segment network.

B Operational features of the Segment Manager shall include the following:

1. Connection to PC or LAN via standard Ethernet TCP/IP.
2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser.
3. Log in security capable of restricting some users to view-only or other limited operations.
4. Automatic discovery of all DLM devices on the segment network(s). Commissioning beyond activation of the discovery function shall not be required.
5. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
6. Ability to view and modify room device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation.
7. Ability to set up schedules for rooms and panels. Schedules shall automatically set controlled zones or areas to either a normal hours or after hours mode of operation.
8. Ability to group rooms and loads for common control by schedules, switches or network commands.
9. Ability to monitor connected load current and display power consumption for areas equipped with room controllers incorporating the integral current monitoring feature.
10. Provide seamless integration with the BAS via BACnet IP. Provide export table with available parameters.

2.14 REALTIME COLOR GRAPHICS

A System Description

1. Color graphics screens shall allow a user to monitor and control the lighting control system through a graphical color interface. The system will control the room controllers in a real-time environment.
2. The application will provide a visual representation of the floor plan, drawn to scale, with each fixture displayed on screen. Fixtures can automatically indicate the relay controlling them on screen.

B Graphic Screen Generation

1. The General Contractor shall provide as built CAD floor plans to the manufacturer for generation of graphic screens.
2. As-Built relay panel and reflected ceiling documentation must be provided to the manufacturer before graphic screen development can begin. Graphic screens will be provided and demonstrated to the owner within 90 days of receiving as built CAD files.
3. District Wide Home Screen
    a. Links to all existing WattStopper Schools in the district
4. School Home screen
    a. School Rendering
    b. Day/ Time
    c. Schedule for that day
    d. Exterior FC reading
    e. Current Lighting Watts per sq.ft.
5. Quick Access System tree
    a. Links
    b. 365 day Scheduler
6. Site Plan
    a. All exterior lighting shown on/ off
7. Screens per floor
    a. For navigation and showing lighting on/off
8. Detail screen per architectural area
    a. Room Occupancy (room shaded green)
    b. Lighting states (3 zones with override)
    c. Real time wattage for lighting
    d. Real Time Wattage for plug load
    e. Real time Photocell footcandle reading if applicable
9. Alarms Reports

C WattStopper Product Numbers: LMSM-6E.

PART 3 - EXECUTION

3.01 INSTALLATION

A Contractor shall provide to the manufacturer all quantities for system including but not limited to relays, room controllers, relay panels, plug load controllers, switches, sensors and wire lengths and configurations for both network and device cable at least 1 week before bid.

B When using wire for connections other than the DLM local network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements

C All MSTP network and Cat 5e low voltage wiring must have “WattStopper” printed on the wire jacket. Any cable substitutions shall be removed and replaced at the contractor’s expense.

D All MSTP network terminations shall utilize wire ferrules for terminations and MSTP network manufacturer’s instructions. Any network deficiencies shall be repaired at the contractor’s expense.

E Electrical contractor must provide a detailed as-built plan in CAD showing MSTP network cable routing and network bridge serial numbers to the manufacturer at least 2 weeks prior to factory commissioning Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated.

3.02 FACTORY COMMISSIONING

A Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete and working system including MSTP network status. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
3. Load Parameters (e.g. blink warning, etc.)

C The electrical contractor shall request factory commissioning by submitting a startup request form at least (4) weeks before startup is required.

D The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

E Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

F Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

3.03 RE-COMMISSIONING

A After 90 days from occupancy the factory authorized representative and electrical contractor shall re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity

END OF SECTION 26 09 43

SECTION 26 21 13 - ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B Power company fees shall be paid by Owner.

C Provide electrical service to comply with contract documents and the power company standards.

1.02 SCOPE

A RELATED WORK:

1. Basic Electrical Materials and Methods.
2. Earthwork
3. Division 1

B Permanent Power: Contractor shall coordinate with the power company to provide electrical service to the building or campus as shown on the drawings. Contractor shall coordinate with power company and submit all required documentation; and shall establish the sequence of work to obtain permanent power.

C Temporary Power: Provided by the contractor.

1.03 PERMITS, CODES, LAWS AND ORDINANCES

A NFPA-70, NEC, State and local.

1.04 MINIMUM COMPLIANCE STANDARDS

A Easements required by power company.

B Duct bank required by power company.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE

A SERVICE TRANSFORMER: Exterior Pad Mounted.

B Terminal pole shall be provided by the power company.

C POWER COMPANY: Bluebonnet.

D SOURCE VOLTAGE: 208Y/120 volt, three phase, four wire system.

2.02 CABLE TAP BOX

A Provide when required by the power company for terminating additional conductors in which the power company transformers terminations are exceeded or for metering.

2.03 METERS

A Provide metering as required by Electric Utility Company Standards and requirements which may include self-contained meters and sockets, current transformers (CT's) and CT enclosures, bussed CT enclosures, transockets, meter modules, and bussed gutters and meter assemblies.

PART 3 - EXECUTION

3.01 SERVICE LATERIAL

A Route service lateral underground to main service disconnect.

B Route service lateral underground to the C/T Can to serve the fire pump.

3.02 COORDINATION

A Confirm with power company exact locations of service entry and other requirements.

B Provide all service laterals, whether above ground or below ground, in accordance with utility company engineered drawings. Information shown on contract documents may vary slightly from utility company engineered drawings and all utility company drawings and specifications shall supersede these contract drawings.

C All electrical service infrastructure, up to the point of delivery, shall be installed per utility company standards. Plans and details included in these contract documents do not depict exact installation details as they may be required by the utility company.

3.03 CONCRETE PADS

A Provide steel reinforced concrete pads with leave outs for conduits to comply with power company standards. Refer to Basic Materials and Methods.

3.04 INSTALLATION

A Provide Primary ductbank, including any and all steel reinforcement, conduit spacers and straps

B Provide secondary service lateral ductbank, including any and all steel reinforcement, conduit spacers and straps

C All unmetered conductors shall be installed in rigid steel conduit, where installed above grade.

3.05 STEEL STRUCTURES

A Provide galvanized steel structure embedded in concrete to support metering equipment and disconnect switches.

3.06 FIRE PUMPS

A Provide a separate concrete encased service lateral to the fire pump controller.

B Provide current transformer (CT) can and meter for fire pump service.

END OF SECTION 26 21 13

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE

A Provide panelboards as shown, scheduled and as specified herein.

B The types of panelboards include:

1. Panelboards.
2. Power distribution panelboards.

1.02 REFERENCE STANDARDS

A NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

C UL 67 - Panelboards; Current Edition, Including All Revisions.

D UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

E UL 943 - Ground fault Circuit Interrupters

F NEMA PB 1 - Panelboards

G NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

H NEMA, ABI, Molded Car Circuit Breakers and Molded Case Switches

I Federal Spec W-P 115, Rev C, Panel, Power Distribution

J NEMA KSI, Enclosed and Miscellaneous Distribution Equipment Switches (600V)

1.03 ACCEPTABLE MANUFACTURERS

A Provide one of the following manufacturers:

1. General Electric Company/ABB
2. Square D Company
3. Siemens
4. Eaton

1.04 SUBMITTALS

A Shop drawings shall include, but not be limited to:

1. Cutsheets of all enclosures, circuit breakers, fusible switches, bussing, rating, schedules and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A WORK IN ACCORDANCE WITH:

1. NFPA 70

2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A General

1. Provide power distribution and panelboards as indicated in the panelboard schedule and as shown on the plans. [<>]. Power distribution panelboards shall be equipped with fusible switches or circuit breakers as shown on the schedule. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule.

B Busing Assembly and Temperature Rise

1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 65°C. rise above 40°C ambient. Heat rise test shall be conducted in accordance with Underwriters Laboratories Standard UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests. All current carrying parts of the bus shall be tin or silver plated copper.

2. Bus structure shall be isolated. Bus bar connections to the branch circuit breakers shall be distributed phase or phase sequence type and shall accept bolt-on circuit breakers for lighting and appliance panelboards.

3. The lugs for terminating conductors shall be rated at 75°C on all panel boards and circuit breakers.

4. Provide a non-insulated bare copper ground bus. Provide an isolated ground copper bus in each panel serving isolated ground circuits as indicated on panel schedule or one-line diagram. Provide a full size copper neutral bus in each panelboard enclosure. Provide a 200% neutral buss when served by a harmonic mitigating transformer and any K4 or higher rated transformers.

C Distribution Panelboards

1. Provide arc energy reduction switch for each overcurrent device rated 1,200 amps or larger to comply with 240.87 of the NEC. Switch shall be equipped with a pad lockable cover with a blue LED pilot light that illuminates when system is activated. Locate switch and cover recessed mounted adjacent to the switch it serves or remote as indicated on the plans. Provide label and all required hardware. Remote switch(es) shall be flush mounted in wall near entry to the room.

2. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Tripped indication shall be clearly shown by the breaker handle taking a position between “ON” and “OFF”. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers. Circuit breakers shall be of the frame size, trip setting and interrupting capacity as indicated on the drawings. Circuit breakers shall be rated 65,000 AIC unless otherwise noted on plans.

3. All fusible switches shall be quick-make, quick-break with visible blades and dual horsepower ratings. Switch handles shall physically indicate “ON” and “OFF” positions. Switches shall be lockable only in the “OFF” position and accept three industrial type heavy duty padlocks. Switch covers and handles shall be interlocked to prevent opening in the “ON” position. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Switches shall include positive pressure rejection type fuse clips for use with UL Class R fuses or Class J fuses and be UL labeled for 200,000 AIC.

D 240 Volt Panelboards

1. Main breakers shall be vertically mounted. Branch mounted main breakers are not acceptable. Provide electronic trip mains with long term, short term and instantaneous trips as indicated on drawings and required for selective coordination.

2. Circuit breakers shall be bolt-on thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3 pole with an integral crossbar to assure simultaneous opening of all poles in multiple circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions.

3. Circuit breakers shall be UL listed in accordance with UL 489 and shall be rated 240 volts ac maximum with continuous current rating as noted on the plans.

4. Branch circuit breakers feeding convenience outlets shall have sensitive instantaneous trip settings of not more than 10 times the trip settings of the breaker to prevent repeated arcing short resulting from frayed appliance cords. Single pole 15 and 20 ampere circuit breakers shall be UL listed as "Switching Breakers" at 120V ac and carry the SWD marking.

5. UL Class A 5mA ground fault circuit protection shall be provided on all receptacle circuits serving wet areas and on all 120V ac branch circuits as specified on the plans or panelboard schedule. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring. Tripping of a branch circuit breaker containing ground fault circuit interruption shall not disturb the feeder circuit to the panelboard. A single pole circuit breaker with integral ground fault circuit interruption shall require no more panelboard branch circuit space than a conventional circuit breaker.

6. UL Class B 30mA ground fault circuit protection (GFEP) shall be provided on all equipment circuits requiring ground fault protection. This protection shall be an integral part of the branch circuit breaker which also provides overload and short circuit protection for branch circuit wiring.

7. Provide Shunt Trip Breakers including control power for circuits under cooking hoods and other equipment having this requirement.

8. Provide Breakers with Switched Neutral circuits with common trip for gasoline pumps and other equipment having this requirement.

9. Circuit breakers shall be rated 10,000 AIC at 240V unless otherwise noted on plans or served by transformers greater than 150 kVA.

10. Provide 200% sized neutral bus with panels served from a non-linear transformer and any K4 or higher rated transformers. This shall be a UL approved assembly.

E Cabinets and Fronts

1. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL 50 for cabinets. Wiring gutter space shall be in accordance with UL 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Provide stainless steel front cover for all panels located in all Pool Equipment rooms, Food Labs, Snack Bars, Culinary Arts, Kitchens and Life Skills rooms. All NEMA-1 panels shall have hinged front covers. The front cover shall have a door with hinges, latch and a lock. The piano hinged front covers door-in-door shall allow full access to the circuit breaker gutter area without having to remove the entire front cover. All panelboard lock shall be keyed alike. Circuit breaker and fusible distribution panels shall have four-piece trims. A welded circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. Provide NEMA 1 enclosure where installed indoors unless otherwise noted. Provide NEMA 3R enclosure where installed outside or in a sprinkled area.

F Safety Barrier

1. The distribution panelboard interior assembly shall be dead front with panelboard cover removed. Main lugs or main breakers shall have a barrier. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.

G Integrated Equipment Short Circuit Rating

1. Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the over-current devices mounted in the panelboard. The short circuit tests on the over-current devices and on the panelboard structure shall be made simultaneously by connecting the fault to each over-current device with the panelboard connected to its rated voltage source. Method of testing shall be per UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard over-current devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

PART 3 - EXECUTION

3.01 INSTALLATION

A General: Install panelboards, including electrical connections, in accordance with manufacturers written instructions, NFPA 70 and recognized industry practices.

B All panels shall be mounted to unistrut. Unistrut shall be securely mounted to the floor and structural ceiling. Toggle bolts or anchor bolts attached to drywall is not acceptable.

C Housekeeping Pads: Mount floor mounted panelboards on 4 inch high concrete housekeeping pads.

D Fuses: Install fuses of the rating and class as shown in each fusible distribution panel scheduled on drawings.

E Conduits: Stub up three one inch conduits to an accessible location above the ceiling for each recessed panelboard.

3.02 IDENTIFICATION

A Nameplate: Each panelboard shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show panel designation. Nameplates shall be attached with stainless steel screws. Refer to Section 26 02 00, paragraph 2.8(C).

B Directory Card: Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include location and name of each item of equipment served. Spares and spaces shall be written in erasable pencil for future use. Circuit directory shall show the room served by each circuit. The final graphs/signage room numbers shall be used. Do not use Architectural numbering on plans.

C Replacement Components: Where circuit breakers or fuses are applied in compliance with the series combination ratings marked on the equipment by the manufacturers, the equipment enclosure(s) shall be legibly marked in the field to indicate the equipment has been applied with a series combination rating. The marking shall be readily visible and state "caution - Series Rated System." (NEC 110-22). Nameplate shall also identify replacement components.

D Replacement Components: Nameplate shall identify replacement components.

3.03 INFRARED SCANNING

A After Substantial Completion by not more than 2 months after Final Acceptance, perform an infrared scan of each panelboard. Remove fronts if not equipped with viewing ports to make joints and connections accessible to a portable scanner. Submit a copy the owner and engineer for review. If O&M manuals are submitted prior to performance of infrared scan, contractor shall submit a signed letter to verify the scan has been arranged. Letter shall indicate the scan provider and the date It will be performed.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.01 SCOPE

A Provide wiring devices as shown, scheduled, required and as specified.

B The types of wiring devices required include:

1. Switches
2. Receptacles
3. Occupancy Sensors
4. Digital Timer Switches
5. Coverplates
6. Floor Boxes
7. Fire Rated Poke Through Devices

1.02 REFERENCE STANDARDS

A FS W-C-596 - Connector, Electrical, Power, General Specification for; 2014h (Validated 2022).

B FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification); 2017g, with Amendment.

C NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

D NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

E NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

G UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

H UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

I UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

J UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 QUALITY ASSURANCE

A All wiring devices shall comply with NEMA WD 1 and NEMA WD 6 as well as FS W-C-596 and FS W-S-896 as applicable.

B All switches shall comply with UL 20 as applicable.

C All receptacles shall comply with UL 498 as applicable.

D All GFCI receptacles shall comply with UL 943.

E All USB charging receptacles shall comply with UL 1310.

F All AFCI receptacles shall comply with UL 1699.

1.04 ACCEPTABLE MANUFACTURERS

A Hubbell

B Leviton

C Pass & Seymour

1.05 SUBMITTALS

A Shop drawings shall include but not be limited to:

1. Cut sheets of all devices indicating NEMA configuration, rating, materials, color, and all accessories.

2. Cut sheets of all coverplates indicating materials, color and any engraving specified on drawing or in the specifications.

1.06 REQUIREMENTS OF REGULATORY AGENCIES WORK IN ACCORDANCE WITH

A National Electric Code.

B Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A GENERAL

1. Provide factory assemble wiring devices with the rating type and color as required and specified for the service indicated.

2. Provide matching one-piece multiple gang plates where switches are ganged.

3. Provide wall plates for each receptacle furnished.

4. Architect reserves the right to select wiring device styles and colors to match wall finish.

5. Wall plates shall be of same manufacturer as devices.

2.02 SWITCHES

A Provide specification grade White toggle switches where indicated on the Drawings. Provide "Red" switches for switching emergency lighting circuits where switching is indicated. Coordinate exact locations with architect.

1. Wall switches shall be 20 amp, 120-277 volt and shall be Hubbell, Leviton or P&S as follows:

TOGGLE SWITCHES	HUBBELL	LEVITON	P&S
SINGLE POLE	HBL1221	1221-2	PS20AC1
DOUBLE POLE	HBL1222	1222-2	PS20AC2
THREE WAY	HBL1223	1223-2	PS20AC3
FOUR WAY	HBL1224	1224-2	PS20AC4
MOMENTARY CONTACT	HBL1557	1257	1251
THREE POSITION, TWO CIRCUIT MAINTAINED CONTACT	HBL1385	1285	1225
KEY TYPE LOCKABLE BARREL KEY OR CORBIN STYLE	HBL1221-RKL	1221-2KL	PS20AC1-KL
PROVIDE WITH EXTRA KEYS	HBL1209RKL	2KL	4609
DISCONNECT SWITCH / INSTA HOT	HBL7810DS	MS303-DSS	7803

2. Dwelling units shall use Hubbell CS115I, CS120I, P&S CS15AC1, and CS20AC1.

3. Dimmers: Provide Lutron DIVA or equal as shown on drawings. Wall box dimmers shall be sized to handle the load served. Provide phase dimmers to control LED lamps when 0-10 volt dimming drivers are not provided.

4. Light Handle Switches: Provide Hubbell HBL1221-IL, Leviton 1221-LHC, P&S PS20AC1-ISl lighted handles to switch emergency lights where noted on the drawings.

2.03 RECEPTACLES

A Provide specification grade White receptacles where indicated on the drawings. Provide “Red” receptacles for receptacles on emergency power. Coordinate exact location with architect.

1. Receptacles shall be Hubbell, Leviton or Pass & Seymour as follows:

CONVENTIONAL RECEPTACLES	HUBBELL	LEVITON	P&S
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R DUPLEX	HBL5352	5362	5362
HEAVY DUTY BRASS MOUNTING YOKE NEMA 5-20R SIMPLEX	HBL5361	5361	5361
ISOLATED GROUND 20A, 125V ORANGE NEMA 5-20R DUPLEX	IG5352	5362IG	IG5362
CLOCK HANGER 15A-125V BROWN WITH STAINLESS STEEL PLATE WITH HANGER	HBL5235	5361-CH	S3733-SS
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER RESISTANT FOR LOCATIONS REQUIRING TAMPER	GFRST20	GFTR2	2097TR

RESISTANT INSTALLATION OR AS INDICATED ON THE DRAWINGS			
GFCI DUPLEX 20A, 125V SELF TESTING, FEED THRU CAPABLE, TAMPER/WEATHER RESISTANT FOR INSTALLATION IN DAMP/WET LOCATION OR AS INDICATED ON THE DRAWINGS	GFTWRST20	GFWR2	2097TRWR
HEAVY DUTY TAMPER RESISTANT BRASS MOUNTING YOKE	HBL5362WTR	5362-SG	---
TAMPER RESISTANT 20A, 125V DUPLEX	BR20WHITR	8300-SG	TR63-H
SURGE PROTECTION 20A, 125V DUPLEX, BLUE NEMA 5-20R WITH AUDIBLE ALARM	HBL5362SA	7380-B	5362SP
USB CHARGER TYPE DUPLEX 20A, 125V TAMPER RESISTANT, DUAL USB TYPE A PORTS MIN. OF 5A USB OUTPUT, TAMPER RESISTANT	USB20A5x 5A OUTPUT	T5832* 3.6A OUTPUT	2097TRUSBA4* 2.1A OUTPUT
PLUG LOAD CONTROLLED RECEPTACLES 20A, 125V TAMPER RESISTANT WITH TWO CONTROLLED FACES	BR20C2WHITR	TBR20-S2W	TR5362CDW
PLUG LOAD CONTROLLED RECEPTACLES 20A, 125V TAMPER RESISTANT WITH ONE CONTROLLED FACE	BR20C1WHITR	TBR20-S1W	TR5362CHW
ARC FAULT CIRCUIT INTERRUPTER RECEPTACLES	AF20TRW	AFTR2-W	AF202TRW
GROUND FAULT CIRCUIT INTERRUPTER / ARC FAULT DUAL FUNCTION	AFGF20TR	AGTR2-W	AFGF202TR

2.04 OCCUPANCY SENSORS

A Provide White dual technology wall mounted sensors, provide one of the following:

1. Single Pole:
    a. Wattstopper #DSW301
2. Double Pole:
    a. Wattstopper # DSW302
3. Dimmer:
    a. Wattstopper #DW311

B Provide dual technology ceiling sensor with low voltage controlling switch and power pack.

1. Single Button:

a. Wattstopper # DT300 Sensor, BZ150 Power Pack and LVSW101 Digital Switch

C Provide Ultra Sonic Ceiling sensor for restrooms.

1. Wattstopper #UT3000, BZ150 Power Pack

2.05 DIGITAL TIMER SWITCHES

A Provide Wattstopper TS-400-G digital timer. Locate in mechanical, electrical, MDF, and IDF rooms.

B The time switch shall provide audible notification and visual notification (blink the room lights) prior to turning lights off.

C The time switch shall have a 12-hour manual override setting.

2.06 COVERPLATES

A Furnish and install coverplates on all outlet boxes. Oversize (Jumbo) coverplates are not acceptable.

B Coverplates shall be smooth nylon and 302/304 smooth stainless steel in kitchen and coffee bar areas.

C Provide Hubbell WP Series, Bell, Carlon or Leviton NEMA 3R weatherproof coverplates on all exterior wiring devices. Enclosure shall be suitable for wet locations when in use.

D Coverplates shall be Hubbell SS Series, Leviton, Pass & Seymour 302/304 smooth stainless steel on all receptacles 30 amps and larger.

E Stainless steel device plates shall be provided at locations with tile or stone walls.

2.07 FLOOR BOXES

A Floor boxes with surface activation shall be cast iron as manufactured by Hubbell or equal by Wiremold 880CS/CM series and as indicated below:

1. Slab at grade (dual level, fully adjustable type 1).

a. Single gang: #B-2436 w/#SB-3083 carpet flange.

b. Two gang: #B-4233 w/#SB-3084 carpet flange.

c. Three gang: #B-4333 w/#SB-3085 carpet flange.

2. Slab above grade (shallow, fully-adjustable, type II)

a. Single gang: #B-2421 w/#SB-3083 carpet flange.

b. Two gang: #B-2422 w/#SB-3084 carpet flange.

c. Three gang: #B-2423 w/#SB-3085 carpet flange.

3. Cover plates shall have brass finish as follows:

    a. #S-3825 for duplex flap for duplex receptacles.

    b. #S-3826 for data/communications.

B PVC floor boxes manufactured by Hubbell or equal shall be as follows:

1. Provide CFBS1R4CFB dual service cast iron body floor box with PVC riser. Provide CFBS1R4CUP adjustable mounting cup, S1R4SP2X2DUPLEX sub-plate for (1) Duplex and (2) RJ-45 Keystone jacks OR S1R4SP2X2STYLE for (1) GFCI duplex, USB or Surge Device & (2) Keystone jacks, OR S1R4SPQUAD sub-plate with (4) 20A simplex receptacles, single and dual circuit wiring capability. Provide with CFBS1R4CVR cover, Color to be chosen by Architect.

    a. Maximum finished floor thickness (above top of box collar) with maximum adjustability is 1-1/2-inches at 5-inch, at 6-inches maximum adjustability is 1/2".

C Floor boxes, recessed activation type, meet UL 514A scrub water requirements, shall be stamped steel with corrosion resistant finish, UL Listed for slab-on-grade installations, or stamped steel for above-grade installations as manufactured by Hubbell or equal by Wiremold RFB2-11 series and as indicated below:

1. Recessed Activation Slab at grade:

    a. Two gang: #CFB2G30CR or CFB2G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15” rise

    b. Four Gang: #CFB4G30CR or CFB4G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.

    c. Six Gang: #CFB6G30CR or CFB6G30RCR (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall maintain the 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.

    d. Ten Gang AV: #CFB10G55CR or CFB10G55RCR (provisions for round cover), with minimum (2) 2” KO’s, multiple front and back ¾” to 1-1/2” concentric KO’s.. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.

2. Recessed Activation Slab above grade

a. Two Gang: #CFB2G30 or CFB2G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange and Furniture Feed cover availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.

b. Four Gang: #CFB4G30 or CFB4G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past 0.15” rise.

c. Six Gang: #CFB6G30 or CFB6G30R (provisions for round cover), capable of up to 2” entry per gang. Flush flange, Surface flange availability. Surface Type Covers shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall maintain the 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise

d. Ten Gang AV: #CFB10G55 or CFB10G55R (provisions for round cover), with minimum (2) 2” KO’s, multiple front and back ¾” to 1-1/2” concentric KO’s.. Flush flange, Surface flange availability. Cover shall not exceed 0.15” rise. Covers with provisions for cable egress, when in use, shall not exceed/extend past the 0.15” rise.

3. Service Fittings

a. Surface Style Rectangular for use with carpet, tile, VCT and other engineered floors, available with or without carpet insert and offer system’s furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

b. Flush Style Rectangular for use with tile, finished concrete or Terrazzo floors, available with or without carpet insert and offer system’s furniture feed type cover providing (1) 1-inch and (1) 2-inch threaded openings

c. Rectangular covers shall be powder coated in variety of common finishes, Aluminum, Black, Brass, Bronze and Satin Nickel.

d. Round Covers for use with all floor types Shall provide cable egress doors and systems furniture feed type cover providing (1) ¾-inch and (1) 2-inch threaded openings Round covers shall be plated metal in variety of finishes except Black (powder coated) Brushed Aluminum, Brass Plated, Bronze Plated, Satin Nickel Plated.

PART 3 - EXECUTION

3.01 WIRING DEVICE MOUNTING HEIGHTS

A Unless noted to the contrary on plans, or directed otherwise during the progress of the Work, wiring devices shall be set as follows:

1. Switches 42" above finished floor.

2. Wall mounted receptacles shall be installed vertically at 15 inches to the bottom outlet above finished floor unless otherwise noted or as required by local codes.

3. Wall telephone outlets shall be mounted 15 inches to the bottom above finished floor unless otherwise noted. Mount even with wall mounted receptacles.

4. At locations above counters, set devices at 6 inches above to the centerline counter tops, verify exact mounting height with the architect.

3.02 INSTALLATION (REFER TO 26 05 33 FOR OUTLET BOX SPECIFICATIONS)

A Wall switches shall be set in a suitable steel box and shall be installed on the strike side of the door as finally hung, whether so indicated on the Drawings or not.

B Receptacles shall be installed in a suitable steel box.

C The Architect reserves the right to relocate wiring device up to a distance of 5 feet from the location shown, before rough-in, without additional cost.

D Provide multi-gang device covers at locations where devices gang together.

E Device locations are indicated schematically on the drawings along with the type and mounting height. Final locations and mounting heights shall be coordinated with the Architect on the jobsite, and with shop drawings of equipment; including equipment to be furnished and installed by the Owner. Devices installed in walls covered with vinyl, fabric wallpaper or other special finishes shall be coordinated and verified with the Architect on the job site.

F Stranded wire termination to switches, receptacles, devices and miscellaneous control devices shall be with an approved solderless terminal if clamp type securing is not possible (i.e. Sta-Con crimp on fork tongue connectors; Burndy Type TP-F).

G Provide keyed switches in all common areas not monitored by the faculty (i.e. gym, corridors, cafeteria, commons natatoriums).

H All 15 amp and 20 amp receptacles shall be tamper-resistant type.

I All 20A, 120V receptacles in food service areas shall be GFCI.

J Provide GFCI circuit breakers for all drinking fountain branch circuits where GFCI receptacles are not indicated on plan.

K Provide ARC Fault circuit interrupters (AFCI) as required to comply with article 210.12 of NFPA 70. This shall include but not be limited to dwelling units and dormitories. AFCI breakers may be used.

L Provide ground fault circuit interrupter (GFCI)/ARC Fault circuit interrupter (AFCI) dual function receptacles to comply with articles 210.8, 210.12 and 406.4 of NFPA 70.

M Contractor shall indicate the circuit serving each wiring device. Provide a typewritten label located on the inside face of the coverplate for all recessed mounted devices and on the outside of the coverplate on all surface mounted devices.

END OF SECTION 26 27 26

SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.01 SCOPE

A Provide fuses as shown and scheduled and indicate by this specification section and other specifications sections.

B The type of fuses include:

1. 600 volt current limiting.

2. 250 volt current limiting.

1.02 STANDARDS

A ANSI

B UL

1.03 ACCEPTABLE MANUFACTURERS

A Eaton Bussmann

B Mersen

1.04 SUBMITTALS

A Shop drawings shall include, but not be limited to:

1. Cutsheets of all fuses showing ratings and fuse curves.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A WORK IN ACCORDANCE WITH:

1. National Electrical Code.

2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 CURRENT - LIMITING FUSES

A General: Provide 200,000 amp interrupting capacity current limiting fuses of the ampacity and voltage indicated and scheduled.

B Mains, Feeders and Branch Circuits

1. Circuits 601 to 6000 ampere shall be protected by current limiting BUSSMANN HI-CAP Time Delay Fuses KRP-C. Fuses shall employ "O" ring as positive seals between the end bells and the glass melamine fuse barrel. The terminals shall be peened. Fuses shall be time-delay and must hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .1 seconds or less and be listed by Underwriters` Laboratories Inc., with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L.

C Class J Fuses

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes rRMS symmetrical. The fuses shall be UL Class J.

2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK LPJ. The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPJ installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class LPJ or L. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPJ as shown on the drawings. The fuses shall be UL Class J.

D Class RK1 Fuses

1. Circuits 0 to 600 ampere shall be protected by current limiting BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). All dual-element fuses shall have separate overload and short-circuit elements. Fuse shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuited clearing chamber. The fuse must hold 500% of rated current for a minimum of 10 seconds and listed by Underwriters' Laboratories Inc., with an interrupting rating of 200,000 amperes RMS symmetrical. The fuses shall be UL Class RK1.

2. Motor Circuits - All individual motor circuits rated 600 amperes or less shall be protected by BUSSMANN LOW-PEAK Dual Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts). The fuses for 1.15 service factor motors shall be installed in ratings approximately 125% of motor full current except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to full speed quickly, such as large fans. Under such conditions the fuse should be 150% to 200% of the motor full load current. Larger H.P. Motor shall be protected by BUSSMANN Type KRP-C HI-CAP Time-Delay Fuses of the rating shown on the drawings. 1.0 service factor motors shall be protected by BUSSMANN LOW-PEAK Dual-Element Fuses LPN-RK (250 volts) or LPS-RK (600 volts) installed in ratings approximately 115% of the motor full load current except as noted above. The fuses shall be UL Class RK1 or L.

3. Circuit breaker panels shall be protected by BUSSMANN LOW-PEAK Dual-Element LPN-RK (250 volts) or LPS-RK (600 volts) as shown on the drawings. The fuses shall be UL Class RK1.

2.02 SPARES

A Upon completion of the building the contractor shall provide the owner with spare fuses as shown below.

1. 10% (minimum of 3) of each type and rating of installed fuses shall be supplied as spares.

2. BUSSMANN spare fuse cabinets - Catalog No. SFC - shall be provided to store the above spares.

PART 3 - EXECUTION

3.01 INSTALLATION

A Fuses: Fuses shall not be installed until equipment is ready to be energized. This measure prevents fuse damage during shipment of the equipment from the manufacturer to the job-site or from installation. All fuses shall be furnished and installed by the electrical contractor. All fuses shall be of the same manufacturer.

B All fuses shall be installed in fuse holders.

END OF SECTION 26 28 13

SECTION 26 28 16 - SAFETY AND DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 SCOPE

A Provide safety and disconnect switches as shown, scheduled and as specified herein.

1.02 STANDARDS

A Products shall be designed, manufactured, tested and installed in compliance with applicable standards.

1. NEMA KS1 - Enclosed switches
2. Federal specification W-S-865C-Heavy duty switches

B Products shall conform all applicable UL standards, including UL98 (standard for safety, enclosed and dead front switches) and shall be UL-labeled.

1.03 ACCEPTABLE MANUFACTURERS

A Provide one of the following manufacturers:

1. General Electric Company/ABB
2. Square D Company
3. Siemens
4. Eaton

1.04 SUBMITTALS

A Shop drawings shall include, but not be limited to:

1. Cutsheets of switches with ratings, physical dimensions and all accessories clearly labeled.

1.05 REQUIREMENTS OF REGULATORY AGENCIES

A WORK IN ACCORDANCE WITH:

1. National Electrical Code.
2. Local, municipal, or state codes that have jurisdiction.

PART 2 - PRODUCTS

2.01 GENERAL

A Furnish and install heavy duty type safety switches with the number of switched poles as indicated on the plans and specifications. All safety switches shall be NEMA Heavy Duty Type HD, and Underwriters Laboratories listed.

2.02 MATERIALS AND COMPONENTS

A Switch Interior

1. All switches shall have switch blades that are fully visible in the "OFF" position when the door is open. Switches shall have removable arc suppressor where necessary, to permit easy access to line side lugs. Lugs shall be front removable and UL listed for 60ºC and 75ºC copper or aluminum cables. All switches blades and contacts shall be plated copper. Adjust fuse block to accept Class J fuses.

B Switch Mechanism

1. Switches shall have a quick-make and quick-break operating handle and mechanism, which shall be an integral part of the box, not the cover. Padlocking provisions shall be provided for locking in the "OFF" position with at least three padlocks. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. A means shall be provided to permit authorized personnel to release the interlock for inspection purposes. Handle position shall indicate if switch is "ON" or "OFF".

C Neutral

1. Provide a solid neutral with the safety switch where a neutral is present in the circuit.

D Ratings

1. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. The fused switches shall have Class R rejection fuse clips or adjusted for Class J fuses. UL listed short circuit ratings of the switches, when equipped with Class R fuses, shall be 200,000 symmetrical amperes.

E Enclosures

1. Indoor switches shall be furnished in NEMA 1 enclosures.

2. Outdoor switches, switches located in wet areas or sprinkled areas shall be furnished in NEMA 3R enclosures.

3. Switches installed in wet areas such as cooling tower areas shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

4. Switches installed in kitchens shall be stainless steel.

5. Switches installed in areas of a corrosive nature and subjected to salt air shall be NEMA 4X stainless steel or fiberglass reinforced polyester.

F Electrical Interlock Contacts

1. Provide electrical interlock contacts on all disconnect switches serving motors in which remote VFDs are serving the motor. Provide conductors from contacts to the safe circuit inside the VFD. De-energizing the disconnect switch shall signal VFD to stop.

G Service Entrance

1. Switch shall be suitable for use as service entrance equipment when installed in accordance with the National Electrical Code.

PART 3 - EXECUTION

3.01 GENERAL

A Install safety and disconnect switches, including electrical connections, and fuses in accordance with manufacturer's written instructions, NEC and recognized industry practices.

B Location: Install switches within sight of controllers.

C Hubs: Provide bolt-on hubs for rainproof or wet area applications.

3.02 IDENTIFICATION

A Nameplate: Each disconnect switch shall have an engraved bakelite nameplate. Nameplates shall be white with black letters and show equipment served. Nameplates shall be attached with stainless steel screws.

END OF SECTION 26 28 16

SECTION 26 29 26 - MISCELLANEOUS ELECTRICAL CONTROLS AND WIRING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

1.02 SCOPE

A Provide the various miscellaneous control devices, wiring and additional branch circuits as required, shown and specified.

B The types of miscellaneous control devices and wiring include but not limited to the following.

1. Contactors
2. Relays
3. Photocells
4. Time switches
5. Relay Panels
6. Additional control wiring and safety devices as shown and specified
7. Connect power from fire alarm relays to starters to shut down air handling units
8. Motorized Dampers
9. Smoke Dampers and Combination Fire/Smoke Dampers

C WORK SPECIFIED ELSEWHERE:

1. Various control devices, of an electrical nature, for the safe operation and temperature control of the heating, ventilating, air conditioning and plumbing systems provided under Division 22 and Division 23.
2. All control wiring and conduit shall be furnished under Division 23. All power wiring 120 volt or larger shall be provided by Division 26.
3. Refer to building controls specification, Division 23 for scope of work required to be performed by Division 26 (electrical contractor).
4. Specification 26 05 19 - Wire, Cable and Related Materials.

1.03 REFERENCE STANDARDS

A ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

B NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

E UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

F UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

1.04 REQUIREMENTS OF REGULATORY AGENCIES

A WORK IN ACCORDANCE WITH:

1. NFPA 70
2. Local municipal or state codes that have jurisdiction.
3. UL 916
4. UL 924

1.05 ACCEPTABLE MANUFACTURERS

A Provide one of the following manufacturers:

1. LIGHTING CONTACTORS AND RELAYS
    a. General Electric Company/ABB
    b. Square D Company
    c. Automatic Switch Company
    d. Eaton
    e. Siemens
2. PHOTOCELLS AND TIME SWITCHES
    a. Tork, Inc.
    b. Intermatic time controls
3. RELAY PANELS
    a. Wattstopper
        1) LMCP
    b. Cooper/Eaton
        1) ControlKeeper

PART 2 - PRODUCTS

2.01 MATERIAL

A GENERAL: This Section shall outline the basic installation of electric devices, conduit, boxes, fittings, and wiring required for complete interconnection of several systems, this may not reflect every required appurtenance. It does not cover integral parts of mechanical equipment.

B CONTACTORS AND RELAYS: Provide control wiring, contactors, and relays with the ampere-rating and number of poles as shown, specified, and required for a complete and functioning system:

1. Rated at 600 volts, 60 hertz.
2. Continuously rated contacts for all types of ballast and tungsten lighting, resistance and motor loads. Contacts shall be sized as scheduled or noted.
3. Shall have totally enclosed, double-break silver-cadmium-oxide power contacts. Auxiliary arcing contacts are not acceptable. Contact inspection and replacement shall be possible without disturbing line or load wiring.
4. The contactor shall have straight-through wiring with all terminals clearly marked.
5. The contactor shall be approved per UL 508 and/or CSA, and be designed in accordance with NEMA ICS 2-21 1B.
6. They shall be industrial-duty rated for applications to 600 volts maximum.
7. The contactor shall have provisions for factory or field addition of:
    a. Four (4) N.O. or N.C. auxiliary contacts rated 6 amperes continuous at 600 volts.
    b. Single or double circuit, N.O. or N.C., 30 or 60 ampere 600 volt power-pole adder.
8. The contactor shall have a NEMA type 1 enclosure unless otherwise noted.
9. Control power to the contactor 120V control circuit shall be provided from the nearest panelboard 120V circuit. If the 120V control power circuit is not shown, provide a control power transformer for 120 volt control power and a 120 volt coil when required for control. Provide primary and secondary fuses on the control power transformer.
10. Electrically Held Lighting - Contactor coils shall be continuously rated and encapsulated. Electrically held contactors are not to be used unless specifically shown on the plans.
11. Mechanically Held Lighting Contactors - Coil-clearing contacts shall be supplied so that the contactor coils shall be energized only during the instance of operation. Both latch and unlatch coils shall be encapsulated. All contactors shall be mechanically held unless noted otherwise on the plans.
12. Provide 2-wire or 3-wire control modules as required to operate lighting contactors.

13. Provide hand-off-automatic controls (H-O-A) for each lighting contactor.

14. Provide relays and contactors to shut down air handling units.

C Photocells for Stand-alone controls (not part of relay panel controls): Provide a specification grade self-contained, weatherproof, photoelectric control that shall be mounted on an FS type weatherproof junction box. The photocell shall:

1. Switch "ON" at dusk and "OFF" at dawn.

2. Adjustable from 2 to 50 foot-candles.

3. Rated at 2,000 watts.

4. Use 1" diameter cadmium sulphide cell.

5. Have a 2-minute delay to prevent false switching.

D TIME SWITCHES: Provide a 7-day digital time clock with battery back-up feature installed in a NEMA 3R enclosure.

E Control wiring shall be not less than #14 AWG type THWN/THHN and shall be color coded and labeled with Brady markers throughout. Bundle multiple conductors with Ty-Raps.

F Relay Panels

1. Rated 277V, 60Hz.

2. Panel operating voltage of 120-277V

3. Uses any of the following relays:

   a. Mechanically Latching Relays

   b. Multi-pole Relays

4. 15A, 20A, and 30A rated relays available

5. Basic Capabilities:

   a. 7-Day Clock

   b. Capable of being set for 7 different day types per week

   c. Includes automatic holiday shutoff feature

   d. Has program backup to restore operations after power failure

   e. Can be expanded to include override switches

   f. On-board programming and processing

6. Each individual relay can be individually or group programmable to operate based on user-provided parameters, manual switch operation, photocells and sensors, or automatic program routines.

7. Rated for minimum of 10 million operations.

8. Contains occupant warning features to flash relays prior to time-out to notify occupants of change of state.

9. Capable of interfacing with other systems via RS-232, RS-485, or Ethernet.

10. Capable of interfacing with occupancy sensors for zone control.

11. Capable of Switch-Masking or Lockout features for user-operated switches.

12. Provide Locking Hinged Enclosures as suitable for relay panel environment. At a minimum, all relay panels shall be NEMA 1, and may be included with the relay panel assembly from the manufacturer. Provide enclosures to house relay panels where NEMA 1 is insufficient, as follows:

    a. Outdoors and unconditioned spaces: NEMA 3R

    b. Central Plants, or any plant with process water systems: NEMA 4/12

    c. Outdoors, Within 50-miles of saltwater coastlines: NEMA 4X

13. Dimming Modules shall be furnished with each relay panel, where dimming is required, per plan.

14. Pushbutton switches manufactured as compatible with the relay panel to either be used as override switches, or general control switches.

15. Provide photocells for use by relay panels for exterior ambient light monitoring:

    a. 1 per relay panel, when relay panels are stand alone

    b. 1 per building, when relay panels are networked

PART 3 - EXECUTION

3.01 INSTALLATION

A Install miscellaneous electrical controls and wiring to provide a functioning system.

B Install contactor and relays in electrical/mechanical rooms unless otherwise noted.

C Install photocells on the roof unless otherwise directed by the architect. Coordinate any roof penetrations with all other trades and shield from other light sources. Install photocells high on North facing walls, or in accordance with manufacturer's installation instructions.

D Provide miscellaneous connections including disconnect switches for signs and other furnished equipment as shown on the Drawings.

E Provide NEMA 3R/4/4X/12 enclosures where located outside.

F Provide low-voltage cabling between relay panels and all control devices. Cabling shall be furnished by contractor as required by panel manufacturer, including Cat5, Cat6, Belden, dimming pairs, or other as required by the manufacturer. Pre-terminated cabling by manufacturer is acceptable.

G All Low-Voltage cabling, for all systems, shall be neatly routed using J-Hooks. Cabling is installed above a hard ceiling, conduit shall be used to traverse the hard-ceiling segments.

H Install elevator power module switches in an elevator machine room, control room, machinery space, or control space in accordance with ASME A17.1. Other installation locations that are readily accessible to qualified persons such as electrical or mechanical rooms may be permissible in the event that machine roomless (MRL) elevators are provided with a control space of inadequate size to accommodate the power module switches.

3.02 DIVISION 22, 23, 27 AND 28 MISCELLANEOUS POWER AND CONTROLS

A Install electrical devices not an integral part of system equipment providing conduit, boxes, fittings, wiring, circuit breakers, disconnecting means and other devices.

B Contractor is responsible for providing all line voltage power to devices that require electrical power to operate. This shall include but not be limited to motorized dampers, smoke dampers, combination fire/smoke dampers, motorized gates, overhead rolling doors, and building control panels. Contractor shall terminate line voltage power to termination points. Contractor shall coordinate between all trades to determine sizing and quantities of line voltage circuits to adequately power and control devices. Provide circuits from nearest low voltage panel using spare circuits provided, if device requires power not already available or indicated.

C Provide GFCI receptacle with weather proof cover within 25 feet of all heating, air conditioning and refrigeration equipment per NFPA 70.

3.03 OPERATIONS PERSONNEL TRAINING

A All relay panels require manufacturer technician time to meet with owner, set programming conditions, time of day operations, and ensure owner-intended operations are met, based on whichever is most appropriate based on project size:

1. 8-Hours per relay panel

2. The amount of time required to successfully meet the criteria of this section and result in a fully working system, accepted by the Owner.

B A one-time recommissioning site visit, 4 Hours in time, by a manufacturer technician anytime between 90 and 120 days of building occupancy to adjust and reprogram (as required) the system based on owner input. This meeting shall be scheduled by the manufacturer and can only be declined by the owner.

C Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

END OF SECTION 26 29 26

SECTION 26 32 13.17 - NATURAL GAS ENGINE-DRIVEN STANDBY GENERATING SYSTEM (200 KW)

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all work herein.

B SCOPE

1. Provide a standby electric generating system electric set rated for continuous standby service at 200 kW, 250 kVA at 0.8 power factor, 3-phase, 208Y/120 volts, 60 cycle. The system shall be a package of new and current equipment consisting of:

   a. A natural gas engine driven electric plant in a (weather-protective housing) to provide emergency electric power.

   b. Automatic transfer switch(es) to provide automatic starting and stopping of the plant and switching of the emergency load.

   c. Mounted accessories as specified.

   d. Control wiring.

   e. Provide oversized alternator as specified.

   f. Load bank.

1.02 PERMITS, TEST INSPECTIONS

A This system shall be completely built, tested and shipped by a manufacturer who has been regularly engaged in the production of such equipment for the past ten years and who has parts and service facilities locally available so that there is one source of supply and responsibility. The performance of the electric plant shall be certified by an independent testing laboratory as to the plant's full power rating and voltage and frequency regulation. The complete system shall bear a seal showing that it is prototype test supported.

1.03 REQUIREMENTS

A Level 1 applications are legally required emergency systems.

B The electric generating system must meet all requirements of NFPA 110 (latest edition) including design specifications, prototype tests, one-step full-load pickup, and installation acceptance. Engine-generator system to provide source of power for Level 1 applications.

1.04 STANDARDS

A Equipment shall meet the latest versions of the following codes:

1. NFPA 30

2. NFPA 37

3. NFPA 70

4. NFPA 99

5. NFPA 101

6. NFPA 110

7. IEEE C62.41.1

8. IEEE 446

9. NEMA MG 1, ICS

10. ANSI

11. UL 1008

12. UL 2200

13. MIL-STD 461 C - Part 9, IEC 801.2, IEC 801.3, IEC 801.5, IEC 1000-4-2,3,6 - RFI and EMI Performance.

1.05 SUBMITTALS

A Provide a specification compliance document noting any deviations to the specification. Document shall be a copy of the specification noting Comply, Deviate, or Exception to each section with detailed explanation for each deviation and exception.

B Shop drawings shall include but not be limited to:

1. Catalog cut sheets with all equipment, accessories and devices including all ratings.

2. Interconnection wiring diagrams.

3. Complete bill of materials.

4. Certified performance tests.

5. Sizing report using manufacturer software confirming the engine and alternator complies with the size required to supply the connected load. Submit alternate generator if the proposed unit will not comply. The generator shall not exceed 85% of the rated load.

C Operation and Maintenance Data

1. Submit under provisions of Division One.

2. Furnish three copies of the manuals and books listed below in substantial three-ring binders for each unit:

a. Operating Instructions: Describe and illustrate all switchgear controls and indicators and engine and general controls. Include instructions for operating transfer switch equipment under normal and emergency conditions when engine generator is running.

b. Parts Books: Illustrate and list all assemblies, subassemblies and components, except standard fastening hardware (nuts, bolts, washers, etc.).

c. Preventative Maintenance Instructions: Describe the daily, weekly, monthly, biannual and annual maintenance requirements and include a complete lubrication chart.

d. Routine Test Procedures: Describe procedures for engine, radiator, all electronic and electrical circuits, and the generator.

e. Troubleshooting Chart: Describe and list all troubles, probable causes, and suggested remedies.

f. Recommended Spare Parts List: List all consumables anticipated to be required during routine maintenance and testing. List special tools, maintenance materials and replacement parts.

g. Wiring Diagrams and Schematics: Show function of all electrical components.

1.06 DELIVERY, STORAGE AND HANDLING

A Deliver, store, protect and handle products to site under provisions of Division One.

B Accept units on site on skids. Inspect for damage.

C Protect equipment from dirt and moisture by securely wrapping in heavy plastic.

1.07 ACCEPTABLE MANUFACTURERS

A Provide products complying with these specifications and produced by the following:

1. Generator Manufacturer

   a. Cummins

   b. Kohler

   c. Generac

2. Automatic Transfer Switches

   a. ASCO

   b. Cummins Power Generation

   c. Kohler

1.08 ACCEPTABLE SUPPLIERS

A All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade power system products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall be authorized to perform warranty service on all products provided.

B The supplier shall maintain a minimum of 6 factory trained and qualified field technicians within 50 mile of the job site, a proper supply of spare parts for the supplied equipment, a shop with overhaul capabilities; and be able to provide 24 hour, 7 days per week, 365 days per year field service capability.

PART 2 - PRODUCTS

2.01 ENGINE

A The engine shall be radiator cooled, natural gas fueled, 4 cycle, 8 cylinder. It shall have a total piston displacement of not less than 673 cubic inches and develop not less than 302 brake horsepower at its operating speed. A radiator air discharge duct flange shall be provided for a connecting duct to allow all heated air and gases to be discharged out of the building, or enclosure, through one opening. The radiator cooling system shall be rated at 104 degrees F ambient against an external restriction of 0.5 inch water column. Engine cooling air requirements shall not exceed 19,000 CFM.

B The engine shall be of 1-piece cast alloy iron construction with cast alloy iron heads. Valves shall be overhead and free to rotate. Valves shall be hard chrome-cobalt alloy faced with replaceable valve seat inserts of solid chrome-cobalt alloy. The crankshaft shall be forged steel. Main bearings provided between all cylinders. The connecting rods shall be forged steel with connecting rod bearings. Provide full-flow, replaceable oil filter with bypass. Oil pressure gauge shall be included.

C The engine shall be equipped with adjustable isochronous electronic governor with speed regulation 5.0 percent, no load to full load main output circuit breaker, fuel carburator system with automatic fuel shut-off and a reusable air element air cleaner and natural gas fuel train.

D Provide a 24 volt electrical system and electric starter.

E 120 VAC thermostatically controlled water jacket heater system (1500 watts) shall be provided. Contractor shall install normal power to the heater.

F Provide the following safety shutdown fault devices:

1. Low oil pressure
2. Over-speed
3. Over-crank
4. High temperature (with low water level)

G Provide the following alarms:

1. Low engine temperature (indicating jacket heater malfunction)
2. Marginally high engine temperature
3. Marginally low oil pressure
4. Flashing light for control switch in "Stop" position.

H Generator main circuit breaker shall be UL listed, set-mounted, factory connected, molded case type with electronic trip unit. Submittals shall demonstrate that the circuit breaker provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. (Lugs on breaker shall match “ATS” lugs). Provide ground fault alarm for breakers rated 1000 amps and larger to comply with Article 700.6 (D) of the National Electrical Code

I Provide output breaker for load bank.

2.02 ALTERNATOR

A Rating 240 kW, 300 kVA, at 0.8 power factor, 105 degrees Celsius, 208Y/120 volts, 60 Hz at 1800 rpm.

B The alternator shall be a single bearing revolving field type, 2/3 pitch, 4-pole and shall be completely brushless. No commutator or commutator brushes shall be allowed. The main alternator and exciter shall be vacuum impregnated. The alternator shall be directly connected to the engine through a rigid coupling to insure permanent alignment. Voltage regulation shall be within plus or minus 1% of rated voltage, from no load to full load. Voltage recovery to rated voltage after acceptance of 100% of rated load in one step shall occur within 10 seconds. Provide a permanent magnet generator (PMG) excitation system. Motor starting capability shall be a minimum of 920 kVA. Rating for non-linear loads shall not be less than 100 kW at 0.8 power factor. The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified kVA load at near zero power factor applied to the generator set. The instantaneous voltage dip shall be less than 10% of rated voltage when full load and rated power factor are applied to the alternator. Stable or study-state operation is defined as operation with terminal voltage remaining constant within plus or minus 1% of rated voltage. Temperature rise shall be within rating as defined by NEMA MG1-22.40. Radio interference reduction shall exceed requirements for general civilian or commercial applications with TIF less than 50 and wave form deviation less than 0.06 line to line.

C Provide a 120 volt anti-condensation heater (minimum of 100 watts) to prevent condensation during non-operating periods. Heater shall be thermostatically controlled and rated for continuous use for the frame. Provide normal power to the heater.

D Overload Rating: Capable of withstanding a three phase load of 300% rated current for 10 seconds, 150% of rated current for 60 seconds and 105% rated current for 60 minutes with field set for normal rated load excitation, and capable of withstanding an overspeed of 125%.

E Performance Criteria:

1. Wave form Deviation: Less than 5%.
2. Crest Factor: 1.41 +/- 0.07.
3. Form Factor: 1.11 +/- 0.05.
4. Total Harmonic Distortion: 5%.
5. Single Harmonic Distortion: 3%.
6. Telephone Interference Factor: 50% maximum.
7. Dynamic Balance: Less than 1 mil displacement peak to peak.

F Enclosure: NEMA MG1, open drip-proof.

G Neutral Ground: As shown on drawings.

2.03 CONTROLS AND INSTRUMENTS

A Provide comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 second. Acceptable methods are a 100% rated, 600 volt circuit breaker mounted in the generator enclosure. Provide Square D size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection.

B A Generator Control Panel mounted on top of the alternator shall contain the following:

1. Run-stop-remote switch
2. Charge rate ammeter
3. Oil Pressure Digital Readout
4. Coolant Temperature Digital Readout
5. Remote start-stop terminals
6. Running time meter
7. Full A.C. Digital Display (A.C. ammeter, A.C. voltage, phase selector switch, frequency meter, and voltage adjustment.) All parameters shall have a readout of not less than 2.5% accuracy.

8. Red alarm lights shall be provided for each fault and alarm condition.

9. Two sets of spare terminals shall be provided for customer selected faults.

10. An Emergency Shutdown contact shall be provided through which customer's push button or other momentary-closing switch contacts shall shutdown the generator set engine.

11. A fault reset switch contacts shall shutdown the generator set engine.

12. A fault reset switch shall be provided to clear fault indications and allow restarting of the engine after shutdown faults.

13. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either AC or DC voltage and shall retain the fault status memory even through complete removal and replacement of the starting batteries.

14. A battery warning that includes load testing the battery on each crank shall be provided.

15. The fault reset function shall operate only when the RUN-STOP-REMOTE switch is in the STOP position.

16. All devices for interconnection and compatibility with digital accuracy and response shall be provided. Digital panels shall comply with electromagnetic interference requirements of Minimum Standard 461C - Part 9, and IEC Standard 801.2, 801.3 and 801.4. indication of voltage level

17. Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from misoperation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate; and be capable of being curve-matched to the engine torque curve with adjustments in the field.

18. The automatic voltage regulator shall be temperature compensated, solid-state design and include overvoltage and overexcitation protection functions. The voltage regulator shall be equipped with three phase RMS sensing. The regulator shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. Overvoltage protection shall sense the AC generator output voltage and (in the event of regulator failure or loss of reference), shut down regulator output on a sustained overvoltage of one (1) second duration. Overexcitation protection shall sense regulator output and shutdown regulator output if overloads exceed ten (10) seconds in duration. Both overvoltage and overexcitation protection shutdowns shall be latched, requiring the AC generator to be stopped for reset.

19. The regulator shall include an under frequency rolloff torque-matching characteristics, which shall reduce output voltage in proportion to frequency below a threshold of 58-59 Hz. The torque-matching characteristics shall include differential rate of frequency change compensation to use maximum available engine torque and provide optimal transient load response. Regulators which use a fixed volts per hertz characteristic are not acceptable.

20. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions.

21. All analog and digital metering shall be true-RMS indicating, and shall not be disrupted by non-linear load generated waveform distortion.

22. Digital metering set shall indicate generator RMS voltage and current, frequency, output current, output kW, kW-hours, and power factor. Generator output voltage shall be available in line-to-line neutral voltages and shall display all three phase voltages (line to neutral or line-to-line) simultaneously.

23. An under frequency sensing and protection system shall be provided which causes a shutdown of the generator set if true RMS frequency falls below 90% of rated frequency for more than 10 seconds.

24. The control system provided shall withstand the surge voltage produced by a 70A DC battery charging alternator operating at full load when the battery bank is disconnected. The test shall be successfully completed without tripping protective circuit breakers or blowing fuse protective devices.

25. All switches, lamps and meters shall be oil-tight and dust-tight and the enclosure door shall be gasketed.

26. All switches shall be provided with fully illuminated back-lit labels and all metering shall be individually lighted to allow for easy reading of functions in a completely dark room.

27. The field connections shall be made on permanently labeled terminal blocks, which are designed and tested by the manufacturer of the generator set to be suitable for use without wire termination lugs. Provisions shall be made for future addition of DIN-rail mounted components.

28. Control panel and interconnection enclosures shall be UL 508 listed as a unit assembly.

29. Communications:

    a. Alarm Relay Mode: Provide Form C alarm contacts that can be individually linked to alarm or status outputs from the generator set to external devices.

30. Interface to Site Monitoring System: Provide necessary electronic components and wiring to interface with and communicate the analog and digital status information to an owner provided site monitoring system. Include in this contract all work required for translation of proprietary protocol required to achieve this interface, and all licensing or other fees associated with this interface. Provide ethernet connection for integrating into modbus protocol.

2.04 ELECTRIC PLANT MOUNTING

A The plant shall be provided with shock or anti-vibration mounts with the plant. Provide Korfund LKD spring-type isolators or type EU pads. Vibration isolation may be integrally a part of the generator set to the skid package. The plant's integral base shall have forklift sockets. Battery rack shall be integral part of plant base.

2.05 ACCESSORIES

A All accessories needed for the proper operation of each plant shall be furnished. These shall include, but not limited to, the following:

1. Critical rated side inlet silencers with installation attachments for mounting within the set housing, flexible exhaust connection.

2. Belt driven battery charging alternator.

3. Lead acid starting batteries

4. Battery cables.

5. Fully automatic 120 volt, 10 amp battery charger. Cummins model number A048G602 or approved equal.

6. Natural Gas Fuel Train consisting of:

    a. Dry fuel strainer

    b. 12 VDC fuel solenoid valve

    c. Pounds-to-ounces primary gas pressure reducing regulator

    d. UL Listed braided metallic flexible fuel line

7. An oil drain valve with hose extension shall be provided for draining oil at the side of the plant.

8. Detailed operation and maintenance manuals with parts list.

2.06 REMOTE ALARM ANNUNCIATOR

A Cummins No.0300-5929 shall be provided for flush mounting at inside location remote from the generator set located by the fire alarm control remote annunciator panel in the front administration office area.

2.07 AUTOMATIC TRANSFER SWITCH

A Scope

1. Provide open transition automatic transfer switches (ATS) with the number of poles, amperage, voltage and withstand current ratings as shown on the plans. Each automatic transfer switch shall consist of an inherently double throw power transfer switch unit and a control module interconnected to provide complete automatic operation.

B Codes and Standards

1. UL 1008 - Transfer Switch Equipment

2. NFPA 70 - National Electrical Code

3. NFPA 99 - Health Care Facilities Code

4. NFPA 110 - Standard for Emergency and Standby Power Systems

C Mechanically Held Transfer Switch

1. The transfer switch unit shall be electrically operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of two possible positions, normal or emergency.

2. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented, blow-on construction and be protected by separate arcing contacts.

3. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes.

4. Designs utilizing components of molded-case circuit breakers, contactors, or parts thereof are not acceptable.

D Microprocessor Control Panel

1. The control panel shall direct the operation of the transfer switch. The panel's sensing and logic shall be controlled by a built-in microprocessor.

2. Operator Panel. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The operator panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The operator panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The operator panel shall allow starting and stopping of the generator set via the transfer switch operator panel in both test and emergency modes.

E Enclosure

1. The ATS shall be furnished in a NEMA4 for exterior use.

F Voltage and Frequency Sensing

1. The voltage of each phase of the normal source shall be monitored, with pickup adjustable from 85% to 100% of nominal, and dropout adjustable from 75% to 98% of pickup setting.

2. Single-phase voltage sensing of the emergency source shall be provided, with pickup voltage adjustable from 85% to 100% of nominal and independent frequency sensing with pickup adjustable from 90% to 100% of nominal.

G Time Delays

1. A time delay shall be provided to override momentary normal source outages and delay all transfer and engine starting signals. Adjustable from 0 to 6 seconds.

2. A time delay shall be provided on transfer to emergency, adjustable from 0 to 5 minutes for controlled timing of transfer of loads to emergency.

3. A time delay shall be provided on retransfer to normal, adjustable from 0 to 30 minutes. Time delay shall be automatically bypassed if emergency source fails and normal source is acceptable.

4. A time delay shall be provided on shutdown of engine generator for cool down, adjustable from 0 to 60 minutes.

H Additional Features

1. A set of DPDT gold-flashed contacts rated 10 amps, 32 VDC shall be provided for a low-voltage engine start signal.

2. A momentary-type test switch shall be provided to simulate a normal source failure.

3. One set of auxiliary contacts rated 10 amps, 250 VAC shall be provided.

4. Position indicating lights shall be provided.

5. An in-phase monitor or delayed transition shall be provided for motor load applications.

6. Provide a field-programmable control which shall periodically start and run the generator with or without transferring the load for a preset time period, then re-transfer and shut down the generator after a preset cool-down period.

I Withstand and Closing Ratings

1. The ATS shall be UL listed in accordance with UL 1008 and be labeled in accordance with that standard's 3 cycle, long-time ratings. ATS's that are tested and labeled with specific breaker ratings only are acceptable. If current limiting fuses are utilized, provide current limiting fuses and disconnect switch mounted in or on Automatic Transfer Switch.

J The ATS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

2.08 LOAD BANK

A Electrical Connection: Power source to load bank connection is 3-phase, 3-wire plus ground. Additional control wire connections for remote control as required.

B Load Bank Rating:

1. Capacity: 50 kW, 1.0 p.f.
2. Load Steps: 20 KW load step resolution
3. Voltage: 208 VAC, 3-ph., 3-W
4. Frequency: 60 Hertz
5. Air intake temperature: 155°F maximum (radiator air outflow)
6. Airflow requirements: Radiator air outflow
7. Duty Cycle: Continuous
8. Air temp. rise: 100°F, nominal
9. Air back pressure: 0.25 - 0.50" water column

C Load Bank Design:

1. General: The load bank shall be a completely self-contained unit which includes all resistive load elements, load control devices, load element branch circuit fuse protection, main load bus and terminals, control terminals, system protection devices and enclosure of required type.
2. The load bank shall be the manufacturer's standard product that has been investigated, tested and listed by Underwriters Laboratories as a system for the purpose intended.

3. Enclosure: Type 3R, welded sheet steel, UL approved finish painted consisting of an epoxy primer and a polyurethane top coat, consisting of a power section, for installation and wiring of the load elements and a control section for installation and wiring of control components. The control section is to be physically and thermally isolated from both the hot load elements and the heated airflow. Mounting adapters suitable for the installation method selected shall be supplied with the load bank. The exhaust of the load bank shall be screened and, if installed outdoors, louvers shall be provided.

4. Load elements: Load elements shall be UL listed, labeled or recognized, Simplex Power Web Open wire, helically wound, chromium alloy, thermally derated to 60%. 5% tolerance, 2% balance. 0.995 p.f. element wire mechanically supported over entire length such that if a wire should break, the broken wire segments will not short to adjacent conductors or to ground. Load elements are individually serviceable and replaceable in the field without major disassembly of the load bank.

5. Load element short circuit protection: Branch circuit fuses, per each 50 kW load branch circuit. Fuses shall be 200,000 A.I.C current limiting type.

6. Load control: One magnetic contactor per each fused branch circuit.

7. Load bank power wiring shall be 150°C insulated.

8. Main terminals: Plated bus bar with a hole pattern to accept customer supplied cable

9. Control wiring shall be 105°C insulated.

10. Control power shall be derived internally from the main load bus. Control and protective circuits shall operate at 120V via control power transformer or line-neutral circuit and shall be fused.

11. System protection: The load bank shall include a comprehensive protection system to protect against overheating. The system shall function to disconnect the load elements from the power source and activate an alarm upon sensing a loss of cooling airflow, or an exhaust air temperature greater than 300 degrees Fahrenheit.

12. The load bank shall be installed adjacent to the generator on a concrete pad.

13. Load bank shall automatically connect to the generator when the running load is less than 30% and automatically disconnect when the load exceeds 50%.

2.09 OUTDOOR WEATHER-PROTECTIVE HOUSING

A Generator set housing shall be provided factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a two-step electro-coating paint process, or equal, meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following requirements:

1. Primer thickness, 0.5 - 2.0 mils. Top coat thickness, 0.8 - 1.2 mils.

2. Gloss, per ASTM D523, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

3. Crosshatch adhesion, per ASTM D3359, 4B-5B.

4. Impact resistance, per ASTM D2794, 120-160 inch-pounds.

5. Salt spray, per ASTM B117, 1000+ hours.

6. Humidity, per ASTM D2247, 1000+ hours.

7. Water soak, per ASTM D2247, 1000+ hours.

B Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.

C A 120 VAC heater with thermostat shall be provided within the generator set control panel to eliminate condensation. Contractor shall provide 120 volt, 20 amp circuit.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install generator and housing on a minimum 6 inch high reinforced concrete housekeeping pad. Provide blockouts as required. Bolt the generator to the pad. The pad shall be designed by a structural engineer. Provide working clearances and operational air flow clearances as required by the manufacturer.

B Install the load bank on a minimum 6 inch high reinforced concrete housekeeping pad. Provide blockouts as required. Bolt the load bank to the pad. The pad shall be designed by a structural engineer. Provide working clearances as required by the manufacturer.

C Provide all power wiring, control wiring, additional contacts and relays required for a complete installation. All conduit shall be in a two-hour enclosure. Underground conduits shall be concrete encased. The wall mounted dual rate battery shall be taken offline during the starting of the generator. The generator belt driven alternator shall charge the batteries when the generator is running.

D Provide conduit and wire routed from the auxiliary contacts in the automatic transfer switch to the elevator controller. The purpose of this wiring is to signal the elevator controller when it is connected to emergency power.

E Install generator set and transfer switches in accordance with manufacturer’s instructions.

F The generator shall be installed as a separately derived system. Contractor shall connect the generator neutral to a grounding electrode. Provide a bonding jumper from the ground bar to neutral.

G Provide engraved plastic nameplates under the provisions of Section 26 02 00.

3.02 WARRANTY

A The complete standby electric power system, including engine-generator set equipped with set exerciser, and running time meter, shall be warranted for a period of five years from the date of initial start-up. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be as detailed in available written documents. In the judgement of the specifying authority, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support. All items of the engine, generator, and controls that are warranted in the first year shall be covered for the full five year term of the warranty. Warranty coverage shall include parts, labor, and travel for the full term of the warranty.

B Extensions of warranty term up to 10 years from start-up and inclusion of comprehensive terms shall be available for one year after start-up.

3.03 TESTS

A Factory production model tests: Before shipment of the equipment, the generator set shall be tested under rated load and power factor for performance and proper functioning of control and interfacing circuits. Testing at unity power factory only (resistance banks only) is not acceptable, since kW output is affected by the higher generator efficiency at unity power factor, and the kVAR for motor starting and regulation loads is not correlatable between unity and rated power factor. Other tests shall include:

1. Single step load pickup per NFPA 110.
2. Transient response and steady state governing.
3. Safety Shutdowns.
4. Prototype tests in accordance with NFPA 110 level 1 have been done on a complete and functional set. Component level type tests will not substitute for this requirement.

B The engineer shall be notified in advance of these test and shall have the option of witnessing these tests. Certified copies of test results shall be forwarded to the engineer for review.

C Field Test After Installation:

1. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative(s) of the engine-generator set and transfer switch manufacturer. The engine lubrication oil and antifreeze, as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set supplier.

2. Upon completion of initial start-up and system checkout, the supplier of the generator set shall perform a field test, with the engineer notified in advance, to demonstrate load carrying capability, stability, voltage, and frequency. The engineer shall be present during the field test.

3. The generator shall be run for four hours continuously with all available facilities emergency load connected to its output; in addition, the generator set supplier must provide a portable load bank to supplement any existing load to enable full load testing. Load shall not exceed 50% of generator-set rating for first 1/2 hour during first initial run for proper engine break-in. Records shall be maintained throughout this period to record water temperature, oil pressure, ambient air temperature, voltage, current, frequency, kilowatts, and power factor. The above data shall be recorded at 15 minute intervals throughout the test. There shall be a 10 minute unloaded run at the conclusion of the test to allow engine to cool before shutdown. Three copies of the field test data shall be furnished to the engineer. The contractor shall make all necessary hook-ups to accomplish field tests and shall furnish all fuel necessary for field test and start-up.

3.04 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:

1. Purpose of equipment.

2. Principle of how the equipment works.

3. Important parts and assemblies.

4. How the equipment achieves its purpose and necessary operating conditions.

5. Most likely failure modes, causes and corrections.

6. On site demonstration.

END OF SECTION 26 32 13.17

SECTION 26 41 13.13 - LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 GENERAL

A The General Conditions, Supplementary General Conditions, Division 1 and the Section entitled "Electrical Work - General Requirements" apply to all work herein.

B Objective: To provide safety for the building and occupants by preventing damage to building structure caused by lightning.

1.02 REFERENCE STANDARDS

A Comply with these following specifications and standards of the latest issue form a part of this specification:

1. Lightning Protection Institute Installation Standard, LPI-175
2. Underwriters Laboratories, Inc. Installation Requirements, UL 96A
3. National Electrical Code (NEC), NFPA 70
4. National Fire Protection Association Installation Standard, NFPA 780
5. U.S. Bureau of Standards

1.03 SCOPE

A The work covered in this section of the specifications consists of providing all labor, materials, and items of service required for a complete lightning protection system. Provide Class I materials for roof levels less than 75 feet and Class II for roof levels 75 feet or greater.

B If any departure from the Contract Drawings or submittal drawings covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the engineer for approval.

C Provide a ground loop using bare #2/0 copper conductor.

1.04 QUALITY ASSURANCE

A The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, NFPA and NEC. Upon completion, application shall be made to the Underwriters Laboratories, Inc. for inspection and certification.

B The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.

1.05 QUALIFIED MANUFACTURERS:

A Robbins Lightning, Inc.

B Advanced Lightning Technology

C Thompson Lightning Protection

D Harger Lightning Protection

E East Coast Lightning Equipment

F nVent ERICO

1.06 SUBMITTALS

A Complete shop drawings showing the type, size and locations of all grounding, down conductors, through-wall assemblies, roof conductors and air terminals shall be submitted to the engineer for approval.

PART 2 - PRODUCTS

2.01 LIGHTNING PROTECTION EQUIPMENT

A All materials shall be copper and bronze and of the size, weight and construction to suit the application and used in accordance with LPI, UL, NEC and NFPA. Class I sized components are required for roof levels not exceeding 75 feet in height Class II size components shall be required for roof levels over 75 feet in height. Bolt-type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware on the roof shall be stainless steel and on the facade shall be brass and/or copper.

B Aluminum Components - Aluminum materials may not be used except on roofs that utilize aluminum roofing components. The entire roof lightning protection system shall utilize aluminum components to insure compatibility on aluminum metal roofs or aluminum parapet caps. However, the downleads and grounding shall utilize copper with bimetal transition occurring at the through roof assembly with and approved bimetal through roof assembly. Copper is acceptable as a bimetal transition.

2.02 MATERIALS

A All equipment used in this installation shall be UL listed and properly UL labeled. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, NFPA and NEC code requirements.

B Air terminals shall be nickel-tipped copper, having a copper base. Air terminals shall be spaced not more than twenty feet apart. Provide flathead air terminals on the roof in areas where accidental implement may occur.

PART 3 - EXECUTION

3.01 INSTALLATION

A The installation shall be accomplished by an experienced installation company that is UL listed, a member of the Lightning Protection Institute, United Lightning Protection Association qualified, and an employer of Certified Master Installers of lightning protection systems. A Certified Master Installer shall directly supervise the work.

B All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network at the roof and include air terminals, connectors, splicers, bonds, copper down leads and proper ground terminals.

C Copper downlead cables shall be utilized.

D Provide a ground test well at all ground rod locations.

E Where conductors are run in metal conduit for protection, the conductor shall be bonded to the entrance and exit point of the conduit or approved methods to maintain electrical continuity.

F Down conductors shall be attached to ground devices in accordance with the specific provisions of the Underwriters' Laboratories, Inc., Code. All-down conductors shall be concealed. Any exposed conductors shall be approved by Architect.

G All metals of conductance within six feet of the lightning protection system shall be securely bonded and made a part thereof. Where stack or chimney is present, tinned covered non-corrosive air terminals and conductors shall be used. Metal water pipes shall be bonded to the grounding system.

3.02 COORDINATION

A The lightning protection installer will work with any other trades present to insure a correct, neat and unobtrusive installation.

B It shall be the responsibility of the lightning protection installer to assure a solid bond to the main water service and to assure interconnection with other ground systems.

3.03 COMPLETION

A Upon completion of the installation, the lightning protection installer shall secure and deliver to the owner the Underwriters Laboratories, Inc. Master Label certification or the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate or the LPI certification certificate.

END OF SECTION 26 41 13.13

SECTION 26 43 13.13 - SURGE PROTECTIVE DEVICES (SPD) - STANDARD INTERRUPTING

LPART 1 - GENERAL

1.01 SCOPE

A Specify the electrical and mechanical requirements for a non-modular high-energy surge protective device system (SPD). The specified system shall provide effective high energy surge current diversion and be suitable for application in IEEE C62.41.1 Category A, B and C3 environments, as tested by IEEE C62.11, IEEE C62.45.

B The system shall be constructed using multiple surge current diversion modules utilizing metal oxide varistors (MOV) computer matched to +/- 1-volt variance and tested for manufacturer's defects. The modules shall be designed and constructed in a manner that ensures surge current sharing. Use of gas tubes, silicon avalanche diodes or selenium cells are unacceptable. Devices shall utilize a minimum of three (3) MOV's fuse links pair per phase. This will allow greater than 50% redundant protection in if a MOV fails.

C Third Party Test Report verifying surge current rating, longevity, testing, and filtering capabilities shall be provided with submittal.

1.02 STANDARDS

A The specified system shall be designed, manufactured, tested and installed in compliance with the following codes and standards:

1. Canadian Standards Association (CSA or CUL)
2. American National Standards Institute and
3. Institute of Electrical and Electronic Engineers (IEEE C62.11, IEEE C62.41.1, IEEE C62.41.2 and IEEE C62.45)
4. Institute of Electrical and Electronic Engineers 1100 Emerald Book
5. Federal Information Processing Standards Publication 94 (FIPS PUB 94)
6. National Electrical Manufacturer Association (NEMA LS-1 1992)
7. National Fire Protection Association (NFPA 20, NFPA 70, NFPA 75 and NFPA 780)
8. National Electric Code
9. Underwriters Laboratories (UL 1449 and UL 1283)
10. International Electrotechnical Commission (IEC 801)
11. International Standards Organization (ISO) Company certified ISO 9001 for manufacturing, design and service
12. EMC Directive 89/336/EEC - CE compliant

B The systems individual units shall be UL/ANSI Listed and labeled under UL 1449 (Fourth Edition) Standard for Surge Protection Devices Type 2 20kA with a nominal discharge current of 20kA and the surge ratings shall be permanently affixed to the SPD. The units shall also be listed and labeled to UL 1283 for type 2 locations Standard for Electromagnetic Interference Filters, and CSA/CUL Listed.

1.03 ACCEPTABLE MANUFACTURERS

A Southern Tier Technologies

1.04 SUBMITTALS

A Shop drawings shall include, but not be limited to:

1. Cutsheets of surge protection devices with ratings, physical dimensions and all accessories clearly labeled.
2. Device labels shall be clearly indicated in cutsheets.
3. All standards and listings, as specified in section 1.2A-B, shall be clearly labeled in cutsheets provided.
4. Cutsheets shall clearly outline that design requirements of this specification have been met.

1.05 QUALITY ASSURANCE

A The manufacturer shall be ISO 9001 certified. The specified system shall be tested at the component and fully assembled level, under surge conditions with AC power applied for a minimum of 1 hour. Testing shall include but not be limited to quality control checks, dielectric voltage withstand test per UL and CSA requirements, UL ground continuity tests and operational and calibration tests.

B The unit shall be designed and manufactured in the USA by a qualified manufacturer of surge protection equipment and Active Tracking Filters. The manufacturer shall have been engaged in the design and manufacture of such products for a minimum of 10 years.

PART 2 - PRODUCTS

2.01 ENCLOSURE

A The specified system shall be provided in a heavy duty NEMA 4 or better dust-tight, drip-tight enclosure with no ventilation openings.

2.02 OVERCURRENT PROTECTION (FUSING)

A Individual surge components shall be fused to prevent violent failure. The fusing shall be UL listed and shall be capable of interrupting up to 200kA symmetrical fault current with 480VAC applied. Replaceable fusing is unacceptable. Overcurrent protection that limits specified surge currents is not acceptable. Devices that utilize a single fuse to protect two or more suppression paths are not accepted.

2.03 DESIGN REQUIREMENTS

A Protection Modes:

1. The SPD shall provide protection as follows: All modes, L-N or L-L, L-G and N-G (where applicable) Note: L = Line, G = Ground, N = Neutral

B UL 1449 Ratings:

1. The maximum UL 1449 listed surge ratings for each and/or all of the specified protection modes shall not exceed the following in any mode of protection:

System Voltage	Voltage Protection Rating			
	L-N	L-L	N-G	L-L
120/240	600-volts	700-volts	700-volts	1200-volts
120/208	600-volts	700-volts	700-volts	1200-volts
240		1200-volts		1000-volts
277/480	1200-volts	1200-volts	1200-volts	1800-volts
480		1800-volts		1800-volts

C Noise Attenuation:

1. The unit shall be UL 1283 Listed as an electromagnetic interference filter in type 2 locations. The filter shall provide insertion loss with a maximum of 60 dB from 100 KHz to 100 MHz per 50 Ohm Insertion Loss Methodology from MIL 220A. The system shall provide up to 120 dB insertion loss from 100 KHz to 100 MHz when used in a coordinated facility system.

D Life Cycle Testing:

1. The SPD system shall be duty life cycle tested to survive 6,000 20kV, 10kA Surges, per IEEE C62.41.1 Category C3 surge current with less than 5% degradation of clamping voltage.

2.04 CONNECTIONS

A Provide 60” wire leads #10 AWG or UL 1449 tested size.

2.05 STANDARD FEATURES

A Unit Status Indicators:

1. Red and green solid state indicators with printed labels shall be provided on the front cover to redundantly indicate on-line unit status including N-G monitoring. The absence of the green light and the presence of the red light shall reliably indicate that surge protection is reduced and service is needed to restore full operation.

B Dry Contacts for remote monitoring:

1. Electrically isolated Form C dry contacts, one normally open and one normally closed set standard on all units for remote monitoring.

C Undervoltage detection:

1. Unit shall be equipped with 70% undervoltage detection capability.

D Phase Loss Monitoring:

1. Unit shall be equipped with phase loss monitoring.

E Power Loss Monitoring:

1. Unit shall be equipped with power loss monitoring.

2.06 TESTING

A Component Testing and Monitoring:

1. Unit shall include an on-line circuit which tests and redundantly monitors individual components in all protection modes including neutral to ground (where applicable). Units that require external test sets or equipment are not acceptable.

2.07 ENVIRONMENTAL REQUIREMENTS

A Storage Temperature: -55 to +85 C (-67 to +187 F)

B Operating Temperature: -40 to +60 C (-40 to 140 F)

C Relative Humidity: 0% to 95%

D Audible Noise: less than 45 dBa at 5 feet (1.5 m).

E Operating Altitude: 0 to 18,000 feet above sea level.

2.08 WARRANTY

A The manufacturer shall provide a full 10 year parts and a 5 year labor warranty from date of shipment against any part failure when installed in compliance with manufacturer's written instructions, UL Listing requirements and any applicable national, state or local electrical codes. Direct, factory trained, ISO 9001 certified employees must be available for 48 hour assessment. A 24 hour 800 number must be available to support warranty.

PART 3 - EXECUTION

3.01 INSTALLATION

A Install the parallel SPD with short and straight conductors as practically possible. Locate adjacent to the switchboard or panel it is serving. The contractor shall twist the SPD input conductors together to reduce input conductor inductance. The contractor shall follow the SPD manufacturer's recommended installation practices as found in the installation, operation and maintenance manual and comply with all applicable codes. Provide STT Tierguide cable if the cable length exceeds 5 feet from the circuit breaker servicing the SPD.

B Provide Flush Mount Stainless Steel Cover Kit for kitchen areas.

C Provide Flush Mount Cover Kit for residential units and hotel suites.

END OF SECTION 26 43 13.13

SECTION 26 51 19 - LIGHTING FIXTURES - LIGHT EMITTING DIODE (LED)

PART 1 - GENERAL

1.01 SCOPE

A Provide general and emergency lighting fixtures as noted on the drawings. Fixtures shall be completely wired with lamps installed and shall be in perfect operating condition at the time of substantial completion.

B The types of lighting fixtures required for this project include:

1. LED

1.02 REFERENCE STANDARDS

A 47 CFR 15 - Radio Frequency Devices; current edition.

B ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2019.

C NEMA JSC 10410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2023.

D NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

F UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

G UL 1012 - Safety Power Units Other Than Class 2; 2010.

H UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

I NFPA 101

J NEMA-LE

K TM-21

L LM-80

M LM-79

N L70

O DLC

1.03 QUALITY ASSURANCE

A All fixtures shall conform to all applicable UL standards and shall be UL label including damp and wet location ratings. “ETL listed” is an acceptable listing.

B All LED drivers shall be UL recognized Class 2 per UL 1310 or non-Class 2 per UL 1012 as applicable.

C All LED drivers shall comply with applicable requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR 15, for Non-Consumer Equipment.

D All LED drivers shall be RoHS compliant.

1.04 ACCEPTABLE MANUFACTURERS

A Provide lighting fixtures produced by manufacturers as shown and scheduled.

B LED DRIVER:

1. Provide one of the following manufacturers

    a. Eldo

    b. Lutron

    c. Osram

    d. Philips

C LAMPS:

1. Provide one of the following LED Chip manufacturers

    a. Cree

    b. Nichia

    c. North American Philips

    d. Seoul

    e. Lumileds

1.05 SUBMITTALS

A Shop drawings shall include a brochure with a separate cut sheet for each fixture type arranged in alphabetical order with fixture and all accessories/options clearly labeled. Provide performance data for each fixture. Provide an independent test lab report for each fixture if requested by the Architect/Engineer.

B Provide driver and LED module data brochures for each fixture type.

C Provide air handling and heat removal data for light fixtures specified with these requirements.

1.06 REQUIREMENTS OF REGULATORY AGENCIES

A WORK IN ACCORDANCE WITH:

1. National Electrical Code.

2. Local, municipal, or state codes that have jurisdiction.

3. UL fire resistance directory.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A General:

1. Provide the size, type and rating of each light fixture shown and scheduled. All light fixtures shall complete with reflectors, lens, trim rings, flanges, LED modules, lamp holders, drivers, fuses, wiring, earthquake clips, etc. to provide a complete functioning light fixture.

B Lighting Fixture Types:

1. LED Fixtures

   a. Fixtures shall be pre-wired with frame-in kit and integral thermal management system for fixtures. Driver shall be encased in metal-can construction for optimal thermal performance.

   b. Total fixture lumen output is dependent on the chip, thermal management, driver current and optical system. LED fixtures shall be tested as a complete unit or system. Only DOE recognized CALiPER testing laboratory results shall be utilized.

   c. Interior LED fixtures shall have integral common mode and differential mode surge protection of 3kV(1.2/50µs, 2 ohm combination wave).

   d. Exterior LED fixtures shall have integral common mode and differential mode surge protection of 10kV/10kA(1.2/50µs, 2 ohm combination wave).

2. Exit signs

   a. Exit signs shall meet all federal, state and local codes.

   b. Provide fire alarm interface relay when required to flash exit signs.

   c. Provide battery packs for emergency operation when not connected to emergency generator power.

2.02 LED MODULES AND DRIVERS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A LED

1. Driver manufacturer shall have a 10-year history producing electronic drivers for the North American market.

2. Driver shall carry a five year limited warranty from date of manufacture against defects in material or workmanship (including replacement) for operation at a maximum case temperature of 80 degrees Celsius.

3. Drivers shall not contain any Polychlorinated Biphenyl (PCB).

4. Provide driver with integral color-coded leads.

5. Driver shall operate from 50/60 Hz input source of 120 Volt through 277 Volt or 347 Volt through 480 Volt with sustained variations of +/- 10% (voltage) with no damage to the driver.

6. Driver output shall be regulated to +/- 5% across published load range. And shall have a power factor greater than .90 for primary application to 50% of full load rating with an input current Total Harmonic Distortion (THD) of less than 20% to 50% of full load rating.

7. Provide drivers with a Class A sound rating.

8. Provide LED drivers for outdoor fixtures with a minimum operating temperature of -40 degrees Celsius (-40 F). Provide LED drivers for indoor fixtures with a minimum operating temperature of -20 degrees Celsius (-2F).

9. Drivers shall tolerate sustained open circuit and short circuit output conditions without fail and auto-resetting without need for external fuses or trip devices.

10. Driver output ripple current shall be less than 15% measured peak-to-average, with ripple frequency being greater than 100Hz.

11. Driver performance requirements shall be met when operated to 50% of full load rating.

12. Driver shall have integral thermal foldback to reduce driver power above rated case temperature to protect the driver if temperatures reach unacceptable levels.

13. Drivers shall comply with NEMA JSC 10410 for in-rush current limits.

14. Dimmable drivers shall be controlled by a Class 2 low voltage 0-10VDC controller with dimming range controlled between 1 and 8VDC with source current 150µA.

2.03 LAMPS - COORDINATE WITH LIGHT FIXTURE SCHEDULE

A LED Lamps shall be appropriately matched to the driver with junction-down design for improved thermal management. Maximum DC Forward Current.

2.04 EMERGENCY LED BATTERY BACKUP

A Provide Bodine #BSL310M for emergency light fixtures in 9 or 10-foot ceiling.

B Provide Bodine #BSL20 for emergency LED driver for emergency light fixtures in ceiling heights greater than 12 feet.

C Provide Bodine #BSL17-C2 for emergency LED driver for LED downlights.

D Provide unswitched hot leg. Hot leg shall originate from the same branch circuit as required in article 700.12 (F) of NFPA 70.

2.05 POLES

A Provide poles for area lighting fixtures as specified. Poles shall be one piece, anchor base, with 2-piece steel bolt cover and vibration dampers. Poles shall be square straight steel as specified on the Lighting Fixture Schedule.

B Provide all poles with appropriate mounting accessories including arms, tenons, or bullhorns as required. Anchor bolts shall be hot dipped galvanized, sized as required by the manufacturer of the pole.

C All poles shall have a normal 3” x 5” hand hole at 18” above the base flange and grounding provision.

D Poles shall be prime painted interior and exterior. The exterior shall be finished with polyester powder coating and architectural finish as specified by the Architect. The interior with 3 mil thermoplastic hydrocarbon resin, or equivalent to meet 1000-hour salt spray exposure (ASTM B117).

2.06 BRANCH CIRCUIT EMERGENCY TRANSFER SWITCH (BCELTS)

A Provide 20 amp, 120-277 Volt, UL 1008 listed Branch Circuit Emergency Transfer Switch to control emergency light fixtures transferring from normal to emergency branch circuits Provide Bodine GTD 20A or ETC SC 1008 UL 924 Devices are not acceptable

2.07 AUTOMATIC LOAD CONTROL RELAY (ALCR)

A Provide 3 amp, 120-277 volt UL 924 listed. Relay to bypass switching controlling emergency branch circuit light fixtures Provide Bodine GTD or Wattstopper ELCU.

PART 3 - EXECUTION

3.01 INSTALLATIONS

A General

1. Install the type of lighting fixture where shown and indicated in accordance with manufacturer's written instructions.

2. Provide earthquake clips on all recessed lay-in lighting fixtures as required by building code.

3. Adjust all adjustable lighting fixtures, as directed by the Architect.

4. Provide safety chains and wire guards for lighting fixtures located in gymnasium, multi-purpose rooms, play areas, etc.

B Coordination

1. The contractor shall verify the type of fixtures with the ceiling types as indicated on the drawings. Any discrepancies shall immediately be brought to the architect's attention before the contractor places his order and accepts delivery. Fixtures shall fit exact in the type of ceiling scheduled. Provide plaster frames, trim rings and other accessories required for a correct fit.

2. Provide supports attached to structural member to support fixtures when the ceiling system cannot maintain support. Provide separate supports for all recessed ceiling mounted HID fixtures.

3. Refer to architectural reflected ceiling plan for the exact location of all lighting fixtures. Notify the architect for any discrepancies or conflicts with structural, architectural, mechanical piping or ductwork before installation.

C Mounting

1. Provide support channels to support outlet boxes used support surface mounted lighting fixtures such as exit signs or downlights.

2. Pendant or surface mounted fixture shall be provided with required mounting devices and accessories, including hickeys and stud-extensions, ball-aligners, canopies and stems. Locations of fixtures in mechanical areas shall be coordinated with mechanical contractor. Mounting stems of pendant fixtures shall be of the correct length to uniformly maintain the fixture heights shown on the drawings or established in the field. The allowable variation tolerance in mounting individual fixtures shall not exceed 1/4 inch and shall not vary more than 1/2 inch from the floor mounting height shown on the Drawings. Fixtures hung in continuous runs shall be installed absolutely level and in line with each other. Hanging devices shall comply with Code requirements. Fixtures shall employ single - not twin - stem hangers unless otherwise noted.

3. All structure mounted fixtures (i.e. bracket mounted, pipe mounted and surface mounted) shall be provided with cables of suitable size and weight to support the weight of the fixture. Cables shall be fastened around or fastened to the housing of the fixture. On pendant fixtures, one safety cable of suitable size and weight to support the weight of the fixture assembly shall connect the top of the pendant to the supporting structure by means of welding or bolting, and one safety cable shall connect the housing of the fixture to the bottom of the pendant. Where more than one pendant per fixture occurs, only one pendant must be cabled. Track fixtures for pendant mounted track shall also be supplied with clip-on safety cables of suitable size and weight to support the weight of the fixture.

4. Provide secondary support wires from all four (4) corners of the lay-in fixtures to the structure above. Do not support fixtures from ceiling grid wire supports, piping, conduit, side walls, or mechanical equipment. Ceiling specifications do not supersede this requirement.

5. Where pole mounted luminaries are provided, provide appropriate anchor base pole as specified with manufacturer's recommended anchor bolts. Verify exact location on site for poles with Architect, Civil, and Landscape documents. Poles shall be installed on proper footing. Refer to details on the drawings. Provide grounding connection to a separately driven ground rod, outside of the footing. Where indicated provide pole with identification plate indicating pole number.

D Electrical Connection

1. All light fixtures shall be connected from a branch circuit junction box using 1/2" flexible metal conduit or MC cable fixture pigtails not exceeding 8'- 0". Provide #12 AWG conductors. All fixtures must be grounded by using a grounding conductor. Fixture to fixture wiring of fixtures installed in accessible ceiling is not permitted. Fixture whips shall not lay-on ceiling tile or grid. Provide caddy clips to provide additional support.

E Fire Rated Ceiling

1. Provide fire rated canopy or enclosure for all fixtures recessed in a fire rated ceiling. The fire rated canopy or enclosure shall be as required by the UL design number listed in the UL fire resistance directory. Refer to architectural drawing for the UL design number. Coordinate with ceiling installer and manufacturer. Provide proper rated drivers for lighting fixtures installed within these rated enclosures.

F Air Handling Fixtures

1. Install all air handling light fixtures with return air slot in the open position, if it is to be as an air handling fixture. Coordinate with mechanical contractor.

3.02 FINAL INSPECTION

A Remove all plastic and protective coating from all fixtures. Fixtures shall be thoroughly cleaned. Replace any damaged fixture or fixture parts including reflectors, louvers, lens and metal parts that show signs of corrosion.

B Replace all other defective fixtures showing signs of excessive usage.

C Demonstrate proper operation of all fixtures and controls. Refer to other sections and details on the drawings for lighting controls.

END OF SECTION 26 51 19

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A Section Includes

1. Hangers and Supports, including open-top supports (cable hooks) for communications systems.
2. Conduits and Pull Boxes for communications systems.
3. Cable Tray and Cable Runway with associated accessories and fittings for communications systems.

B Related Sections

1. Section 27 02 00 - Basic Materials and Methods for Communications Systems
2. Section 27 05 26 - Grounding and Bonding for Communications Systems
3. Section 27 11 00 - Communications Room Fittings
4. Section 27 15 00 - Communications Horizontal Cabling
5. Section 27 13 00 - Communications Backbone Cabling
6. Section 27 05 43 - Underground Ducts and Raceways for Communications Systems

1.02 REFERENCES

A The publications referenced in Section 27 02 00 form a part of this specification. The publications are referred to in the text by basic designation only.

B Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean the latest printed edition of each in effect at the date of contract unless the document is shown dated.

C Conflicts

1. Refer to Section 27 02 00.

D Codes and Standards

1. Refer to Section 27 02 00.

1.03 SUBMITTALS

A Refer to Section 27 02 00.

1.04 QUALITY ASSURANCE

A Refer to Section 27 02 00.

1.05 DELIVERY, STORAGE, AND HANDLING

A Refer to Section 27 02 00.

B Conduit Storage

1. Package conduits in bundles maximum 10’-0” long, with conduit and coupling thread protectors for indoor/outdoor storage.

2. Package fittings in manufacturer`s standard quantities and packaging suitable for indoor storage.

3. Protect coating on plastic-coated rigid conduit, fittings, and bodies from damage during shipment and storage.

4. Store conduit above ground on horizontal racks to prevent corrosion and entrance of debris.

5. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Protect plastic conduit and inner duct from sunlight. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Subject to compliance with requirements, manufacturers that may be incorporated in the work, include:

B Cable Hooks

1. Cooper B-Line, Inc.

2. Erico

3. Caddy

4. Owner approved alternate

C Basket Type Cable Tray (for use in work areas)

1. Cooper B-Line, Inc.

2. Chatsworth (CPI)

3. Owner approved alternate

D Wire Basket Cable Tray Cutting Tool

1. Cooper B-Line, Inc.

2. Chatsworth (CPI)

3. Owner approved alternate

E Polyethylene Cable Support System

1. Erico
2. Owner approved alternate

F Innerduct

1. Carlon Riser Guard Flexible Raceway (corrugated innerduct)
2. Owner approved alternate

G Measured pull tape (pull tape printed with sequential footage markings)

1. Fibertek
2. Condux International
3. Owner approved alternate

H Labeling

1. Refer to Section 27 02 00.

I Firestopping

1. Refer to Section 27 02 00.

2.02 CABLE HOOKS

A Cable hooks shall be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, floor posts, etc. to meet job conditions.

B Features

1. Cable hooks shall have a flat bottom and provide a minimum of 0’-1.625” cable-bearing surface.
2. Cable hooks shall have 90° radius edges to prevent damage while installing cables.
3. Cable hooks shall be designed so that the mounting hardware is recessed to prevent cable damage.
4. Cable hooks for non-corrosive areas shall be pre-galvanized steel. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish.
5. Cable hooks for corrosive areas shall be stainless steel.
6. Cable hooks shall have a stainless steel cable latch retainer to provide containment of cables within the hook.
7. The retainer shall be removable and reusable.

C Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

D Load cable hooks in accordance with manufacturer requirements and recommendations.

E Provide capacity for 25% growth, add additional hooks as needed.

2.03 PULL BOXES, JUNCTION BOXES, AND GUTTERS

A All junction boxes, gutters and pull boxes shall be UL listed and comply with NEC requirements.

B All junction boxes, gutters and pull boxes shall meet the following minimum material requirements:

1. 16-gauge steel or heavier
2. Seams shall be continuously welded and grounded smooth
3. External screws and clamps
4. External mounting feet (where applicable)
5. Oil-resistant gasket and adhesive
6. ANSI 61 gray polyester powder coating inside and out over phosphatized surface

C All junction boxes, gutters and pull boxes shall be provided with bushings for conduits and/or cabling.

D All junction boxes, gutters and pull boxes shall be securely installed.

2.04 CONDUITS

A All conduits shall be UL listed and comply with NEC requirements.

B Conduit Fittings

1. All fittings shall be compression or threaded.
2. Fittings shall provide a secure connection for pulling communications cables.
3. Setscrew fittings are not permitted.
4. Conduit “condulets” are not permitted.

C Non-metallic conduits are not permitted in above ground installations. Conversion fittings are required for non-metallic (below ground) to metallic (above ground) transitions.

D Innerduct:

1. All fiber shall be installed in innerduct unless fiber cabling is armored.
2. Shall be constructed of non-metallic material.

E Only manufacturer’s fittings, transition adapters, terminators and fixed bends shall be used.

F Measured Pull Tape

1. Pre-lubricated, woven polyester, low friction, and high abrasion resistant yarn with footage markers printed on the tape.

2. Minimum average tensile strength shall be 1130 lbs. for 0'-1.5" and smaller conduits and innerduct.

3. Minimum average tensile strength shall be 1800 lbs. for conduits larger than 0'-1.5".

G Fill and Bend Radius

1. Conduit fill shall comply with NEC requirements.

2. The minimum bend radius is 6 X the conduit inside diameter (ID) for 0'-2" conduit or less.

3. The minimum bend radius is 10 X the conduit ID for a conduit greater than 0'-2".

4. There shall be no more than two 90° bends (180° total) between conduit pull boxes.

5. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above.

6. Do not use pull boxes for direction changes unless specifically designated otherwise in the drawings.

7. Unless otherwise noted in the drawings, conduits entering pull boxes shall be aligned with exiting conduits.

H Routing

1. Conduits shall be routed in the most direct route possible, with the fewest number of bends possible.

2. There shall be no continuous conduit sections longer than 100'-0" for premises conduits. For runs that total more than 100'-0", insert junction or pull boxes so that no continuous run between pull boxes is greater than 100'-0".

I Penetrations

1. All conduit penetrations shall comply with all applicable fire codes.

2. All conduit penetrations in fire-rated walls or floors shall be sealed and fire-proofed to meet or exceed the designed rating of the penetration area.

2.05 CABLE TRAY

A Cable tray systems are defined to include, but are not limited to, straight sections of cable trays, bends, tees, elbows, reducers, crosses, wyes, vertical bends, up/down tees, cable support fittings, drop-outs, supports and accessories.

B Install all tray types utilizing manufacturer recommended installation instructions and applicable standards.

C Load cable tray and cable runway in accordance with manufacturer requirements and applicable standards.

D Cable Tray Materials

1. Aluminum
2. Pre-galvanized Steel
3. Hot-dip Galvanized Steel
4. Stainless Steel
5. Yellow Zinc Dichromate
6. Pre-Galvanized Zinc
7. Electro-Galvanized Zinc

E Cable Tray Systems

1. Wire basket (mesh) of types and sizes indicated on the drawings; with connector assemblies, clamp assemblies, connector plates, splice plates, cable drop outs, bonding accessories, and splice bars. Construct units with rounded edges and smooth surfaces.
2. Continuous mesh polyethylene cable-support system: with connector assemblies and appropriate support components. All parts shall be UL-listed. Plastic (non-metallic) parts shall have a zero detectable halogen content as substantiated by an independent test laboratory.
3. Ladder type trays shall consist of two longitudinal members (side rails) with transverse members (rungs) welded to the side rails. Rungs shall be spaced 0`-9" on center. Spacing in radius fittings shall be 0’-9” as measured at the center of the tray`s width. Rungs shall have a minimum cable-bearing surface of 0’-.875” with radius edges. No portion of the rungs shall protrude below the bottom plane of the side rails.
4. Ventilated trough type trays shall consist of two longitudinal members (side rails) with a corrugated bottom welded to the side rails.
5. Solid bottom trough type trays shall consist of two longitudinal members welded to the side rails.

F Cable trays shall have sufficient depth and width so as not to exceed a maximum 50% fill ratio, including 25% capacity for anticipated growth.

G All straight sections shall be supplied in minimum 8’-0” lengths, except where shorter lengths are permitted to facilitate tray assembly lengths.

2.06 HANGERS AND SUPPORT

A Steel support brackets shall be galvanized steel and capable of supporting a minimum of 200 lbs with a safety factor of 3.

B Steel support brackets shall have a removable galvanized steel retaining strap.

C Steel support brackets shall accept 0'-3/8" (10mm) threaded rod for attachment to building structure or sub structure.

PART 3 - EXECUTION

3.01 EXAMINATION

A Refer to Section 27 02 00.

3.02 PREPARATION

A Refer to Section 27 02 00.

B Verify system is properly sized for cables before installation.

C Verify that the manufacturer recommended loads are not exceeded.

D Verify general routing and coordinate locations with other trades before installation. Layout cable runs in advance to determine quantities of cable to be installed along pathways, and to ensure non-interference from other trade installations.

3.03 INSTALLATION

A Refer to Section 27 02 00.

B Cable Hooks

1. Provide cable hook (j-hook) cable support system for horizontal and/or riser cabling in accessible ceiling space. Assemblies shall be complete with mounting hardware.
2. Provide threaded rod for supporting hangers when hanging from floor deck and deck members.
3. Follow manufacturers fill capacities.
4. Locate cable hooks on 4' to 5' centers to adequately support and distribute the cable's weight.
5. Suspended cables shall be installed with at least 0'-3" of clear vertical space above the ceiling tiles and support channels.
6. For larger quantities of cables, provide special supports that are specifically designed to support the required cable weight and volume.
7. Do not support pathways or cables with the ceiling suspension system or use electrical, plumbing, or other pipes for support.
8. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached, and that are suitably sized to carry the weight of the cables to be supported.

9. Secure and support exposed horizontal cable at intervals not exceeding 5’-0” and not less than 1’-4” (16”) from cabinets, pack pole, boxes, fittings, outlets, racks, frames, and terminals.

10. Cable sag between vertical supports for horizontal pathway shall not exceed 0’-6”. Provide at least 0’-3” cable sag between supports.

11. Painted J-hooks shall meet or exceed NEC requirements for the environment in which the product is installed.

C Conduit and Pull Boxes

1. The Contractor shall route the conduit in approximate locations unless drawing is dimensioned for precise placement.

2. Conduit cuts shall be square. Ream ends of burrs, and remove metal shavings and cutting lubricants before conduit is connected to the conduit system.

3. For conduit embedded in concrete, coat threaded connections in conduits with colloidal rust and corrosion inhibitor and sealant. Conduit must be clean and dry and must pass standard sizing test after concrete is poured.

4. Cap unused conduits with watertight caps

5. Make conduit connections with appropriate fittings and tighten securely.

6. Use appropriate tools to install PVC coated conduit; avoid damage to exterior coating.

7. Install liquid-tight flexible metal conduit where exposed to weather, water, or other liquids.

8. Use IMC, PVC conduit, or rigid galvanized steel conduit in underground installations.

9. The Contractor shall provide fabric innerduct in all underground conduits, as indicated on the drawings.

    a. The Contractor shall use pre-lubricated, woven polyester, low friction, and high abrasion resistant fabric.

    b. The Contractor shall be trained for proper installation technique by the innerduct manufacturer. The Contractor shall coordinate with the owner to demonstrate that pull ropes in each inner duct cell move freely from end to end.

D Cable Tray and Cable Runway

1. Cut wire basket tray members square with approved cable tray cutting tool as to not leave sharp edges at cut point. Remove burrs and smooth the ends before the cut is connected to wire-mesh tray system.

2. Ensure that standard splices are designed to have less than 1 milliohm (0.0001 Ω) of resistance between connections and provide bonding between sections. Painted wire mesh tray requires the outer mask of the non-conductive surface be removed at each end of the tray prior to installing the splice to provide continuity between painted tray sections.

3. Threaded rod (minimum 0'-½" diameter) or equivalent and slotted channel shall be used for hanging cable tray between floor deck and deck members

E Fiber Support:

1. Support vertical fiber optic cable with basket weave wire/cable grips. Support fiber riser with single weave support grip with a single offset eye.

2. Mount/attach pulling eye to a wall or ceiling deck secured hook to support/provide strain relief to riser cable. Provide a minimum 3'-0" loop of fiber prior to entering fire stopped floor sleeve.

3. Where required coil up slack fiber cable into pull box and secure with single weave support grip.

F Clearances

1. A minimum of 1'-0" access headroom shall be provided above a cable tray. Ensure that other building components do not restrict access to the cable trays from the sides.

2. Power outlets shall not be installed in or mounted to cable tray or cable runway.

3. Provide 3'-0" of unencumbered space for every 10'-0" segment of tray.

4. Cable tray clearances

a. Motors or transformers: 4'-0"

b. Power cables and conduit: 1'-0"

c. Fluorescent lighting: 0'-5"

d. Halide lights: 1'-0"

e. Above the ceiling tiles: 0'-3"

f. Access above and on one side of the cable tray: 1'-0"

3.04 FIELD QUALITY CONTROL

A Test system to ensure electrical continuity of bonding and grounding connections.

B Ensure compliance with specified maximum ground resistance.

C Refer to NFPA 70B Chapter 18 for testing and test methods.

3.05 CLEANING

A Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where Work has been completed unless designated for storage.

B Wipe clean all cable trays and apply appropriate manufacturer's paint to areas that have been scratched.

END OF SECTION 27 05 28

SECTION 27 51 29 - EMERGENCY RADIO COMMUNICATION ENHANCEMENT SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A The requirements of the General Conditions, Supplementary Conditions, Division 1, Division 20, and Drawings apply to all Work herein.

B Requirements of the following Division 20-28 Sections apply to this section:

1. Scope of Work - Section 27 02 00
2. Fire Alarm System - Section 28 46 00

1.02 SCOPE

A Provide an in-building radio signal amplification system to provide complete coverage in the building for the public safety agencies as required by the local fire department and other agencies and authorities having jurisdiction. System users shall receive and transmit radio broadcasts from their portable radio units within the building. This shall be accomplished utilizing the following components:

1. Bi Directional Amplifiers (Signal Boosters)
2. Plenum rated Coaxial Cable
3. Antennas
4. Cable taps
5. Connectors
6. Power dividers
7. Other components and interconnecting circuitry as required

B The system shall comply with the requirements of UL 2524 In-building 2-Way Emergency Radio Communication Enhancement Systems, NFPA 72, NFPA 1221 and ICC (IFC), as referenced.

C The entire system shall meet with approval of the Fire Department, the Building Department and all other agencies and authorities having jurisdiction (AHJ).

D The work in this section shall include the responsibility for all filings with the AHJ. Where filings require engineer's signature, documents shall be submitted for his review and signature. This responsibility shall include furnishing of required quantities of floor plans, descriptive notes and/or specifications, wiring diagrams, shop drawings and amendment forms.

E Early completion of the in-building emergency radio communication enhancement system will be required as to permit a Certificate of Occupancy to be obtained in a timely manner

F Any permits necessary for the installation of the work shall be obtained prior to the commencement of the work. All permit costs and inspection fees shall be included as the part of the required work.

G The in-building emergency radio communication enhancement system shall use a UL 2524, NFPA 72, NFPA 1221 and ICC (IFC) compliant NOTIFIER® signal booster or approved equal.

H All conductors shall be installed in conduit. Conduit installation shall be as specified in the Conduit Section.

I Related Sections: Other Division 20-28 Sections contain requirements related to the work of this Section. These may include, but not be limited to, the following sections:

1. Conductors - Section 26 05 19
2. Conduit - Section 26 05 33 and 26 06 34
3. Outlet Boxes - 26 05 33

1.03 QUALITY ASSURANCE

A Basis: To establish the type, quality and features of the system required, the equipment specified is that of the Notifier Fire Systems. All references to manufacturer or supplier model numbers and other pertinent information herein is intended to establish a minimum standard of quality, performance and features required. All equipment proposed as an EQUAL to that specified shall COMPLETELY conform to the Specifications herein.

B Manufacturers: If they comply with these specifications and requirements, products of the following manufacturers will be acceptable:

1. Notifier Fire Systems (Provided by Fire Tron)
2. Or Engineer approved equal.

C Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the In-building Radio System Manufacturer to sell, install, and service the proposed manufacturer`s equipment. The equipment supplier shall have technical factory training specifically for the system proposed.

D Codes and Standards: The system shall comply with the applicable Codes and Standards as follows:

1. National Fire Protection Association Standards:
    a. NFPA 70 National Electrical Code
    b. NFPA 72 National Fire Alarm Code
    c. NFPA 101 Life Safety Code

d. NFPA 1221 Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems

2. The Americans with Disabilities Act (ADA).

3. The Texas Accessibility Standards.

4. Local and State Building Codes.

5. Requirements of Local Authorities having Jurisdiction.

1.04 SUBMITTALS

A The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Riser wiring diagram with associated conduit sizes.

2. Complete floor plan drawings locating all devices and interfaces associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.

3. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage and configuration.

4. Detailed written system description in this Specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.

5. Complete Bill of Material for reference.

B All submittal data shall be in bound form with contractor`s name, supplier`s name, project name, and state fire alarm license number adequately identified.

C Only basic equipment devices have been shown on the contract drawings. Specific wiring between equipment/devices has not been shown. It is the contractor`s responsibility to submit for approval the Complete Engineered System Configuration and Layout showing all devices, wiring, conduit, and locations along with other required information as specified herein.

PART 2 - PRODUCTS

2.01 DESIGN REQUIREMENTS

A In-building emergency radio communication enhancement systems for emergency responders are an integral component of the life safety equipment of a building or structure. The primary function is to provide reliable emergency responder communications at the required signal strength within the specified areas.

B Critical Areas such as Fire Command Center, fire pump room, exit stairs, exit passageways, elevator lobbies, standpipe cabinets, sprinkler sectional valve locations and similar critical areas shall be provided with 100% floor area radio coverage.

C General building areas shall be provided with 95% radio coverage, or as specified by AHJ.

D The In-building emergency radio communication enhancement systems must provide the following signal strengths:

1. Downlink - Minimum signal strength of -95 dBm throughout the coverage area.

2. Uplink - Minimum signal strength of -95 dBm received at the AHJ Radio System.

E The system shall be complete with all components and wiring required for compliance with all applicable codes and regulations, and for its operations described hereinafter.

F EC shall sub-contract an approved manufacturer or a qualified and approved vendor to supply, test and determine locations of components which are required for proper operation as well as to supply, deploy, test and certify the performance of the complete system. Vendor qualifications must be acceptable to the AHJ.

G All tests shall be conducted, documented, and signed by a person in possession of an FCC General Radio Telephone Operators License. All testing personnel shall be certified and authorized by the signal booster manufacturer in the installation and operation of their equipment. Personnel qualifications must be acceptable to the AHJ.

H The system design shall be based on the NOTIFIER® line of Public Safety Signal Boosters UL 2524, NFPA 72, NFPA 1221, ICC (IFC) and FCC compliant to establish standards of quality for materials and performance. The naming of a specific manufacturer or a catalog number does not waiver any requirement or performance of individual components described in the specifications.

I Assembly and installation of all components of the Emergency Responder Radio Communication Enhancement System shall comply with all applicable sections of the National Electrical Code.

J Survivability from attack by fire shall meet NFPA 72, National Fire Alarm and Signaling Code, and NFPA 1221.

K The system must comply with all applicable sections of the FCC rules. Signal booster shall have FCC certification prior to installation.

L Antenna isolation shall be maintained between the donor antenna and all inside antennas (D.A.S.) to a minimum of 20 dB under all operating conditions

2.02 PERFORMANCE REQUIREMENTS

A The basis of design system is specified based upon NOTIFIER® line of Public Safety UL 2524, NFPA 72, NFPA 1221, ICC (IFC) compliant signal boosters.

B The signal booster shall be a Class B Public Safety type as designated by the FCC and as required by the AHJ.

C The secondary power supplies, battery chargers and system monitoring shall be fully compliant with NFPA 72 and NFPA 1221. The signal booster shall have both the primary and the secondary power supplies built in a fully sealed NEMA-4 type approved enclosure.

D All signal boosters and other active system components must have FCC certification prior to installation. The equipment FCC ID must be shown on the product datasheets and technical submittals. The ID must also be displayed on the product as required by the FCC.

E The signal booster shall be set and tuned by the equipment manufacturer to pass frequencies as specified by the local fire department.

F To reduce the possibility of unwanted interference affecting the operation of the system, signal boosters shall be band or channel selective type with a maximum 3dB channel bandwidth of 200KHz (Fc +/- 100KHz). Wide-band signal boosters shall not be accepted, unless required to cover multiple channels within the same band.

G Signal Boosters shall have oscillation prevention circuitry to protect the public safety radio system in case of signal booster malfunction.

H Signal Booster gain shall be rated at minimum of 80dB and the gain shall be adjustable in a minimum of 25dB range. System gain shall be set and documented at the time of the final system test.

I Maximum Propagation delay of the signal booster system shall be 14µs (microseconds) or as specified by AHJ.

J The signal booster system shall include built-in automatic alarming of malfunctions of the signal booster and battery system as per NFPA 1221 Section 9.6, NFPA 72, Sections 24.5.2.6.1, and 24.5.2.6.2. Aftermarket equipment add-ons and modifications to comply with this specification will not be accepted.

K A dedicated supervised monitoring panel shall be provided within the emergency command center or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

1. Normal AC power
2. Signal booster trouble
3. Antenna Failure
4. Loss of normal AC power
5. Failure of battery charger
6. Low battery capacity

L The signal booster system shall include a built-in addressable monitor module tied to the Building Fire Alarm Panel for monitoring the signal booster.

M The vendor shall verify the system monitoring requirements with the AHJ prior to system installation. System monitoring shall be fully compliant with the AHJ requirements.

N External filters, attachments or other aftermarket modifications of the original equipment shall not be accepted.

O All signal booster components shall be contained in a NEMA4-type approved waterproof cabinet. All enclosures shall be painted red with signage in bright yellow or as required by AHJ

PART 3 - EXECUTION

3.01 INSTALLATION

A General: It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the in-building radio system with all trades including, but not exclusive of: electrical contractor, sprinkler contractor, and HVAC/Controls Contractor. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

B The in-building radio system contractor shall be responsible for coordinating all devices, panels and other equipment requiring 120V input power with the Electrical Contractor prior to bid. Provide a dedicated 120 volt 20 amp emergency circuit for this equipment.

C Assembly and installation of all components of the Emergency Responder Communication Enhancement System shall comply with all applicable sections of the National Electrical Code, NFPA 70 and the National Fire Alarm and Signaling Code, NFPA 72, NFPA 1221.

D At least two independent and reliable power supplies shall be provided as specified below.

E The primary power source shall be supplied from a dedicated twenty (20) ampere branch circuit and comply with NFPA 70 National Electrical Code, NFPA 72, National Fire Alarm and Signaling Code, and NFPA 1221.

F The emergency responder radio coverage enhancement system shall be equipped with a secondary source of power. The secondary source of power shall be a battery system with a dedicated battery charger powered by a separate, dedicated twenty (20) ampere branch circuit. The secondary power supply shall supply power automatically when the primary power source is lost. The secondary source of power shall be capable of operating the emergency responder radio coverage enhancement system for a period of at least 24 hours. The battery system shall automatically charge in the presence of external power input. Battery charger and all other electronic components must be fully enclosed in a non-vented NEMA4 Type approved enclosure. Batteries shall be enclosed in a separate, vented NEMA 3R Type approved enclosure.

G The signal booster shall be designed to allow degraded performance in adverse conditions, such as high temperatures in the event of heat from a nearby fire, voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, etc.) are not acceptable. External UPS (Uninterruptable Power Supplies) are not acceptable. It is the purpose of this specification to assure the maximum possible level of communications to public safety personnel depending upon the signal booster, even to the extent of damaging the signal booster, as long as some communications benefit can be provided during the emergency.

H System design shall be such that neither the failure of the normal power source, the transfer to an emergency source, nor the re-transfer to the normal source shall cause a change in system status.

I The amplifier shall be housed in a 2-hour fire rated room or other suitable space as approved by the Engineer, or where specifically shown on the drawing.

J Radiating cable, if used, shall be run without conduit. All other cable can be run in conduit.

K RF Coaxial Cable shall be a fire-resistant, low-smoke type, UL classified as plenum. The classification shall be clearly marked on the outer surface of the cable regular intervals.

L All vertical wiring for the BDA system shall be located within a 2-hour enclosure.

M The remote annunciator shall be located adjacent to the fire alarm control panel.

N All wiring shall be in accordance with NFPA 72, the National Electrical Code, Local Codes, and Article 760 of NFPA 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

O All conductors shall be UL Listed FPL for LIMITED ENERGY (300 volt) and fire alarm applications and shall be installed in conduit.

P All conductors for intelligent/addressable circuits shall be of the TWISTED/SHIELDED type to guard against outside RF interference and induced noise. Alarm and telephone communications circuits shall also be of the twisted/shielded type. Conductor size shall be determined by calculated voltage drop and circuit loading but shall not be less than #18 AWG.

Q All wiring shall be run in a supervised fashion (i.e., no branch wiring or dog-legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA and UL requirements.

R Conduit and raceway system shall be installed as specified under the CONDUIT Section of the specifications, and per NEC.

S Minimum conduit size shall be 2" EMT. Install conduit per engineered shop drawings.

3.02 TEST AND REPORTS

A Acceptance testing for an in-building radio system is required upon completion of installation.

B The coverage testing shall be done in accordance with NFPA 72, National Fire Alarm and Signaling Code, NFPA 1221 and as required by the local AHJ.

C All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio Operator License.

D All test records along with system diagrams, equipment specifications, user manuals, RF link budget calculations, battery backup calculation and other design data shall be submitted upon completion of the project.

3.03 WARRANTY

A The in-building radio system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

B The equipment manufacturer shall be represented by a local organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

C Additions required to the in-building radio system shall not affect or void any warranty to the existing system provided that said additions are installed by an authorized manufacturer's dealer. All additions to sch shall be of compatible components to match existing manufacturer's components.

3.04 OPERATIONS PERSONNEL TRAINING

A Provide a training session for the owner's operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum

1. Purpose of equipment.
2. Principle of how the equipment works.
3. Important parts and assemblies.
4. How the equipment achieves its purpose and necessary operating conditions.
5. Most likely failure modes, causes and corrections.
6. On site demonstration.

END OF SECTION 27 51 29

SECTION 28 02 00 - BASIC MATERIALS AND METHODS FOR SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore, shall be submitted to the Architect and Engineer for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect and Engineer.

1.02 SCOPE OF WORK

A The Work included under this Contract consists of the furnishing and installation of all labor, material, tools, equipment and services necessary and required to form the complete and functioning electronic safety and security systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C The approximate locations of Security items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least seven (7) working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning Safety and Security system shall be considered a part of the overall "Scope".

H Coordinate with other contractors on items required for the proper functioning of Safety Security system and indicated as provided by others, such as power, backboxes, conduits, sleeves, air conditioning, structural support, etc..

I Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

1.03 RELATED SECTIONS

A Div 1 and conditions of the contract

B Section 08 71 00 - Door Hardware

C DIv 26 Electrical

D Div 27 Communications

1.04 REFERENCES

A Americans with Disabilities Act (ADA)

B Building Codes (UBC) (IBC), latest editions

C National Electrical Code (NEC)

D American Society for Testing and Materials (ASTM)

E Underwriter's Laboratories, Inc. (UL)

F Insulated Cable Engineer's Association (ICEA).

G National Electrical Manufacturer's Association (NEMA).

H Institute of Electrical and Electronics Engineers (IEEE).

I American National Standards Institute (ANSI).

J National Fire Protection Association (NFPA).

K International Energy Conservation Code (IECC).

L BICSI (Building Industry Consulting Services International)

M Owner's Design Guidelines and Construction Standards

N Local, county, state and federal regulations and codes in effect as of date of installation.

1.05 COMPLETE FUNCTIONING OF WORK

A All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of Security devices, equipment cabinets, conduits and sleeves, etc. are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such items and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.

2. Communicate with the Architect and secure his approval of any location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of ceiling devices shall be coordinated with reflected ceiling plans.

C Additional coordination with mechanical, electrical, plumbing contractor may be required to allow adequate clearances for all building components. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.06 DESCRIPTION OF SYSTEM WORK

A Furnish and install all materials, tools, equipment, and services for all electronic security/surveillance devices to provide functioning systems in accordance with performance requirements specified and any modifications resulting from reviewed shop and field coordinated drawings.

1. Access Control System

a. This system replaces the typical mechanical key-controlled door lock with a door locking system that uses an access card as the access credential.

b. The system includes an electric door-locking mechanisms, card reader located adjacent the door, door status sensor, door prop alarm and a request to exit device.

c. Typical system configuration is card or schedule-controlled entry with free exiting.

2. Intrusion Detection System

a. This system monitors areas for unauthorized entrance or intruder.

b. This system can consist of motion sensors, door status sensors, glass break sensors and one or more control keypads.

c. The keypad is used to arm/disarm system by entering a numeric code on the keypad.

3. Video Surveillance System

a. This system is used to provide video surveillance through the use of cameras of security sensitive areas and target items.

b. The system shall allow for the viewing and recording of images.

B RACKS AND ENCLOSURES

1. Wall mounted enclosures, data gathering panels, and power supply panels shall be installed as per manufacturer's requirements.

a. Coordinate pathways and power with Electrical and Telecommunications Contractors

b. Furnish all labor, materials, tools, equipment, and services for all control consoles, equipment racks, cabinets, and enclosures not provided by others in accordance with contract documents.

c. Completely coordinate with work of other trades to avoid duplication in purchasing.

d. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, and devices incidental to or necessary for a sound, secure and complete installation.

2. Coordinate with rack/cabinet provider if it's indicated to be provided by others. Include them in scope of work if no other contractor is available or no indication that it is to be provided by others.

a. Coordinate with G.C.

3. The designated security space will provide an area reserved for rack and wall mounted security equipment.

a. The rack area allows for vertical relay rack(s).

b. Backboard wall area of 8’-0” X 8’-0” shall be reserved for wall-mounted components.

4. Provide all supplementary or miscellaneous items and devices incidental to or necessary for a sound and complete installation.

5. Drawings are representative and show general arrangement of systems and equipment, except when dimensioned or detailed.

   a. For exact locations refer to dimensioned architectural drawings.

      1) Field measurements take precedence over dimensioned drawings.

      2) Field verify locations and arrangement of all systems and equipment.

      3) Coordinate all work with other trades and Contractor.

6. Circuit Supervision

   a. Supervise all signal and data transmission lines, links with other systems, and sensors.

      1) Indicate circuit and detection device faults with both protected zone and trouble signals.

      2) Initiate an alarm in response to opening, closing, or shorting of a signal or data transmission line.

7. Electronic Safety and Security work as specified in this Section and sub sections shall include but not limited to:

   a. A project kick-off/pre-submittal meeting with the Architect, Designer, and Contractor to review security design package.

      1) Additional participants shall include:

         (a) Division 8 subcontractors

         (b) Division 26 subcontractors

   b. Preparation of pre-installation submittals, including point-to-point wiring information for security equipment to interface to work by others prior to start of any installation work. Include lock permit requests in submittals for review.

   c. Furnishing and installation of all devices, components and accessories.

   d. The furnishing and coordination on installation of special back boxes for equipment and field devices as required.

   e. Furnishing, installation and termination of all wiring and cabling including any special purpose wire and cable for electronic safety and security systems.

      1) Coordinate all phone, network and fiber optic cable interface provided by telecommunications subcontractor or carriers.

f. Coordinate raceway and power distribution systems provided by Division 26.

g. Provide and install 12/24 VAC/DC input power to all field devices as required.

h. Coordination with other trades and Owner required to facilitate the installation of the safety and security equipment including:

1) Division 08 (doors)

2) Division 26 (power, raceways, and fire alarms)

3) Division 27 (telecommunications network interface).

i. Wiring and termination of electrified door hardware by security subcontractor shall be concurrent with the installation of these electrified components by the door hardware subcontractor.

j. Programming of all security control equipment and prior coordination with the Owner's security and telecommunications personnel, unless noted otherwise.

k. Preparation of "As-Built" documentation.

l. Warranty service for completed work.

1.07 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.08 QUALITY ASSURANCE

A Contractor shall have a complete working knowledge of the Security system being installed.

B Maintain a valid Type B license from the Texas Private Security Bureau.

C Contractor shall have installed similar-sized systems in at least ten (10) other projects in the last five (5) years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document and maintain manufacturer certification for the system to be installed.

D The security integrator must maintain an operating facility in the local area (50 mile radius) of the Project location to provide service to the Owner for the warranty period.

1. At the Owners request for service, the security integrator shall dispatch a service technician to the location to affect the required repairs or adjustments.

E The contractor shall maintain a spare parts inventory necessary to resolve component failures of the system.

1. Refer to individual specification section for a list of specifically required parts provided to the owner and stored on site. These parts will become the property of the owner.

2. At the end of the warranty period the Safety and Security integrator shall test the owner's spare parts and repair or replace as needed to bring the parts up to proper operation.

F Contractor shall obtain Safety and Security system product manufacturer's certification if applicable.

G Refer to General Conditions for other requirements.

1.09 CONTRACTOR REQUIREMENTS

A In order to accomplish the conditions of this agreement, the Contractor shall perform the specific duties listed herein.

B Contractor shall provide and pay for all labor, supervision, tools, equipment, test equipment, tests and services to provide and install a complete Safety and system. Pay all required sales, gross receipts, and other taxes.

C Insurance

1. The Contractor shall procure, submit for review, and maintain for the duration of this agreement, insurance against claims for injuries to persons or damages to property which may arise from, or in connection with, the performance of work hereunder by the Contractor, his agents, representatives, employees or subcontractor. The Contractor shall pay the cost of such insurance.

2. The Owner, its directors, officers, representatives, agents and employees, respectively, shall have no responsibility to the Contractor with respect to any insurance in accordance with the provisions set forth herein.

D Regulatory Requirements

1. Safety and Security Contractor shall supply all city, county, and state telecommunication cabling permits required by Authority Having Jurisdiction (AHJ).

2. Safety and Security Contractor shall be licensed and/or bonded as required for Safety and Security systems.

E Privacy and Confidentiality

1. The Contractor will respect and protect the privacy and confidentiality of Owner, its employees, processes, products, and intellectual property to extent necessary, consistent with the legal responsibilities of the Owner policies.

2. Contractors shall sign a non-disclosure agreement and abide by the requirements to keep confidential all information concerning bid documents and this project.

F Use of Subcontractors

1. Successful bidder shall inform the Owner's contact and General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired.

2. The Owner or Owner's designated contact must approve the use of Subcontractors in writing prior to the Subcontractor's hiring and start of any work.

G The Contractor's designated Project Manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications, references, and drawings) to ensure a quality installation and attend project meetings with the telecommunication consultant, the Owner and others.

H Coordination

1. Coordinate installation work with other trades (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) to resolve procedures and installation placement for cable trays and cable bundle pathways.

2. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for Safety and Security components.

3. Exchange information and agree on details of equipment arrangements and installation interfaces.

4. Coordinate with electrical contractors and plan for the pathway routes used Safety and Security cabling to minimize cable lengths.

5. Record agreements with other trades and distribute record to other participants, Owner and telecommunication consultant.

1.10 GENERAL REQUIREMENTS

A Upon completion of commissioning testing and Owner acceptance, DBR bears no liability or responsibility for the continued proper operation of the installed systems.

B The Items described herein shall not be modified or substituted without consent of DBR and/or the Owner.

C Electronic Safety and Security systems integrator (Safety and Security subcontractor) manager/supervisor shall attend meetings arranged by the Contractor, Architect, Owner or other parties affected by the work of this Section.

D If the manufacturer of Safety and Security devices or connecting hardware has supplied post manufacture performance data, copies of such are to be kept for inclusion in the documentation and made available to the Owner upon request.

E All materials are to be new unused and of the latest series of model number, unless otherwise indicated by the Owner or Safety and Security system designer.

F All Safety and Security integrator personnel must be manufacturer certified and capable of an installation that falls under the manufacturer's guidelines necessary to obtain a manufacturer warranty.

1. The integrator shall provide all components/materials essential for a complete and functional Safety and Security access and surveillance system.

G Safety and Security integrator shall issue a 2-year warranty on installation and workmanship.

H These Specifications and Drawings are intended for bidding purposes only; no part shall be copied or used for any purpose other than bidding on this project.

1. This package shall be contractual upon bid award.

I Drawings and Specifications are to be used in conjunction with one another and to supplement one another.

1. In general Specifications determine the nature and quality of the materials and tests, and drawings establish the quantities, details and give characteristics of performance that should be adhered to in the installation of the Safety and Security system components.

2. If there is an apparent conflict between the drawings and specifications, or within the specifications themselves, the items with greater quantity or quality shall be estimated and installed.

3. Clarification with the Owner/Designer about these items shall be made prior to purchase and installation.

4. Questions regarding the Specification or system requirements should be directed in writing to DBR or the Owner.

J Safety and Security integrator shall adhere to Division 1 general requirements and written Safety and Security Specifications and Drawings within this construction package and shall be responsible for complying with all local, state and federal laws or regulations applicable to the work being performed, even though said law, rule or regulation is not identified herein.

K Safety and Security integrator shall arrange and pay for any inspections required by the public agencies having jurisdiction in the area.

L The Safety and Security contractor shall procure and maintain for the duration of this agreement, insurance against claims for injuries to persons or damages to property which may arise from, or conjunction with, the performance of the work hereunder by the Safety and Security integrator, his agents, representatives, or employees.

1. The Safety and Security integrator shall pay the cost of such insurance.

M The Safety and Security integrator will respect and protect the privacy and confidentiality of the Owner, his employees, processes, products, and intellectual property to the extent necessary, consistent with the legal responsibilities of the State of Texas and the Owner.

N If required the Safety and Security integrator shall sign a non-disclosure agreement and abide by its requirements to keep confidential all information concerning bid documents and this Project.

O Furnish submittals and manuals in accordance with Division 1.

P Furnish a detailed material list complete with suppliers (distributors) list of components and distributors name, address, and phone number.

Q Refer to Specifications issued by Architect, Division 1, for Project and cost payments.

1.11 DATE OF FINAL ACCEPTANCE

A The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.12 DEFINITIONS AND SYMBOLS

A General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B Definitions and explanations of this Section are not necessarily either complete or exclusive, but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances), or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances, and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by 1993 ASHRAE Fundamentals Handbook, chapter 34 "Abbreviations and Symbols", ASME and ASPE published standards.

1.13 DELIVERY, STORAGE, AND HANDLING

A Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.14 SUBMITTALS

A Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.

2. An index page with a listing of all data included in the Submittal.

3. Product Data and Shop Drawings shall be submitted in separate submittals, to avoid rejection of one due to errors in the other.

B Shop Drawings

1. Safety and Security Contractor shall submit, for approval, floor plans that identify all device locations, device ID, cable routes and quantities, cable types, riser locations, and references to installation details and diagrams.

2. A functional description of each system.

3. All cable and wiring types for each device type used.

4. Certification that lock wiring and access control systems requirements have been coordinated with electrified door hardware, fire alarm systems, automatic door controls, and overhead door controls specified in other sections and other packages.

5. Riser diagram showing routes between floors or other areas that are not easily identified on the floor plans.

6. Safety and Security One-line diagrams showing all input and output points of the system.

    a. The Contractor shall make any corrections required by the consultant team, file with him two corrected copies and furnish such other copies as may be needed.

7. Power supply points listing with devices and maximum loads to prevent overloading.

8. Equipment schedules listing all system components, manufacturer, model number and quantities of each.

9. Safety and Security Contractor shall submit, for approval, diagrams that show Safety and Security equipment layouts, rack layouts (including wall and rack elevations), cabling riser and interconnection diagrams, etc.

10. Safety and Security Contractor shall submit, for approval, labelling scheme for all Safety and Security devices and cabling components (faceplates, horizontal cables, riser cables, inter-building cables, racks, patch panels, etc.) installed.

11. The Contractor shall make any corrections as required by the Engineer and submit revised shop drawings to the team for approval.

12. Approval by the Engineer of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from the drawings or specifications, nor shall it relieve the Contractor from responsibility for errors of any sort in shop drawings or schedules. Requests to deviate shall be submitted in writing to the Architect.

13. Drawings shall show the proposed firestop systems and locations, (stamped/embossed by the PE) to restore/maintain the designed fire rating of the building structure (walls, ceilings, floors, etc.).

14. Shop Drawings shall be newly prepared and not reproduced from the Contract Documents. Drawings shall be prepared by a draftsman skilled in this type of work. Submitting copy of the engineering drawings or engineering drawings with contractor's markup as shop drawings is NOT ACCEPTABLE.

15. Shop drawings shall be developed in coordination with other trades (MEP, Architecture, Structural, etc.) to avoid any collision or conflict and to meet all industry standards best practices, codes and regulation requirements. By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified

16. Additional coordination with other trade contractors may be required to allow adequate clearances and meet code requirements. All transitions, offsets and relocations as required by actual field conditions shall be performed by the contractor at no additional cost to the owner

C Product Data Submittals

1. Safety and Security Contractor shall submit catalogue cut-sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten and/or highlighted to indicate exact selection.

2. Safety and Security Contractor shall identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.

3. Inlcude battery backup calculations to show load and back-up times for UPS and power supplies with batteries.

4. Include licenses and permit required, and qualifications and proof of work history (with references).

5. All data sheets shall be organized by specification sections and provided with table of contents. All products required shall be included in one submittal.

6. All product substitutions shall be submitted in advance for review and approval before being included in product submittal package.

7. Specification variations pages with a listing of all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then the specification page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

8. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

9. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.

10. Identification of each item of material or equipment matching that indicated on the Drawings.

11. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.

12. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

D Warranty

1. The Safety and Security Contractor shall submit appropriate documentation from the certifying manufacturer showing the project is registered and qualified for the System Assurance Warranty.

2. All subsequent work shall be in accordance with approved submittals. The Safety and Security Contractor shall not perform any portion of the work requiring approval of the System Assurance Warranty manufacturer's warranty registration qualification procedures that would disqualify any part or all of the system from that warranty qualification.

E Qualifications

1. Safety and Security Contractor shall submit a list of the Contractor's previous projects that demonstrate qualification for this project. This list shall include, but not be limited to:

   a. At least ten (10) other projects in the last five (5) years

   b. Name and location of project

   c. Project contacts, email addresses, and phone numbers

   d. Total square footage

   e. Total number of devices

   f. Types of system platform

2. Safety and Security Contractor shall submit an up-to-date and valid statement of qualifications for those assigned to perform the work specified herein at time of bid submission.

   a. Safety and Security Contractor Employees

   b. Subcontractors

3. Manufacturer certifications for Contractor and installers.

F Samples

1. Provide sample of all visible devices such as camera mount, motion detectors, card reader, door contact, etc. for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color selection before purchasing materials.

G Refer to Division 1 for additional information on shop drawings and submittals.

H Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

I Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

J Submittals shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor does not need to take further submittal action, shall include this submittal in the O&M manual, and verify with Architects and other parties (Owner, etc) reviewing the submittals that no other correction is required before placing orders and starting installations.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted, and verifed with Architects and other parties (Owner, etc) reviewing the submittals that no other correction is required before placing orders and starting installations.

3. NOT APPROVED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is not approved, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR’S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor’s stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

K Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

L Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

M Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

1. Fire Alarm System
2. Access Control System
3. Video Surveillance System
4. Intrusion Detection System

N Refer to each specification section for additional requirements.

1.15 COORDINATION DRAWINGS

A Before submit shop drawings, Contractor shall prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of Safety and Security conduits/sleeves, pullboxes, equipment, cabinet and other materials. Include the following:
    a. Wall and type locations.
    b. Clearances from other building structure and MEP equipment.
    c. Clearances for servicing and maintaining equipment and cabling, and space for equipment disassembly required for periodic maintenance.
    d. Equipment connections and support details.
    e. Exterior wall and foundation penetrations.

f. Fire-rated wall and floor penetrations.

g. Sizes and location of required concrete pads and bases.

h. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: cable routing, equipment location, clearance, space requirements, sequence of construction, building requirements and special conditions.

C By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.16 OPERATION AND MAINTENANCE MANUALS

A Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

5. Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 28, include the following information for equipment items:

a. Identifying names, name tags designations and locations for all equipment.

b. Fault Current calculations and Coordination Study.

c. Reviewed shop drawing submittals with exceptions noted compliance letter.

d. Fabrication drawings.

e. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.

f. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

g. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.

h. Equipment name plate data.

i. Wiring diagrams.

j. Exploded parts views and parts lists for all equipment and devices.

k. Color coding charts for all painted equipment and conduit.

l. Location and listing of all spare parts and special keys and tools furnished to the Owner.

m. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

6. The Safety and Security Contractor shall deliver the Installer's Warranty and Manufacturer's signed System Warranty.

a. Delivery shall be completed within two (2) weeks of the time of final punch list review.

b. Product Certificates shall be signed by manufacturers certifying that products furnished comply with requirements.

7. Testing Report Requirements

a. Submit certified test reports of Contractor-performed tests. Contractor shall submit the required Test Reports in the format and media specified, upon completion of testing the installed system.

b. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.

c. Three (3) sets of electronic and hardcopy versions of test reports shall be submitted together and clearly identified with cable designations.

8. Supply Owner with training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

1.17 RECORD DRAWINGS

A Maintain a continuous record during the course of construction of all changes and deviations in the work from the contract drawings. Upon completion of the work, purchase a set of "Auto Positive Tracings" on vellum and make corrections as required to reflect the electrical systems as installed. Location and size of all conduit shall be accurately shown to dimension. Submit three prints of the tracings for approval. Make corrections to tracings as directed and deliver "Auto Positive Tracings" to the Architect. Record drawings shall be furnished in addition to shop drawings. Symbols on the Record drawings shall correspond to the identification symbols on the contract drawings and equipment identification plates and tags.

B The Contractor shall maintain a set of clearly marked black line record "AS-BUILT" prints on the job site on which he shall mark all work details, alterations to meet site conditions and changes made by "Change Order" notices. These shall be kept available for inspection by the Owner, Architect or Engineer at all times.

C Refer to Division 1 for additional requirements concerning record drawings. If the Contractor does not keep an accurate set of as-built drawings, the pay request may be altered or delayed at the request of the Architect. Mark the drawings with a colored pencil. Delivery of as-built prints and reproducibles is a condition of final acceptance.

D The record prints shall be updated on a daily basis and shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed device and cabling, and any deviations from the work shown on the Construction Documents which are required for coordination. All dimensions shall include at least two dimensions to permanent structure points.

E Submit three prints of the tracings for approval. Make corrections to tracings as directed and delivered "Auto Positive Tracings" to the architect. "As-Built" drawings shall be furnished in addition to shop drawings.

F When the option described in paragraph E., above is not exercised then upon completion of the work, the Contractor shall transfer all marks from the submit a set of clear concise set of reproducible record "AS-BUILT" drawings and shall submit the reproducible drawings with corrections made by a competent draftsman and three (3) sets of black line prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The reproducible record "AS-BUILT" drawings shall have the Engineers Name and Seal removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____

(SIGNATURE)

1.18 CERTIFICATIONS AND TEST REPORTS

A Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 28.

1.19 OPERATOR TRAINING

A The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C Refer to other Division 28 Sections for additional Operator Training requirements.

1.20 SITE VISITATION

A Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C Understand the existing utilities from which services will be supplied; verify locations of utility services, and determine requirements for connections.

D Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.21 WARRANTY

A The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B See requirements in Division 1 Specifications.

C The Security Integrator shall warrant all completed work, including all materials and labor, to be free from defects in design, workmanship, and/or materials for a period of two (2) years from final acceptance date.

1. System acceptance is defined as the completion of all functional performance testing and the resolution of all punch list items.

D Warranty Service

1. In the event that defects in the materials and/or workmanship are identified during the warranty period, the contractor shall provide all labor and materials to correct the deficiency.

2. All service work shall be performed by factory certified technicians.

3. All warranty service shall include the replacement of all parts and or components as required to restore normal system operation.

    a. If parts or components need to be repaired, a loaner will be supplied and installed until the part or component can be repaired and reinstalled.

4. Immediately following a warranty service request, the Contractor shall provide written documentation to Owner which details the service work completed, cause of trouble, and any outstanding work required to restore a complete and normal system.

E Warranty service requests shall be responded to within 4 hours of notification with a qualified service technician on site.

F All repairs shall be completed within 48 hours upon site arrival.

1. If the failure exceeds 48 hours, the Owner reserves the right to require the contractor provide on-site manufacturer support at no additional cost to Owner.

G Extended warranties on equipment components offered by the manufacturer shall be passed through to the Owner.

1. Warranty provisions shall be fully transferable only at the direction of the Owner, in the event that ownership of the installed security systems is transferred.

1.22 TRANSFER OF ELECTRONIC FILES

A Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

1.23 PRE-INSTALLATION MEETINGS

A Safety and Security Contractor shall attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section. This venue is to ask and clarify questions in writing with consultant and/or project manager/Owner representative.

1. Agenda

   a. Safety

   b. Work to be performed

   c. Scheduling

   d. Coordination

   e. Other topics as necessary

2. Attendance

   a. Safety and Security project manager/supervisor shall attend meetings arranged by General Contractor, Owner's representatives, and other parties affected by work of this document.

   b. All individuals who will serve in an on-site supervisory capacity, including project managers, site supervisors, and lead installers, shall be required to attend the pre-installation conference.

   c. Individuals who do not attend the conference will not be permitted to supervise the installation and testing of Safety and Security cables on the project.

1.24 CONTRACT ADMINISTRATION

A The Engineer may perform site visits and provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the client.

B Job Field Report outline:

1. General: The general installation progress in relation to scheduled work made by the Contractor up to that date.

2. Deficiencies and/or Items of Note: Documents observations of the cable installation that may require corrective action by the Contractor.

1.25 POST INSTALLATION MEETINGS

A At the time of substantial completion the contractor shall call and arrange for a post installation meeting to present and review all submittal documents to include but not be limited to As-Built Drawings, Test reports, Warranty paperwork, etc.

B Attendees shall include

a. Safety and Security Contractor

b. Project Manager/Owner Representative

c. General Contractor

d. Safety and Security Engineer.

e. Other trades that the GC deems appropriate.

C At this meeting the Safety and Security Contractor shall present and explain all documentation.

D Any discrepancies or deviations noted by and agreed to by participants shall be remedied by the Safety and Security Contractor and resubmitted within one (1) week of the meeting.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.

2. Alternate equipment must be equal from the standpoint of materials, construction and performance.

3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.02 GENERAL REQUIREMENTS

A All materials and products used on this project shall be listed by Underwriters' Laboratories.

B Equipment and materials shall be standard products of a manufacturer regularly engaged in the manufacture of Safety and Security cabling products and shall be the manufacturer's latest standard design in satisfactory use for at least one year prior to bid opening.

C All material and equipment, as provided, should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products.

1. All shall be typical commercial designs that comply with the requirements specified.

2. All material and equipment shall be readily available through manufacturers and/or distributors.

D Installer is to comply in every way with the requirements of local laws, ordinances, and rules, the National Board of Fire Underwriters, and the National Electrical Code.

E In the event of any conflicts between documents referenced herein and the contents of this specification, the Installer is to notify in writing to the Architect/Engineer of any such occurrences before the purchasing of any equipment, materials and/or installation by the Installer. The Architect/Engineer will notify the Installer of any actions required to resolve these conflicts.

F No change in the plans or in the specifications is to be made without written instruction to do so from the Owner or Architect/Engineer.

G Materials are to be installed in accordance with manufacturer's recommendations and best industry practices.

H The Installer is to promptly correct all discrepancies and/or defects for which the Installer is responsible.

I The Installer is to maintain a set of working specifications and drawings on site at all times and to make this set available for inspection during site visits.

J All materials are to be new and of the highest quality.

K All products installed in the above ceiling space are to meet or exceed the Underwriters Laboratories (UL) fire rated cable insulation requirements and are to be Plenum rated.

L The Installer is to seal ALL penetrations, conduits, sleeves, cable trays, etc., where cabling has been installed through rated walls/floors with Wiremold Flamestopper intumescent fire-stop system (or approved equivalent) where they pass through rated walls. The Installer is responsible for returning any and all penetrations through rated walls or floors made for Safety and Security cable to their pre-penetration rating.

1. All material used to dress cable bundles shall be applied loosely to allow the dressing material to slide around the bundle. Tension of dressing materials shall not deform the cable sheath. Dressing materials should be limited to the Safety and Security rooms only. Cabling shall be placed unbundled in cable tray and/or j hooks in the above ceiling spaces. No bundling materials are to be used above ceiling. All j hooks installed shall include the corresponding clip provided by the hook manufacturer. Plastic cable ties will not be permitted.

M Any discrepancy in the contract documents is to be remedied by the Installer providing and installing the newer, greater quality or quantity of the item or items in question.

N A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.

O Provide nylon bushings for all conduit openings.

P All horizontal cables not in a cable tray or conduit shall be supported at a maximum of 48 to 60 inch intervals. Cable support system is to be independent of supports for other trades. At no point shall cable(s) make contact with acoustic ceiling supports, grids, panels, electrical conduits, water pipes or HVAC ductwork or supports.

Q Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the installer prior to final acceptance at no cost to the Owner.

2.03 ACCESS DOORS

A Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.04 FIRE STOPPING

A Contractor shall restore the fire rating of penetrations to rated walls, ceiling, flooring after cable pulling. Fire stopping products shall be as follows:

1. Hilti
2. SpecSeal
3. 3M
4. Owner approved alternate

2.05 IDENTIFICATION (LABELING) SYSTEM

A Contractor shall label al communications system components installed. Labeling products shall be as follows:

1. Brady (LAT-19-361-4)
2. Dymo
3. Hellerman-Tyton
4. Owner approved alternate

2.06 ESCUTCHEONS

A Provide heavy chrome or nickel-plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.07 SPACE LIMITATIONS

A Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.08 PAINTING

A All factory assembled equipment shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

PART 3 - EXECUTION

3.01 PREPARATION

A Field Measurements

1. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.

B Established Dimensions

1. Where field measurements cannot be made without delaying the work, coordinate with the General Contractor to establish dimensions.

2. When approved in writing, proceed with fabricating units without field measurements.

3. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

C Pre-installation inspection

1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport.

2. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

3.02 DEMOLITION AND REMODELING

A Where only portions of the existing Safety and Security system are to be modified as part of the renovation and addition project, devices related to or part of this system outside of the renovation area shall be kept in operations.

B The Drawings do not show all demolition work required. The Contractor shall make himself familiar with the required scope of work to accomplish the work required by these documents. All demolition work implied or required shall be included in the scope of this contract.

C Utility service outages required by the new installation will be permitted but only at a time approved by the Owner. The Contractor shall allow the Owner two (2) weeks in order to schedule required outages. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including overtime charges, shall be included in the contract amount.

D The contractor shall perform a preconstruction walk thru of the site to observe and test the existing systems for operation. The owner assumes that the system is 100% operational and functioning prior to the commencement of construction. If any portion of the system observed or tested to be non-functional or inoperable at the commencement of the project will be noted by the contractor. A written report will be generated by the contractor noting their findings and submitted to the project team for review and handling. The owner will determine if the items found to be non-functional are to be repaired by contractor or repaired by the owner. If this repair of the equipment found to be non-functional is to be added to the contractor's scope of work the contract amount for the Work shall be adjusted accordingly.

E Work Sequence and Timing. The Owner will cooperate with the Contractor; however, the following provisions must be observed:

1. During the construction of this project, normal facility activities will continue in existing buildings until new buildings or renovated areas are completed. Plumbing, fire protection, lighting, electrical, Safety and Security, heating, air conditioning, and ventilation systems shall be maintained in service within the occupied spaces of the existing building.

2. A meeting will be held at the project site, prior to any construction, between the Owner's Representative, the General Contractor, the Subcontractors and Sub-subcontractors, and the Engineer to discuss Contractor's employee parking space, access, storage of equipment or materials, and use of the Owner's facilities or utilities. The Owner's decisions regarding such matters shall be final.

F In the preparation of these documents every effort has been made to show the approximate locations of, and connections to the existing safety and security devices and headend equipment. However, this Contractor shall be responsible for verifying all of the above information. This Contractor shall visit the existing site to inspect the facilities and related areas. This Contractor shall inspect and verify all details and requirements of all the Contract Documents, prior to the submission of a proposal. All discrepancies between the Contract Documents and actual job-site conditions shall be resolved by the contractor, who shall produce drawings which shall be submitted to the Architect/Engineer for review. All labor and materials required to perform the work described shall be a part of this Contract.

G All equipment and/or systems noted on the Drawings "To Remain" shall be inspected and tested on site to certify its working condition. A written report on the condition of all equipment to remain, including a copy of the test results and recommended remedial actions and costs shall be made by this Contractor to the Architect/Engineer for review.

H All equipment and/or systems noted on the Drawings "To Be Removed" should be removed including, associated pipe and duct, pipe and duct hangers and/or line supports. Where duct or pipe is to be capped for future or end of line use, it shall be properly tagged with its function or service appropriately identified. Where existing equipment is to be removed or relocated and has an electric motor or connection, the Electrical Contractor shall disconnect motor or connection, remove wiring to a safe point and this Contractor shall remove or relocate motor or connection along with the equipment.

I During construction and remodeling, portions of the Project shall remain in service. Construction equipment, material, tools, extension cords, etc., shall be arranged so as to present minimum hazard or interruption to the occupants of the building. None of the construction work shall interfere with the proper operation of the existing facility; or be so conducted as to cause harm or danger to persons on the premises. All fire exits, stairs or corridors required for proper access, circulation or exit shall remain clear of equipment, materials or debris. The General Contractor shall maintain barricades, other separations in corridors and other spaces where work is conducted.

J Certain work during the demolition and construction phases may require overtime or night time shifts or temporary evacuation of the occupants. Coordinate and schedule all proposed down time with the Owner at least seventy-two (72) hours in advance in writing.

K Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately.

L Equipment, piping or other potential hazards to the occupants of the building shall not be left overnight outside of the designated working or construction area.

M Make every effort to minimize damage to the existing building and the Owner's property. Repair, patch or replace as required any damage which occurs as a result of work at the site. Care shall be taken to minimize interference with the Owner's activities during construction and to keep construction disrupted areas to a minimum. Coordinate with the Owner and other trades in scheduling and performance of the work.

N When applicable, Include in the contract price all rerouting of existing backbone cabling, , etc., and the reconnecting of the existing equipment as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the drawings. Furnish all temporary pipe, duct, controls, etc., as required to maintain heating, cooling, and ventilation services for the existing Safety and Security rooms in areas scheduled to remain operational with a minimum of interruption.

O All existing cabling, equipment, controls and appurtenances not included in the remodel or alteration areas are to remain in place.

P Cabling and equipment serving Safety and Security system which is to remain but which is served by pipe, duct, equipment and controls that are disturbed by the remodeling work, shall be reconnected in such a manner as to leave this equipment in proper operating condition.

Q It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and operating system in cooperation with other trades with a minimum of disruption or downtime.

R Refer to Architectural Demolition and/or Alteration plans for actual location of walls, ceilings, etc., being removed and/or remodeled.

S Field verify measurements, and cabling arrangements are as shown on Drawings.

T Verify that scheduled cabling and equipment serving only those abandoned devices to be demolished and removed in its entirety.

U Demolition Drawings are based on casual field observation and existing Record Documents. Report discrepancies to Architect and Engineer before disturbing existing installation.

V Beginning of demolition means that the contractor accepts existing conditions.

W Demolish and extend existing Safety and Security work under provisions of Division 02 and this Section.

X Remove, relocate, and extend existing systems to accommodate new construction.

Y Remove abandoned cabling to source of origination point. Remove racks and other equipment as scheduled on the drawings.

Z Remove exposed / abandoned cabling systems, including abandoned systems above accessible ceiling finishes. Cut systems flush with walls and floors, and patch surfaces.

AA Repair adjacent construction and finishes damaged during demolition and extension work.

BB Maintain access to existing systems which remain active. Modify installation or provide access doors as appropriate.

CC Extend existing systems using materials and methods compatible with existing systems, or as specified.

DD Clean and repair existing materials and equipment which remain or are to be reused. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operating condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

EE All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

FF When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

GG Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

HH The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all electrical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

II Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

JJ Where partitions, walls, floors, or ceilings of existing construction are being removed, all contractors shall remove and reinstall in locations approved by the Architect all devices required for the operation of the various systems installed in the existing construction.

3.03 INSTALLATION

A General

1. Contractor shall install work in accordance with specifications, drawings, manufacturer’s instructions and approved submittal data.

B Allowable cable bend radius and pull tension:

1. Refer to cable manufacturer's bend radius recommendations for the maximum allowable limits.

2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.

C Pull Strings

1. Provide pull strings in all new conduits, including all conduits with cable installed (trailer strings) as part of this contract.

2. Data and video cables can be pulled in tandem with pull strings.

3. The pull strings must move freely to prevent cable jacket/cable damage during pulls.

3.04 EXCAVATING AND BACKFILLING

A Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.05 WORKMANSHIP AND CONCEALMENT

A The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of Electronic Safety and Security work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.

2. Where exposure is necessary to the proper function.

3.06 SLEEVES, CUTTING AND PATCHING

A This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C All un-used sleeves shall be sealed with 2-hour UL approved fire sealant manufactured by "3M" or approved equal.

3.07 LABELING

A Cable labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

B Flat-surface labels: Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.

C Provide transparent plastic label holders, and 4-pair marked colored labels.

D In accordance with ANSI/TIA-606-B "Administration Standard for Commercial Telecommunications Infrastructure":

1. Install colored labels according to the type of field as per color code designations.

2. Use “designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields”.

E Pathway Labels and Labeling System

1. Labeling system shall consist of a hand-held portable printer

2. Conduits: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive. Label size shall be appropriate for the conduit size. Font size shall be legible from the finished floor.

3. Inner duct: Polyethylene general-purpose tagging material attached using tie wraps.

4. Junction boxes: General-purpose label designed for powdered coated surfaces with an ultra-aggressive adhesive, trade name. Font size shall be easily visible from the finished floor.

5. All labels shall be permanent, i.e. will not fade, peel, or deteriorate due to environment or time.

6. Identification

a. All conduits, junction boxes, gutters, and pull boxes shall have machine-generated labels easily visible from the finished floor.

b. Conduits shall be labeled with the word “Security” and the conduit’s origination room number and destination room number.

c. The Contractor shall label conduit at each wall and floor penetration and at each conduit termination, such as outlet boxes, pull boxes, and junction boxes, or as otherwise specified in other sections.

d. Junction boxes, gutters and pull boxes shall be labeled with identification name or number as determined by contractor and submitted for approval.

e. The Contractor shall label conduit sleeves at each wall and floor penetration.

3.08 FIRESTOPPING

A Provide approved fire-resistant materials to restore originally-designed fire-ratings to all wall, floor, and ceiling penetrations used in the distribution and installation for Safety and Security cabling system.

B Install and seal penetrations (conduit, sleeves, slots, chases) in fire-rated barriers created for Safety and Security infrastructure to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.

C The firestopping material shall maintain/establish the fire-rated integrity of the wall/barrier that has been penetrated.

D All through penetrations in a fire rated surface require a sleeve, regardless of penetration diameter or penetrating cable count.

E Using a “ring and string” method of installing cabling for membrane penetrations in a wall cavity is acceptable, provided the solution was accepted by the Owner in writing. Code-compliant firestopping rules still apply.

F Coordinate firestopping procedures and materials with General Contractor.

G Sharing the pathway of other trades/utilities through compliant and non-compliant penetrations does not remove the requirement to maintain code-compliant firestopping.

H Provide and install removable, intumescent mechanical systems in floor chases for all openings greater than 0’-4”.

I Provide and install removable, intumescent, firestop bricks for all openings greater than 0’-4” where there are penetrations through walls.

J Bricks shall be listed for insertion in fire-rated openings and require restraining materials or apparatus as needed per manufacturers’ specifications.

K Provide manufacturer recommended material for rated protection for any given barrier.

L Laminate and permanently affix adjacent to chases the following information:

1. Manufacturer of firestop system.
2. Date of installation/repair.
3. Part and model numbers of system and all components.
4. Name and phone numbers of local distributor and manufacturer’s corporate headquarters.

M Solutions and shop drawings/submittals for firestop materials and systems shall be presented to the General Contractor for written approval of materials/systems prior to purchase and installation.

N Materials shall be installed per manufacturer instructions, be UL-listed for intended use, and meet NEC and locals codes for fire stopping measures.

O The material chosen shall be distinctively colored to be clearly distinguishable from other materials, adhere to itself, and maintain the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.

P Develop training manuals with instructions on methods of adding or removing cabling to/from firestopped sleeves and chases.

Q Within the normal environment, the installed systems shall not generate nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.

R Expansion Capability: Unless otherwise indicated, provide spare conductor pairs in cables, positions in patch panels, cross connects, and terminal strips, and space in cable pathways and backboard layouts to accommodate 20% future increase in structure cable system capacity.

S In the event of a breach of the representations and warranties contained herein, the Contractor, at their own expense, shall take all measures necessary to make the cabling system work and comply with the applicable manufacturer written technical recommendations and standards.

3.09 WALL MOUNTED EQUIPMENT

A Install all wall mounted equipment in accordance with the National Electrical Code, industry standards and as shown on the drawings.

B Unless noted otherwise, all wall mounted equipment that need to be accessed for operation or maintenance shall be mounted at a working height not requiring a ladder when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices(note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.10 CLEANING

A The Contractor will clean all surfaces of equipment and devices prior to final acceptance by Owner.

3.11 CORROSIVE AREAS

A In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4 X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.12 TESTS AND INSPECTIONS

A Tests and inspection requirements shall be coordinated with Division I.

B Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D Put circuits and equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E Final Inspection:

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.

2. All devices, equipment, and equipment cabinets/enclosure shall be cleaned and in operating condition.

3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.

4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.

5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

3.13 ACCEPTANCE

A Once all work has been completed, test documentation has been submitted, and Owner is satisfied that all work is in accordance with contract documents, the Owner shall notify Contractor in writing of formal acceptance of the system.

B Contractor must warrant in writing that 100% of the installation meets the requirements specified herein (Standards Compliance & Test Requirements).

C Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and receipt of full documentation soft and hard copies as described herein.

END OF SECTION 28 02 00

SECTION 28 05 00 - BASIC MATERIALS AND METHODS FOR FIRE ALARM

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A The requirements of the General Conditions and Supplementary Conditions apply to all Work herein.

B The Contract Drawings indicate the extent and general arrangement of the systems. If any departure from the Contract Drawings are deemed necessary by the Contractor, details of such departures and the reasons, therefore, shall be submitted to the Architect for approval as soon as practicable. No such departures shall be made without the prior written approval of the Architect.

1.02 SCOPE OF WORK

A The Work included under this Contract consists of the furnishing and installation of all equipment and material necessary and required to form the complete and functioning systems in all of its various phases, all as shown on the accompanying Drawings and/or described in these Specifications. The contractor shall review all pertinent drawings, including those of other contracts prior to commencement of Work.

B This Division requires the furnishing and installing of all items Specified herein, indicated on the Drawings or reasonably inferred as necessary for safe and proper operation; including every article, device or accessory (whether or not specifically called for by item) reasonably necessary to facilitate each system's functioning as indicated by the design and the equipment specified. Elements of the work include, but are not limited to, materials, labor, supervision, transportation, storage, equipment, utilities, all required permits, licenses and inspections. All work performed under this Section shall be in accordance with the Project Manual, Drawings and Specifications and is subject to the terms and conditions of the Contract.

C The approximate locations of Electrical items are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of outlets, apparatus, etc. Exact locations are to be determined by actual measurements at the building, and will in all cases be subject to the Review of the Owner or Engineer, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

D Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

E All discrepancies within the Contract Documents discrepancies between the Contract Documents and actual job-site conditions shall be reported to the Owner or Engineer so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or more costly of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

F It is the intention of this Section of the Specifications to outline minimum requirements to furnish the Owner with a turn-key and fully operating system in cooperation with other trades.

G It is the intent of the above "Scope" to give the Contractor a general outline of the extent of the Work involved; however, it is not intended to include each, and every item required for the Work. Anything omitted from the "Scope" but shown on the Drawings, or specified later, or necessary for a complete and functioning heating, ventilating and air conditioning system shall be considered a part of the overall "Scope".

H The Contractor shall rough-in fixtures and equipment furnished by others from rough-in and placement drawings furnished by others. The Contractor shall make final connection to fixtures and equipment furnished by others.

I Contractor shall participate in the commissioning process; including but not limited to meeting attendance, completion of checklists and participation in functional testing.

J Refer to 260313 for demolitions requirements.

1.03 RELATED SECTIONS

A General Conditions

B Supplementary Conditions

C Division One

1.04 COOPERATION WITH TRADES

A Cooperation with trades of adjacent, related, or affected materials or operations shall be considered a part of this work in order to affect timely and accurate placing of work and bring together in proper and correct sequence, the work of such trades.

1.05 REFERENCES

A National Electrical Code (NEC)

B American Society for Testing and Materials (ASTM)

C Underwriter's Laboratories, Inc. (UL)

D Insulated Cable Engineer's Association (ICEA)

E National Electrical Manufacturer's Association (NEMA)

F Institute of Electrical and Electronics' Engineers (IEEE)

G American National Standards Institute (ANSI)

H National Fire Protection Association (NFPA)

I International Energy Conservation Code (IECC)

1.06 COMPLETE FUNCTIONING OF WORK

A All work fairly implied as essential to the complete functioning of the electrical systems shown on the Drawings and Specifications shall be completed as part of the work of this Division unless specifically stated otherwise. It is the intention of the Drawings and Specifications to establish the types of the systems, but not set forth each item essential to the functioning of the system. In case of doubt as to the work intended, or in the event of amplification or clarification thereof, the Contractor shall call upon the Architect for supplementary instructions, Drawings, etc.

B Contractor shall review all pertinent Drawings and adjust his work to all conditions shown there on. Discrepancies between Plans, Specifications, and actual field conditions shall be brought to the prompt attention of the Architect.

1. Approximate location of transformers, feeders, branch circuits, outlets, lighting and power panels, outlets for special systems, etc., are indicated on the Drawings. However, the Drawings, do not give complete and accurate detailed locations of such outlets, conduit runs, etc., and exact locations must be determined by actual field measurement. Such locations will, at all times, be subject to the approval of the Architect.

2. Communicate with the Architect and secure his approval of any outlet (light fixture, receptacle, switch, etc.) location about which there may be the least question. Outlets obviously placed in a location not suitable to the finished room or without specific approval, shall be removed and relocated when so directed by the Architect. Location of light fixtures shall be coordinated with reflected ceiling plans.

C Additional coordination with mechanical contractor may be required to allow adequate clearances of mechanical equipment, fixtures and associated appurtenances. Contractor to notify Architect and Engineer of unresolved clearances, conflicts or equipment locations.

1.07 SCHEMATIC NATURE OF CONTRACT DOCUMENTS

A The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the approved shop drawings.

1.08 CONTRACTOR'S QUALIFICATIONS

A An approved contractor for the work under this division shall be:

a. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.

b. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

c. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. Onsite supervision, journeyman shall have minimum of journeyman license. Helpers, apprentices shall have minimum of apprentice license.

1.09 DATE OF FINAL ACCEPTANCE

A The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division One for additional requirements.

B The date of final acceptance shall be documented in writing and signed by the architect, owner and contractor.

1.10 DEFINITIONS AND SYMBOLS

A General Explanation: A substantial amount of construction and Specification language constitutes definitions for terms found in other Contract Documents, including Drawings which must be recognized as diagrammatic and schematic in nature and not completely descriptive of requirements indicated thereon. Certain terms used in Contract Documents are defined generally in this article, unless defined otherwise in Division 1.

B Definitions and explanations of this Section are not necessarily either complete or exclusive but are general for work to the extent not stated more explicitly in another provision of the Contract Documents.

C Indicated: The term "Indicated" is a cross-reference to details, notes or schedules on the Drawings, to other paragraphs or schedules in the Specifications and to similar means of recording requirements in Contract Documents. Where such terms as "Shown", "Noted", "Scheduled", "Specified" and "Detailed" are used in lieu of "Indicated", it is for the purpose of helping the reader locate cross-reference material, and no limitation of location is intended except as specifically shown.

D Directed: Where not otherwise explained, terms such as "Directed", "Requested", "Accepted", and "Permitted" mean by the Architect or Engineer. However, no such implied meaning will be interpreted to extend the Architect's or Engineer's responsibility into the Contractor's area of construction supervision.

E Reviewed: Where used in conjunction with the Engineer's response to submittals, requests for information, applications, inquiries, reports and claims by the Contractor the meaning of the term "Reviewed" will be held to limitations of Architect's and Engineer's responsibilities and duties as specified in the General and Supplemental Conditions. In no case will "Reviewed" by Engineer be interpreted as a release of the Contractor from responsibility to fulfill the terms and requirements of the Contract Documents.

F Furnish: Except as otherwise defined in greater detail, the term "Furnish" is used to mean supply and deliver to the project site, ready for unloading, unpacking, assembly, installation, etc., as applicable in each instance.

G Install: Except as otherwise defined in greater detail, the term "Install" is used to describe operations at the project site including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance.

H Provide: Except as otherwise defined in greater detail, the term "Provide" is used to mean "Furnish and Install", complete and ready for intended use, as applicable in each instance.

I Installer: Entity (person or firm) engaged by the Contractor or its subcontractor or Sub-contractor for performance of a particular unit of work at the project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protection, cleaning and similar operations, as applicable in each instance. It is a general requirement that such entities (Installers) be expert in the operations they are engaged to perform.

J Imperative Language: Used generally in Specifications. Except as otherwise indicated, requirements expressed imperatively are to be performed by the Contractor. For clarity of reading at certain locations, contrasting subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or when so noted by other identified installers or entities.

K Minimum Quality/Quantity: In every instance, the quality level or quantity shown or specified is intended as minimum quality level or quantity of work to be performed or provided. Except as otherwise specifically indicated, the actual work may either comply exactly with that minimum (within specified tolerances) or may exceed that minimum within reasonable tolerance limits. In complying with requirements, indicated or scheduled numeric values are either minimums or maximums as noted or as appropriate for the context of the requirements. Refer instances of uncertainty to Owner or Engineer via a request for information (RFI) for decision before proceeding.

L Abbreviations and Symbols: The language of Specifications and other Contract Documents including Drawings is of an abbreviated type in certain instances and implies words and meanings which will be appropriately interpreted. Actual word abbreviations of a self-explanatory nature have been included in text of Specifications and Drawings. Specific abbreviations and symbols have been established, principally for lengthy technical terminology and primarily in conjunction with coordination of Specification requirements with notations on Drawings and in Schedules. These are frequently defined in Section at first instance of use or on a Legend and Symbol Drawing. Trade and industry association names and titles of generally recognized industry standards are frequently abbreviated. Singular words will be interpreted as plural and plural words will be interpreted as singular where applicable and where full context of Contract Documents so indicate. Except as otherwise indicated, graphic symbols and abbreviations used on Drawings and in Specifications are those recognized in construction industry for indicated purposes. Where not otherwise noted symbols and abbreviations are defined by ASHRAE Fundamentals Handbook, chapter 39 "Abbreviations and Symbols", ASME and ASPE published standards.

1.11 DELIVERY, STORAGE, AND HANDLING

A Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B Deliver products to the project at such time as the project is ready to receive the equipment, pipe or duct properly protected from incidental damage and weather damage.

C Damaged equipment shall be promptly removed from the site and new, undamaged equipment shall be installed in its place promptly with no additional charge to the Owner.

1.12 SUBMITTALS

A Coordinate with Division 01 for submittal timetable requirements, unless noted otherwise within thirty (30) days after the Contract is awarded. The Contractor shall submit an electronic copy of a complete set of shop drawings and complete data covering each item of equipment or material. The submittal of each item requiring a submittal must be received by the Architect or Engineer within the above thirty day period. The Architect or Engineer shall not be responsible for any delays or costs incurred due to excessive shop drawing review time for submittals received after the thirty (30) day time limit. The Architect and Engineer will retain a copy of all shop drawings for their files. All literature pertaining to items subject to Shop Drawing submittal shall be submitted at one time. Submittals shall be placed in one electronic file in PDF 8.0 format and bookmarked for individual specification sections. Individual electronic files of submittals for individual specifications shall not be permitted. Each submittal shall include the following items:

1. A cover sheet with the names and addresses of the Project, Architect, MEP Engineer, General Contractor and the Subcontractor making the submittal. The cover sheet shall also contain the section number covering the item or items submitted and the item nomenclature or description.

2. An index page with a listing of all data included in the Submittal.

3. A list of variations page with a listing all variations, including unfurnished or additional required accessories, items or other features, between the submitted equipment and the specified equipment. If there are no variations, then this page shall state "NO VARIATIONS". Where variations affect the work of other Contractors, then the Contractor shall certify on this page that these variations have been fully coordinated with the affected Contractors and that all expenses associated with the variations will be paid by the submitting Contractor. This page will be signed by the submitting Contractor.

4. Equipment information including manufacturer's name and designation, size, performance and capacity data as applicable. All applicable Listings, Labels, Approvals and Standards shall be clearly indicated.

5. Dimensional data and scaled drawings as applicable to show that the submitted equipment will fit the space available with all required Code and maintenance clearances clearly indicated and labeled at a minimum scale of 1/4" = 1'-0", as required to demonstrate that the alternate or substituted product will fit in the space available.

6. Identification of each item of material or equipment matching that indicated on the Drawings.

7. Sufficient pictorial, descriptive and diagrammatic data on each item to show its conformance with the Drawings and Specifications. Any options or special requirements or accessories shall be so indicated. All applicable information shall be clearly indicated with arrows or another approved method.

8. Additional information as required in other Sections of this Division.

9. Certification by the General Contractor and Subcontractor that the material submitted is in accordance with the Drawings and Specifications, signed and dated in long hand. Submittals that do not comply with the above requirements shall be returned to the Contractor and shall be marked "REVISE AND RESUBMIT".

B Refer to Division 1 for additional information on shop drawings and submittals.

C Equipment and materials submittals and shop drawings will be reviewed for compliance with design concept only. It will be assumed that the submitting Contractor has verified that all items submitted can be installed in the space allotted. Review of shop drawings and submittals shall not be considered as a verification or guarantee of measurements or building conditions.

D Where shop drawings and submittals are marked "REVIEWED", the review of the submittal does not indicate that submittals have been checked in detail nor does it in any way relieve the Contractor from his responsibility to furnish material and perform work as required by the Contract Documents.

E Shop drawings shall be reviewed and returned to the Contractor with one of the following categories indicated:

1. REVIEWED: Contractor need take no further submittal action, shall include this submittal in the O&M manual and may order the equipment submitted on.

2. REVIEWED AS NOTED: Contractor shall submit a letter verifying that required exceptions to the submittal have been received and complied with including additional accessories or coordination action as noted, and shall include this submittal and compliance letter in the O&M manual. The contractor may order the equipment submitted on at the time of the returned submittal providing the Contractor complies with the exceptions noted.

3. and/or drawings. Contractor shall not order equipment that is not approved. Repetitive requests for substitutions will not be considered.

4. REVISE AND RESUBMIT: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked revise and resubmit, the Contractor will automatically be required to furnish the product, material or method named in the Specifications and/or provide as noted on previous shop drawings. Contractor shall not order equipment marked revise and resubmit. Repetitive requests for substitutions will not be considered.

5. CONTRACTOR'S CERTIFICATION REQUIRED: Contractor shall resubmit submittal on material, equipment or method of installation. The Contractor's stamp is required stating the submittal meets all conditions of the contract documents. The stamp shall be signed by the General Contractor. The submittal will not be reviewed if the stamp is not placed and signed on all shop drawings.

6. MANUFACTURER NOT AS SPECIFIED: Contractor shall resubmit new submittal on material, equipment or method of installation when the alternate or substitute is marked manufacturer not as specified, the Contractor will automatically be required to furnish the product, material or method named in the specifications. Contractor shall not order equipment where submittal is marked manufacturer not as specified. Repetitive requests for substitutions will not be considered.

F Materials and equipment which are purchased or installed without shop drawing review shall be at the risk of the Contractor and the cost for removal and replacement of such materials and equipment and related work which is judged unsatisfactory by the Owner or Engineer for any reason shall be at the expense of the Contractor. The responsible Contractor shall remove the material and equipment noted above and replace with specified equipment or material at his own expense when directed in writing by the Architect or Engineer.

G Shop Drawing Submittals shall be complete and checked prior to submission to the Engineer for review.

H Furnish detailed shop drawings, descriptive literature, physical data and a specification critique for each section indicating "compliance" and/or "variations" for the following items:

1. Fire Alarm System

2. Intrusion System

I Refer to each specification section for additional requirements.

1.13 OPERATION AND MAINTENANCE MANUALS

A Prepare maintenance manuals in accordance with Division 1 and in addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

1.14 COORDINATION DRAWINGS

A Prepare coordination drawings to a scale of 1/4"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of pipe, duct, equipment, and other materials. Include the following:

   a. Wall and type locations.

   b. Clearances for installing and maintaining insulation.

   c. Locations of light fixtures and sprinkler heads.

   d. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.

   e. Equipment connections and support details.

   f. Exterior wall and foundation penetrations.

   g. Routing of storm and sanitary sewer piping.

   h. Fire-rated wall and floor penetrations.

   i. Sizes and location of required concrete pads and bases.

   j. Valve stem movement.

   k. Structural floor, wall and roof opening sizes and details.

2. Indicate scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Prepare reflected ceiling plans to coordinate and integrate installations, air distribution devices, light fixtures, communication systems components, and other ceiling-mounted items.

B This Contractor shall be responsible for coordination of all items that will affect the installation of the work of this Division. This coordination shall include, but not be limited to: voltage, ampacity, capacity, electrical and piping connections, space requirements, sequence of construction, building requirements and special conditions.

C By submitting shop drawings on the project, this Contractor is indicating that all necessary coordination has been completed and that the systems, products and equipment submitted can be installed in the building and will operate as specified and intended, in full coordination with all other Contractors and Subcontractors.

1.15 RECORD DRAWINGS

A Prepare Record Documents in accordance with the requirements of Division 00 and Division 01, in addition to the requirements specified in Division 26 and Division 28.

B The Contractor shall maintain a separate set of clearly and legibly marked Record Drawings on the job site to record all changes and modifications, including, but not limited to the following: work details, alterations to meet site conditions, and changes made by "Change Order" notices. Mark the drawings with colored pencil(s). These shall be available for review by the Owner, Architect or Engineer during the entire construction stage.

C The Record Drawings shall be updated concurrently as construction progresses, and in no case less frequently than a daily basis. They shall indicate accurate dimensions for all buried or concealed work, precise locations of all concealed pipe or duct, locations of all concealed valves, controls and devices and any deviations from the work shown on the Construction Documents. All dimensions shall include at least two dimensions to permanent structure points.

D Engage the services of a Land Surveyor or Professional Engineer registered in the state in which the project is located as specified herein to record the locations and invert elevations of underground installations.

E If the Contractor does not keep an accurate set of Record Drawings, the pay request may be altered or delayed at the request of the Architect. Delivery of Record Documents is a condition of final acceptance. Record Drawings shall be furnished in addition to Shop Drawings.

F The Contractor shall submit an electronic copy of the record documents in PDF format and one (1) full size set of Record Drawing prints to the Architect or Engineer for review prior to scheduling the final inspection at the completion of the work. The drawings shall have the name(s) and seal(s) of the Engineer(s) removed or blanked out and shall be clearly marked and signed on each sheet as follows:

CERTIFIED RECORD DRAWINGS

DATE:

(NAME OF GENERAL CONTRACTOR)

BY:_____

(SIGNATURE)

(NAME OF SUBCONTRACTOR)

BY:_____

(SIGNATURE)

1.16 CERTIFICATIONS AND TEST REPORTS

A Submit a detailed schedule for completion and testing of each system indicating scheduled dates for completion of system installation and outlining tests to be performed and schedule date for each test. This detailed completion and test schedule shall be submittal at least 90 days before the projected Project completion date.

B Test result reporting forms shall be submitted for review no later than the date of the detailed schedule submitted.

C Submit 4 copies of all certifications and test reports to the Architect or Engineer for review adequately in advance of completion of the Work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

D Certifications and test reports to be submitted shall include, but not be limited to those items outlined in Section of Division 26.

1.17 MAINTENANCE MANUALS

A Coordinate with Division 1 for maintenance manual requirements, unless noted otherwise bind together in "D ring type" binders by National model no. 79-883 or equal, binders shall be large enough to allow ¼" of spare capacity. Three (3) sets of all approved shop drawing submittals, fabrication drawings, bulletins, maintenance instructions, operating instructions and parts exploded views and lists for each and every piece of equipment furnished under this Specification. All sections shall be typed and indexed into sections and labeled for easy reference and shall utilize the individual specification section numbers shown in the Electrical Specifications as an organization guideline. Bulletins containing information about equipment that is not installed on the project shall be properly marked up or stripped and reassembled. All pertinent information required by the Owner for proper operation and maintenance of equipment supplied by Division 26 shall be clearly and legibly set forth in memoranda that shall, likewise, be bound with bulletins.

B Prepare maintenance manuals in accordance with Special Project Conditions, in addition to the requirements specified in Division 26 and Division 2, include the following information for equipment items:

1. Identifying names, name tags designations and locations for all equipment.
2. Reviewed shop drawing submittals with exceptions noted compliance letter.
3. Fabrication drawings.
4. Equipment and device bulletins and data sheets clearly highlighted to show equipment installed on the project and including performance curves and data as applicable, i.e., description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and model numbers of replacement parts.
5. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
6. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions, servicing instructions and lubrication charts and schedules.
7. Equipment name plate data.
8. Wiring diagrams.
9. Exploded parts views and parts lists for all equipment and devices.
10. Color coding charts for all painted equipment and conduit.
11. Location and listing of all spare parts and special keys and tools furnished to the Owner.

12. Furnish recommended lubrication schedule for all required lubrication points with listing of type and approximate amount of lubricant required.

C Refer to Division 1 for additional information on Operating and Maintenance Manuals.

D Operating and Maintenance Manuals shall be turned over to the Owner or Engineer a minimum of 14 working days prior to the beginning of the operator training period.

1.18 OPERATOR TRAINING

A The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include 12 hours of onsite training in three 4 hour shifts.

B Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

C Refer to other Division 26 Sections for additional Operator Training requirements.

1.19 SITE VISITATION

A Visit the site of the proposed construction in order to fully understand the facilities, difficulties and restriction attending the execution of the work.

B Before submitting a bid, it will be necessary for each Contractor whose work is involved to visit the site and ascertain for himself the conditions to be met therein in installing his work and make due provision for same in his bid. It will be assumed that this Contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install the equipment shown. Failure on the part of the Contractor to comply with this requirement shall not be considered justification for the omission or faulty installation of any work covered by these Specifications and Drawings.

C Understand the existing utilities from which services will be supplied; verify locations of utility services and determine requirements for connections.

D Determine in advance that equipment and materials proposed for installation fit into the confines indicated.

1.20 WARRANTY

A The undertaking of the work described in this Division shall be considered equivalent to the issuance, as part of this work, of a specific guarantee extending one year beyond the date of completion of work and acceptance by Owner, against defects in materials and workmanship. Materials, appliances and labor necessary to effect repairs and replacement so as to maintain said work in good functioning order shall be provided as required. Replacements necessitated by normal wear in use or by Owner's abuse are not included under this guarantee.

B All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, freight/shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service call required to diagnose warranty problems.

1.21 TRANSFER OF ELECTRONIC FILES

A Project documents are not intended or represented to be suitable for reuse by Architect/Owner or others on extensions of this project or on any other project. Any such reuse or modification without written verification or adaptation by Engineer, as appropriate for the specific purpose intended, will be at Architect/Owner's risk and without liability or legal exposure to Engineer or its consultants from all claims, damages, losses and expense, including attorney's fees arising out of or resulting thereof.

B Because data stored in electric media format can deteriorate or be modified inadvertently, or otherwise without authorization of the data's creator, the party receiving the electronic files agrees that it will perform acceptance tests or procedures within sixty (60) days of receipt, after which time the receiving party shall be deemed to have accepted the data thus transferred to be acceptable. Any errors detected within the sixty (60) day acceptance period will be corrected by the party delivering the electronic files. Engineer is not responsible for maintaining documents stored in electronic media format after acceptance by the Architect/Owner.

C When transferring documents in electronic media format, Engineer makes no representations as to the long term compatibility, usability or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by Engineer at the beginning of the Project.

D Any reuse or modifications will be Contractor's sole risk and without liability or legal exposure to Architect, Engineer or any consultant.

E The Texas Board of Architectural Examiners (TBAE) has stated that it is in violation of Texas law for persons other than the Architect of record to revise the Architectural drawings without the Architect's written consent.

1. It is agreed that "MEP" hard copy or computer-generated documents will not be issued to any other party except directly to the Architect/Owner. The contract documents are contractually copyrighted and cannot be used for any other project or purpose except as specifically indicated in AIA B-141 Standard Form of Agreement Between Architect and Owner.

2. If the client, Architect or Owner of the project requires electronic media for "record purposes", then AutoCAD/ Revit documents will be prepared by Engineer on electronic media such as removable memory devices, flash drives or CD's. These documents can also be submitted via file transfer protocols. AutoCAD/ Revit files will be submitted with all title block references intact to permit the end user to only view and plot the drawings. Revisions will not be permitted in this configuration.

3. At the Architect/Owner's request, Engineer will assist the Contractor in the preparation of the submittals and prepare one copy of AutoCAD/ Revit files on electronic media or submit through file transfer protocols. The electronic media will be prepared with all indicia of documents ownership removed. The electronic media will be prepared in a ".rvt" or ".dwg" format to permit the end user to revise the drawings.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A The names and manufacturers and model numbers have been used in the Contract documents to establish types of equipment and standards of quality. Where more than one manufacturer is named for a specific item of equipment, only one of the specified manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer for consideration, provided the following conditions are met:

1. Submit alternate equipment with complete descriptive data in shop drawing form. Provide sample of equipment upon request for review by Architect. Samples will be returned if requested in writing.

2. Alternate equipment must be equal from the standpoint of materials, construction and performance.

3. Alternate submittal must be presented to the Engineer/Architect ten (10) days prior to bid date for approval.

B The Architect and Engineer shall be the sole judge of quality and equivalence of equipment, materials and methods.

2.02 UL LISTING

A All materials and products used on this project shall be listed by Underwriters' Laboratories.

2.03 ACCESS DOORS

A Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:

1. Plaster Surfaces: Milcor Style K.

2. Ceramic Tile Surfaces: Milcor Style M.

3. Drywall Surfaces: Milcor Style DW.

4. Install panels only in locations approved by the Architect.

2.04 ESCUTCHEONS

A Provide heavy chrome or nickel plated plates, of approved pattern, on conduit passing through walls, floors and ceilings in finished areas. Where conduit passes through a sleeve, no point of the conduit shall touch the building construction. Caulk around such conduit with sufficient layers of two hour rated firesafing by Thermafiber 4.0 P.C.F. density, U.S.G. fire test 4/11/78 and seal off openings between conduit and sleeves with non-hardening mastic prior to application of escutcheon plate. Escutcheons shall be Gravler Sure-Lock, or approved equal.

2.05 SPACE LIMITATIONS

A Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with Code requirements. Physical dimensions and arrangement of equipment shall be subject to the approval of the Architect.

2.06 PAINTING

A All factory assembled equipment for electrical work, except light fixtures, that normally is delivered with a factory applied finish shall be delivered with a hard surface factory applied finish such as baked-on machinery enamel which will not require additional field painting. The finish shall consist of not less than 2 coats of medium gray color paint USA No. 61 Munsell Notation 8-3G, 6. 10/0.54 enamel. This Contractor shall protect this finish from damage due to construction operations until acceptance of the building. He shall be responsible for satisfactorily restoring any such finishes or replacing equipment that becomes stained or damaged.

2.07 RACEWAY IDENTIFICATION

A Conduit Systems: Provide adequate marking of major conduit which is exposed or concealed in accessible spaces to distinguish each run as either a power or signal/communication conduit. Use red banding with black lettering except as otherwise indicated. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, on pull boxes, on junction boxes and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction and at spacings of not more than 50 feet along each run of conduit.

B Underground Cable Identification: Bury a continuous, preprinted, bright colored plastic ribbon cable marker with each underground cable (or group of cables), regardless of whether conductors are in conduit, duct bank, or direct buried. Locate each directly over cables, 6 to 8 inches below finished grade.

C Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Care shall be taken not to obliterate this nameplate in any way.

2. Prohibited Markings: Markings which are intended to identify the manufacturer, vendor, or other source from which the material has been obtained are prohibited for installation within public, tenant, or common areas within the project. Also, prohibited are materials or devices which bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters' Laboratories, Inc.), and approval labels are exceptions to this requirement.

3. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of facilities. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with recognized industry standards for color and design.

4. Operational Tags: Where needed for proper and adequate information on operation and maintenance of electrical system, provide tags of plasticized card stock, either preprinted or hand printed.

PART 3 - EXECUTION

3.01 EXCAVATING AND BACKFILLING

A Trenching and backfilling and other earthwork operations required to install the facilities specified herein shall conform to the applicable requirements of Division 2 (95% of maximum standard density). Where trenching or excavation is required in improved areas, the backfill shall be compacted to a condition equal to that of adjacent undisturbed earth and the surface of the area restored to the condition existing prior to trenching or excavating operations. Provide a minimum of 3" of sand underneath all conduits. The plans indicate information pertaining to surface and sub-surface obstructions; however, this information is not guaranteed. Should obstructions be encountered whether or not shown, the Contractor shall alter routing of new work, reroute existing lines, remove obstructions where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of new work and leave existing surfaces and structures in a satisfactory and serviceable condition. All work shall comply with OSHA Standards.

3.02 WORKMANSHIP AND CONCEALMENT

A The work of this Section shall be performed by workman skilled in their trade. Installation shall be consistent in completeness whether concealed or exposed. Each item of electrical work shall be concealed in walls, chases, under floors and above ceilings except:

1. Where shown to be exposed.

2. Where exposure is necessary to the proper function.

3.03 SLEEVES, CUTTING AND PATCHING

A This section shall be responsible for placing sleeves for all conduit passing through walls, partitions, sound walls, beams, floors, roof, etc. Sleeves through below-grade walls shall use water-tight fitting manufactured by O-Z/Gedney.

B All cutting and patching will be done under another Division, but this Section will be responsible for timely performance of this work and layout of holes and setting sleeves.

C All un-used sleeves shall be sealed with 2 hour UL approved fire sealant manufactured by "3M" or approved equal.

D Refer to 26 05 33 for additional requirements.

3.04 CONTROL PANELS

A Install all Panels in accordance with the National Electrical Code, industry standards and as shown on the drawings.

B Panels mounted in telecom, MDF, IDF, mechanical/electrical rooms shall be mounted at a working height not requiring a ladder when wall space is available. Installation of these devices at greater elevations shall be approved by the Engineer. Contractor shall provide a coordination sketch of each mechanical/electrical room noting locations and mounting heights of all electrical devices (note bottom and top elevations) shown to be installed. Sketches shall be provided to the Engineer for review and the general contractor for coordination with other trades working in these rooms.

3.05 CLEANING

A Touch-up and refinish scratches and marred surfaces on panels.

3.06 CORROSIVE AREAS

A In areas of a corrosive nature, which include but are not limited to the following: pool equipment rooms, cooling towers and areas subject to salt air, etc., provide NEMA 4X stainless steel or fiberglass reinforced enclosures for contactors, panel boards, controllers, starters, disconnects and materials used as supporting means (i.e. plastibond unistrut, pipe, fittings). The use of spray on coating may be acceptable in some applications.

3.07 TESTS AND INSPECTIONS

A Tests and inspection requirements shall be coordinated with Division 01.

B Date for final acceptance test shall be sufficiently in advance of completion date of contract to permit alterations or adjustments necessary to achieve proper functioning of equipment prior to contract completion date.

C Conduct re-tests as directed by Architect on portions of work or equipment altered or adjusted as determined to be necessary by final acceptance test. No resultant delay or consumption of time as a result of such necessary re-test beyond contract completion date shall relieve Contractor of his responsibility under contract.

D Put equipment into service under normal conditions, collectively and separately, as may be required to determine satisfactory operation. Demonstrate equipment to operate in accordance with requirements of these specifications. Perform tests in the presence of Architect. Furnish instruments and personnel required for tests.

E Final Inspection

1. At the time designated by the Architect, the entire system shall be inspected by the Architect and Engineer. The contractor or his representative shall be present at this inspection.

2. Panels shall be cleaned and in operating condition.

3. Certificates and documents required hereinbefore shall be in order and presented to the Architect prior to inspection.

4. Panel covers, junction box covers, etc., shall be removed for visual inspection of the wire, bus bars, etc.

5. After the inspection, any items which are noted as needing to be changed or corrected in order to comply with these specifications and the drawings shall be accomplished without delay.

END OF SECTION 28 05 00

SECTION 28 46 00 - FIRE ALARM SYSTEM WITH ELECTRONIC AUDIO AND VISUAL DEVICES

PART 1 - GENERAL

1.01 SCOPE

A The contractor shall provide a complete microprocessor based 24VDC, electrically supervised, analog intelligent fire alarm system as specified. The system shall include, but not be limited to, all control equipment, power supplies, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B All equipment, materials, accessories, devices, etc. covered by the specifications shall be new and shall be U.L. listed for their intended use.

C The system shall operate as a non-coded, continuous sounding system which will sound alarm devices until manually silenced, as herein specified.

D The system shall be wired as a Class B supervised system for all circuits.

1.02 REFERENCE STANDARDS

A ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

E NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2024.

F NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces; Current Edition, Including All Revisions.

H UL 38 - Standard for Manual Signaling Boxes for Fire Alarm Systems; Current Edition, Including All Revisions.

I UL 228 - Safety Door Closers-Holders, with or without Integral Smoke Detectors; 2008.

J UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

K UL 268A - Standard for Smoke Detectors for Duct Application; Current Edition, Including All Revisions.

L UL 464 - Standard for Audible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

M UL 521 - Standard for Heat Detectors for Fire Protective Signaling Systems; Current Edition, Including All Revisions.

N UL 864 - Control Units and Accessories for Fire Alarm Systems; Current Edition, Including All Revisions.

O UL 1638 - Standard for Visible Signaling Devices for Fire Alarm and Signaling Systems, Including Accessories; Current Edition, Including All Revisions.

P UL 1971 - Standard for Signaling Devices for the Hearing Impaired; Current Edition, Including All Revisions.

Q UL 2034 - Standard for Single and Multiple Station Carbon Monoxide Alarms; Current Edition, Including All Revisions.

R UL 2075 - Standard for Gas and Vapor Detectors and Sensors; Current Edition, Including All Revisions.

1.03 INSTALLING CONTRACTOR'S RESPONSIBILITY

A The installing fire alarm contractor is responsible for the design of a code compliant system, which meets the intent of all State and Local Authority Having Jurisdiction Codes and their adopted amendments along all permitting of such plans and associated permit fees. Reference and coordinate with all contract specifications and plans.

1.04 ACCEPTABLE MANUFACTURERS

A Provide one of the following manufacturers:

1. Notifier Fire Systems NFS2 Series
2. Siemens / Cerberus Pro Modular
3. Edwards System Technology (EST 4)

B Alternate Manufacturers

1. Equipment from other manufacturer's or supplier's may be considered as an equal to that specified provided that completely marked and identified catalog sheets of all proposed equipment is provided to the architect/engineer for review ten (10) days prior to the date of bid for evaluation. In addition, a list of the contractor's qualifications and any exceptions to the specifications must be provided for review. Approval for any such substitution of equipment must be obtained in writing from the architect/engineer for five (5) days prior to bid.

1.05 GENERAL REQUIREMENTS

A Contractor Qualifications:

1. The equipment supplier shall be an authorized and designated representative of the Fire Alarm Manufacturer to sell, install, and service the proposed manufacturer's equipment.

2. The equipment supplier and installing contractor shall be licensed by the State Fire Marshal to sell, install, and service fire alarm systems as required by Article 5.43-2 of the State Insurance Code.

3. The installing contractor and/or equipment supplier shall have on his staff a minimum of three (3) installation superintendents who are licensed by the State Fire Marshal's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State insurance code.

4. The installing contractor or equipment supplier shall have on staff a minimum of one (1) certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place.

5. The installing contractor shall provide 24 hour, 365 days per year emergency service with qualified and state licensed service technicians.

6. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing fire alarm systems for at least ten (10) years.

1.06 SUBMITTALS

A The installing contractor and/or equipment manufacturer shall provide complete and detailed shop drawings and include:

1. Control panel configuration including wiring and interconnection schematics.

2. Complete point to point wiring diagram showing terminal connections to all system devices.

3. Riser wiring diagram and associated zoning/addressing configurations with associated conduit sizes.

4. Complete floor plan drawings in a PDF format shall locate all devices associated with the fire alarm system. Floor plan drawings shall include conduit and wiring routing complete with conduit sizing and number of conductors by type.

5. Factory data sheets on each piece of equipment to be used and so marked as to model, dimensions, size, voltage, and configuration.

6. Detailed system description in this specification format describing system functions and operation. All specification variations and deviations shall be clearly noted and marked.

7. Complete Bill of Material for reference.

8. Programming matrix defining all input/output functions and zoning.

9. Power supply and battery calculations.

10. A written certification from the manufacturer stating that the fire alarm system contractor is authorized to sell, service and install the submitted equipment.

B Submittal shall include documentation confirming all qualifications have been met. Submittals without qualification documentation shall be returned "Revise and Resubmit".

C All submittal data shall include the contractor's name, supplier's name, project name, and state fire alarm license number adequately identified.

1.07 COORDINATION

A It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all trades including, but, not exclusive of: elevator, electrical contractor, sprinkler contractor, and HVAC/controls contractor and intercom system. Adequate coordination shall be provided to insure proper installation and interface to all peripheral items required to interact with the fire alarm and communication system to provide a complete and functional life safety system.

PART 2 – PRODUCTS

2.01 SYSTEM FUNCTIONAL OPERATION

A Alarm Detection

1. When a fire alarm condition is detected by any of the system alarm initiating devices, the following functions shall occur:

   a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledgment or silencing the alarm condition shall silence the alarm signals and cause flashing alarm LED's to illuminate steady.

   b. A multi-character back-lit LCD display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.

   c. Any remote or local annunciator LED's associated with the alarm zone shall be illuminated as herein specified.

   d. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.

   e. Activate all audible and visual alarm notification devices throughout the facility.

   f. De-activate HVAC systems over 2,000 CFM.

   g. Display system status changes on the remote annunciators.

h. Release all smoke doors, fire doors, fire coiling doors, fire smoke dampers and fire shutters.

i. Activate the smoke control system for the atrium.

j. Recall elevators to ground floor as specified herein, or to the alternate floor if the alarm condition originates on the ground floor

k. Unlock all electrically operated doors

B System Trouble Detection

1. When a trouble condition is detected by the CPU, one of the system initiating, alarm or SLC circuits, the following functions shall immediately occur:

a. The system trouble LED on the CPU module shall flash and the internal audible trouble device shall sound. Acknowledgment of the trouble condition shall silence the audible trouble device and cause all trouble LED's to illuminate steady.

b. The multi-character alphanumeric LCD annunciator shall display all applicable information via the alphanumeric display associated with the respective trouble condition and its location.

c. The system common trouble indicator on associated remote annunciators shall be illuminated as specified herein.

C Auxiliary Control

1. All designated "non-silenceable" auxiliary control functions shall remain in operation (even upon silencing of audible alarms) until such time as the control panel is cleared and reset manually (i.e. fan control outputs, central station interface, elevator recall interface, etc.).

2. Activation of duct smoke detectors associated fans shall shutdown their respective units immediately in addition to identifying the condition as herein specified. Duct detectors shall be programmed as a supervisory condition per NFPA 72.

D System Supervisory Detection

1. When a supervisory condition is detected by the fire alarm control panel, the following functions shall occur:

a. The fire alarm control panel supervisory indicator shall flash and the internal audible device shall sound Acknowledgment of the supervisory condition shall silence the audible device and cause the supervisory indicator to illuminate steady

b. The multi-character liquid crystal display shall display all applicable information associated with the respective supervisory condition.

c. Display the system status change on the remote annunciators

E Remote Off-site Monitoring

1. The remote off-site monitoring system shall transmit point specific alarm, trouble and supervisory signals to an Approved Central Supervising Station (Central Station connection, phone lines or cellular connectivity service provided by Owner).

F Fire Drill Control

1. Provide a fire drill switch located on the Fire Alarm Control Panel. When activated, this switch will activate all horns and visual devices (strobes) for a fire drill. It shall not release fire shutter, shut down air handling equipment or recall elevators. If a fire alarm condition is detected, the system shall operate as defined in part A - "Alarm Detection" of this section.

2.02 ZONING

A The system shall have the inherent capability to employ "Intelligent" smoke detectors and addressable interface devices capable of being recognized and annunciated at the main control panel on an individual basis. All zoning/device location information shall be totally field programmable to exact job requirements as approved by the Architect/Engineer.

2.03 FIRE ALARM CONTROL PANEL

A The fire alarm control panel shall be provided with adequate number of SLC points to serve the building plus 50% spare. The control panel shall utilize DISTRIBUTED solid state MICROPROCESSORS. The microprocessor based CPU shall be completely FIELD PROGRAMMABLE. CPU module shall provide for programmable non-volatile EEPROM memory. All circuitry shall be U.L. listed for power-limited application. System shall be sized to accommodate the capacity of the system specified and shown on the drawings. System shall be capable of being networked for future expansion.

B Central Processing Unit Module (CPU)

1. The CPU shall contain and execute all custom time control functions or control- by-event programs for specified events including 'Holiday' exceptions. Time control event/programs shall be automatically overridden by priority fire alarm events. All programs shall be held in non-volatile programmable memory, and shall not be lost if both system primary and secondary power failure occurs.

2. System CPU shall also provide for non-alarm points for non-fire, low priority building functions. The CPU shall provide capability of multi-stage signaling, tornado warning, emergency radio communication enhancement system, positive alarm sequencing as well as remote control system operation.

C Display Interface Assembly (DIA)

1. The DIA shall provide a multi-character backlit, supertwist Liquid Crystal Display (LCD). It shall provide Light-Emitting Diodes (LED's) for AC POWER; SYSTEM ALARM; SYSTEM TROUBLE; SUPERVISORY; CPU FAIL; and ALARM SILENCED.

2. The display shall provide power to a 25-key membrane keypad with control capability to command all system functions, status readouts, manual control action, and entry of any alphanumeric or numeric information. The keypad shall include means to enter multiple five digit passwords to prevent unauthorized manual control programming.

D Control Switches

1. Acknowledge/step Switch
2. Signal Silence Switch
3. System Reset Switch
4. System Test Switch
5. Lamp Test

E System Outputs

1. The system shall provide the following outputs:
   a. One port for lap top and/or modem
   b. One port for supervised remote LCD annunciators (RS-485)

F Loop Interface (SLC)

1. The CPU shall communicate and provide power to all devices on its loop over a single pair of wires. The CPU shall receive digital/ANALOG information from all "intelligent" detectors and shall process this information to determine normal, alarm, trouble, and sensitivity conditions. The analog information may be used for automatic test and determination of maintenance requirements, and be U.L. listed for such use. The CPU module shall individually monitor all "intelligent" detectors for sensitivity variation initiating a trouble condition should detector sensitivity "drift" become excessive. The system control unit shall have the capability to remotely read each detector's sensitivity in % obscuration, and if need be, electronically adjust the detector sensitivity as required for existing conditions within U.L. recommended limits. In addition, the system shall incorporate a "day/night" sensitivity feature. The system shall provide capability to program each individual detector for multiple 'pre-alarm' conditions. Each 'pre-alarm' level shall be field programmable as a function of the programmed alarm level. The system shall allow designated control-by-event actions to occur as may be required prior to any sensor reaching the designated alarm point.

G Non-Lock Walk Test

1. The system shall include a special non-lock "walk test" mode. The walk test mode shall incorporate a time-out feature to return system to normal. Test results shall be capable of being generated and displayed on the LCD annunciator.

H Automatic Detector Test

1. The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. An automatic detector test shall occur automatically a minimum of every two hour period or be initiated manually from the FACP as desired. Automatic detector test sequencing shall be terminated upon receipt of a true alarm condition.

I Special System Reports

1. The system shall have the ability to generate and print, upon command, system and point status reports. Selection of 'system' read status provides the operator with global system programming information as well as providing the operator with all individual point programming data. The system shall also provide the capability to print out a detailed 'history' report from system history file upon command.

J Field Programming

1. The system shall be 100% field programmable without the need for external computers or, PROM programmers, and shall NOT require replacement of memory IC's. All programs shall be stored in non-volatile EEPROM memory. Programming shall be accomplished only after entering an appropriate and pre-selected five digit password security code. System programming mode shall NOT require the system to be taken off-line nor prohibit the system from performing its normal operations and routines. The system shall be capable of revising/changing programmed functions or system expansion at any time subsequent to initialization as described herein without factory modifications or factory programming. Field programming via the use of external computers may be considered provided programming can be accomplished on-site and the owner is permanently furnished with the required programming apparatus and software as part of this contract.

K Event History

1. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via five digit password security code.

L Power Supply

1. The power supply shall provide all control panel and peripheral power needs with filtered power as well as rectified 24VDC power for external audio-visual devices. All power supplies shall be designated to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits.

2. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide both positive and negative ground fault supervision, battery/charger fail condition, A.C. power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.

3. Batteries shall have 24 hours of standby capacity and 5 minutes of alarm capacity. Battery charger shall recharge batteries from full discharge to full charge over a 24-hour period. Switching from normal power to battery power and back shall occur automatically.

2.04 FIELD DEVICES

A Multi Criteria Smoke Detector (Smoke and Heat)

1. Provide intelligent multi detector. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in micro processor to determine its environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen, etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes)

3. The intelligent multi criteria detection devices shall included the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chamber and comparing them to a database of actual fire and deceptive phenomena.

4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

B Air Sampling Smoke Detector

1. Provide VESDA air sampling addressable smoke detection system to provide proper coverage based on in areas with ceiling higher than 18 feet. Fire alarm contractor shall include pipe layout as well as pipe calculations in the fire alarm system shop drawings.

2. The air sampling smoke detection system shall integrate into the fire alarm system as an addressable device residing on the signaling line circuit. Each VESDA detector shall be interfaced to the fire alarm system via four separate points (one trouble and three distinct alarm points). Each VESDA detector shall be provided with its own battery backup system as required by NFPA 72. VESDA smoke detector shall be located in a non-public area such as a mechanical, telephone, IDF, or storage room in the vicinity of the atrium. All VESDA air sampling shall be supported every five feet.

C Linear Beam Detector

1. Linear Beam Detector shall be a single unit containing the transmitter and receiver in the same enclosure. This detector can operate over a range from 17ft to 280ft (5m to 85m). The detector shall have three sensitivity settings, shall have high immunity to extraneous light, and have automatic and comprehensive test. Unit shall be monitored and interconnected to the main fire alarm control panel.

D Intelligent Duct Detector

1. Provide duct mounted “intelligent” photoelectric smoke detectors shall be provided per applicable codes. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type “intelligent” smoke sensors. The unit shall be capable of interchanging/accepting either photo-electronic or ionization type sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the use of zone modules.

2. The unit shall consist of a clear molded plastic enclosure with integral conduit knockouts. The unit shall be provided with clear faceplate cover to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit’s sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination. Detectors shall be installed per NFPA 90A, and be listed with the fire alarm control panel. A remote LED shall be located on the corridor ceiling adjacent to the respective detector where detectors are not plainly visible or concealed from view.

E Intelligent Thermal Detectors

1. Provide analog, fixed temperature thermal detectors. The detectors shall use dual electronic thermostats to measure temperature levels in the chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.

2. The detectors shall provide dual alarm and power/status LED's. Status LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel. Both LED's may be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. An output connection shall also provided in the base to connect an external remote alarm LED.

3. The detectors shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.

F Conventional Weatherproof Thermal Detector

1. Provide heat detection devices when located in harsh and/or moist environments, such as showers and similar areas, which are subject to high humidity, the following device shall be provided. Weatherproof Heat Detector 135°F Rate Compensated shall be provided. The detector shall mount in a weatherproof 4" electrical box with 1/2" NPT threaded hub. This detector shall be connected to an addressable monitor module.

G Addressable Manual Pull Stations

1. Provide Manual stations..

   a. The manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel.

   b. All manual pull stations shall be considered of durable molded polycarbonate material and shall be RED in color with raised white lettering. Stations be the dual action type.

   c. All manual pull stations shall be provided with an STI-1100 series clear plastic cover with integral horn.

H Monitor Module

1. Provide addressable monitor modules where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.

I Control Module

1. Provide control and relay modules where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.

2. The control module shall be addressable. A status LED shall be provided which shall flash under normal conditions, indicating that the control module is operational and in regular communication with the control panel. The LED shall illuminate steady when the device is actuated via the fire alarm control panel.

J Electronic Audio Visual Devices

1. Audible/Visual alarm devices shall be electronic horn/strobe units. Devices shall be wall or ceiling mounted. Devices shall be provided with the ability to provide multiple candela settings. Units shall operate at 24VDC and be polarized supervised. Each unit shall provide a choice of three difference audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA. The visual device shall use Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit and meet the requirements of ADA and local codes. Strobe unit shall automatically flash upon operation of the horn. Horn/strobe unit shall be provided in textured white finish and be flush mounted. All visual devices shall be synchronized.

K Electronic Alarm Horn

1. Provide solid state electronic alarm devices where indicated on the contract drawings. Units shall operate at 24 VDC and be polarized supervised. Each unit shall provide a choice of three different audible tones capable of being field selected. Preferred alarm signal shall be a temporal tone producing a sound pressure level of 84 dBA.

2. Units shall be flush mounted and molded of high-impact white plastic.

L Exterior Audio Visual Devices

1. All audio visual devices located outside or labeled weatherproof shall be weatherproof.

2. All devices shall be provided with a weather proof type back box.

M High Intensity Visual Signals

1. Provide visual signal device as may be required by the Americans with Disabilities Act (Public Law 101-336) and local codes. High intensity visual alarms shall be Xenon strobe type producing a minimum of 15 candela on a 24 VDC limited energy supervised circuit. Alarm devices shall be ceiling mounted. Signals shall operate in unison with audible alarm appliances. All visual devices shall be synchronized. Units shall be flush mounted and shall be provided in textured white.

N Sprinkler Waterflow Switch

1. Sprinkler water flow switches shall be installed where indicated on the drawings. Each unit shall contain one set of SPDT alarm contacts. Water flow switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor.

O Sprinkler Valve Supervisory Switch

1. Sprinkler valve supervisory switches shall be installed on each valve as indicated on the drawings. Each unit shall contain on set of SPDT contacts. Sprinkler valve supervisory switches shall be provided, installed, and adjusted by the fire protection contractor, and connected by the fire alarm contractor.

P Auxiliary Air Handling Unit (AHU) Relays

1. Relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy duty type and rated up to 10 amps at 24 VDC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with SPDT contacts as well as (fail safe) so that if the cable is broken, disconnected etc., the AHU will automatically shutdown.

Q Field Charging Power Supplies

1. Provide power supplies with battery backup as required. Provide 120 volts dedicated circuit to each power supply.

R Remote LCD Alpha-Numeric Annunciators

1. Provide remote LCD alpha-numeric annunciator to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator shall be a backlit eighty-character LCD display and operate via the system RS485 and RS232 serial output terminal from main FACP. The LCD display shall automatically illuminate upon receipt of an alarm or trouble condition. The luminary source shall extinguish during normal/standby model to conserve power. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote LCD annunciator shall include:

    a. Integral time-date clock

    b. Time-date select clock

    c. Time-date/contrast adjust

    d. Display/step switch

    e. System reset

    f. System silence

    g. System acknowledge

    h. Integral trouble buzzer

2. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The unit shall be equipped with an integral lamp test feature. The unit shall be semi flush mounted where shown.

S Protective Covers

1. Provide protective covers on all wall mounted fire alarm devices located in student restrooms, corridors and in the cafeteria. These protective covers shall be manufactured by Safety Technology International, Inc. (STI). These covers shall be provided on all devices including but not limited to smoke detectors, heat detectors, audible and visual devices, pull stations, etc. The mounting of a device shall be reinforced to enable the protective covers to protect the fire alarm devices.

T Multi Criteria Fire/Carbon Monoxide (CO) Detector (FCO-951) for sleeping rooms

1. Multi criteria acclimating detector shall be provided where shown on the drawings. The intelligent multi criteria detector shall be an addressable device that is designed to monitor a minimum of photoelectric, flame, thermal and CO technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine its environment and choose the appropriate sensing settings.

2. The detector design shall allow for a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.

3. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).

4. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the flame, thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.

5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base with integral sounder.

6. Provide integral low frequency sounder base for smoke detection and 4-code temporal sound for CO detection.

U Smoke Alarms for Dwelling Units

1. The combination photoelectric smoke and carbon monoxide alarm shall be a Gentex Model GN-503/GN-503F/GN-503FF or approved equal which shall provide at least the following features and functions:

   a. The smoke alarm portion of device shall utilize an infrared LED sensing circuit which pulses in 4 to 5 second intervals when subjected to smoke. After 2 consecutive pulses in smoke, the alarm shall activate.

   b. The CO alarm shall utilize an electrochemical sensing element with a minimum 5-year life.

   c. The carbon monoxide alarm portion of device is adjusted not to detect CO levels below 30 PPM and will not alarm when exposed to constant levels of 30 PPM for 30 days. Per UL 2034 requirements, the device will alarm at the following levels: 70 PPM CO between 1 to 4 hours, but not less than 1 hour. 150 PPM CO between 10 to 50 minutes. 400 PPM between 4 to 15 minutes.

   d. The GN-503 Series device shall have a 9VDC alkaline battery as a back-up in the event building power is lost.

e. The alarm shall provide an indicator when the battery is low in power, high impedance or is missing.

f. The CO alarm will provide an audible indicator of 3 quick chirps every 30 seconds at end of life of CO sensor.

g. The alarm shall include a solid state red color LED that will indicate presence of CO at the unit.

h. The audible alarm shall include a solid state piezo alarm rated at 85dBA at 10ft.

i. A visual LED monitor (condition indicator) shall slow pulse in normal operation and rapid pulse in alarm (red color)

j. An easily accessible test button shall be provided. Push down on button for 5 seconds causing smoke/CO alarm to activate.

k. The device shall have tandem interconnect capability of up to 12 smoke/CO alarms.

l. The GN-503FF alarm shall have the capability to tandem interconnect with all Gentex tandem capable smoke alarms, CO alarms or combination smoke/CO alarms.

m. The manufacturer shall provide models with the optional feature of auxiliary Form A/Form C relay contacts for initiating remote functions and annunciation and a relay option that is capable of activation by tandem interconnect wire.

n. The combination smoke/CO alarm shall be non-latching (self-restoring).

2. Power and Interconnection Requirements

a. Provide 120 VAC primary power from building wiring served from a commercial source.

b. Provide interconnecting tandem wiring between smoke/CO alarms so that the activation of one alarm will activate all of the alarms in the individual unit.

PART 3 - EXECUTION

3.01 DESIGN CRITERIA

A The contractor shall provide drawings for Owner, Engineer and Fire Marshal's approval.

B Drawings shall be prepared by a state licensed alarm planning superintendent.

C Drawings shall comply with all local, state and federal code. These include but are not limited to NEC, UL, NFPA, etc.

D Locate the fire alarm control panel in main telecommunications / MDF room unless otherwise directed by the owner.

E Locate a remote annunciator in the main lobby area unless otherwise directed by the owner.

F Provide additional items required above minimum codes include the following:

1. Manual pull stations shall be located not more than 5 feet from the entrance to each exit. Additional manual stations shall be located so that the travel distance to the nearest manual station does not exceed 200 feet. Provide Stopper II covers on all manual pull stations

2. Manual pull station heights shall be a minimum of 42" and a maximum of 48" measured vertically, from the finished floor level to the activating handle or lever.

3. Smoke Detectors – Paths of egress, electrical rooms, mechanical rooms, MDF, IDF, elevator lobby, storage rooms, top of stairs, elevator machine room, top of elevator shaft, above each fire alarm panel and remote power supplies terminal cabinets. Smoke detectors shall also be provided in each room/area that can be occupied by kindergarten and pre-kindergarten children, which shall include cafeteria, gymnasiums, daycares, libraries, classrooms and similar areas. Provide a VESDA smoke detection system in paths of egress where ceiling heights exceed 18 feet.

4. Duct type smoke detectors – all air handling units over 2,000 CFM in duct work or return air paths.

5. Heat Detectors – Shops, kitchens, coffee bars, central plants, boiler room, garages, truck bays and other non conditioned areas when detection is required..

6. Flow switches – Sprinkler riser.

7. Horns - throughout the building.

8. Strobes – throughout the building.

9. Remote Power supplies: Locate in mechanical rooms, electrical rooms, MDF or other areas approved by Owner.

10. Smoke Detectors with low frequency sounder bases inside and outside all sleeping rooms. Do not locate over bed.

11. Monitor Fire Pump.

12. System Carbon Monoxide Detectors - Provide one in each sleeping room, kitchen, and the first room of each mechanical system where gas furnaces are serving spaces. Combination CO and smoke detector may be utilized in sleeping rooms. Provide CO detection in locations where gas water heaters are provided. Locate near the door; do not locate over the bed.

13. Tamper Switches- Sprinkler riser and vaults located on the site.

3.02 INSTALLATION

A Wiring

1. All wiring shall be in accordance with NFPA 72 and NFPA 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

2. All wire shall be plenum rated, U.L. Listed, limited energy (300 volt) FPLP or MPP wire and shall be run open in return air ceiling plenums. The wire shall comply with NFPA 262 for such applications, shall be of the low smoke producing fluorocarbon type and shall comply with NEC Article 760 if so approved by the local authority having jurisdiction. Provide conduit in all inaccessible locations, inside concealed wall, all mechanical/electrical rooms, or other areas where wiring might be exposed and subject to damage.

3. Support wire clear of knock out panels, access panels, and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.

4. All wiring for SLC signaling circuits shall be of the twisted low capacitance type to guard against outside RF and EMF interference and induced noise.

5. All wiring shall be run in a supervised fashion (i.e. no branch wiring or dog-legged wiring) per NFPA requirements such that any wiring disarrangement will initiate the appropriate trouble signals via the main control panel per NFPA.

6. Wiring splices shall be kept to a minimum with required splices to be made in designated terminal boxes or at field device junction boxes. Transposing or color code changes of wiring will not be permitted. End-of-line supervisory devices shall be installed with the last device on the respective circuit. Devices shall be appropriately marked designating it as the terminating device on the respective circuit.

7. No A.C. wiring or any other wiring shall be run in the same conduit as fire alarm wiring.

8. All insulation on conductors shall be RED with traces to identify circuits.

B Open Wiring

1. Systems utilizing open wiring techniques with low smoke plenum cable.

2. Support wire clear of knock out panels access panels and maintenance spaces for equipment. Wire and cable shall be run using wire management techniques supporting cable as close as possible to within one foot of the floor or roof rafters. Wire supports shall be directly fastened to the structure on a maximum of five foot on centers. Wire routing shall be parallel and perpendicular to building lines. The wire and cable shall be secured with tie wraps or carrier wire. Sagging in excess of three inches will not be allowed nor will bending of the supporting ring structure.

3. Provide Caddy J-hooks supported independently from other system to support cable at 4-foot on center or closer if required by manufacturer.

4. Provide a junction box to make up all joints and splices.

5. Provide cable supports in all vertical raceways in accordance with Article 300-19 of NFPA 70.

C Conduit/Raceway

1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

2. Conduit and raceway system shall be installed as specified in division 26 specifications and per National Electrical Code.

3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

4. All wiring in mechanical rooms, electrical rooms, drywall ceiling, inaccessible areas, underground, plaster ceiling, inside concealed walls areas exposed to occupant view, and other areas subject to physical damage shall be run in conduit.

5. Sleeves shall be placed in the forms of concrete, masonry and fire rated walls, floor slabs and beams for the passage of wiring. Sleeves should be set in place a sufficient time ahead of the concrete work so as not to delay the work. Sleeves shall be rigid galvanized steel.

D Minimum Wire Sizes Shall Be As Follows:

1. Signaling Line Circuit: 18 AWG

2. Notification Appliance Circuit: 14 AWG

3. Relay Control Circuits: 18 AWG

E 120 VAC Power wiring

1. Contractor shall provide all required dedicated 20 amp, 120 VAC power circuits for the fire alarm system including but not limited to the main fire alarm panel, remote amplifier panels, and remote strobe light power supplies. Connect to emergency power when available in the building.

F Sprinkler Valves

1. Contractor shall connect all tamper switches and post indicator valves to the supervisory circuit. Connect all water flow switches to the alarm circuit. Coordinate exact locations of water vaults valves and flow switches with sprinkler contractor.

3.03 NOTIFICATION APPLIANCE CIRCUITS SYNCHRONIZATION

A All visual and audible devices shall be synchronized per the current state adopted version of NFPA 72. Provide all components required.

3.04 SMOKE AND COMBINATION FIRE SMOKE DAMPERS

A Provide duct type smoke detectors in ductwork downstream of each smoke damper and fire smoke damper. Locate within 5 feet on the damper. Provide a remote smoke detector reset device. Provide access panel when not located above an accessible ceiling. Interlock with HVAC unit serving the ductwork to shut down.

3.05 MISCELLANEOUS SYSTEMS

A Monitor all fire suppression systems, carbon monoxide system panels and refrigerant system control panels.

3.06 TEST AND REPORTS

A A state licensed factory trained technical representative of the manufacturer shall perform the final control panel connections and supervise testing of the system and it shall be subject to the approval of the responsible engineer and owner. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

B The installing contractor shall functionally test each and every device in the entire system for proper operation and response. In addition, each circuit in the system shall be fully tested for wiring supervision to insure proper wiring installation. Any items found not properly installed or non-functioning shall be replaced or repaired and re-tested. All testing shall be supervised by a licensed fire alarm superintendent.

C The installing contractor shall provide a complete written report on the functional test of the entire system. The test and report shall verify the function of each device in the system, operation of all auxiliary control functions, and the proper operation of the main fire alarm control panel. A copy of the test report shall be provided with maintenance manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout.

D The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction.

3.07 SPARE PARTS AND ATTIC STOCK

A Provide 5% spare field devices including labor to install them. Devices not used shall be given to the Owner at completion of the job.

B The fire alarm contractor shall include in his bid the cost to provide and install the additional spare parts and attic stock and associated cabling as indicated on the schedule on the contract drawings. All devices on this schedule not used during construction shall be turned over to the owner at the time of job completion.

3.08 WARRANTY

A The fire alarm system shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of acceptance or beneficial occupancy, whichever shall occur first. Any equipment shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner.

3.09 GRAPHIC FLOOR PLANS

A Provide 1/16” = 1’-0” floor plan showing all devices and zoning. Zoning shall correspond to the zone on the fire alarm control panel. The floor plans shall be framed with a glass cover and located by the fire alarm control panel. This graphic floor plan shall use the actual room numbers based on the architectural graphics package. Verify specific requirements with Owner. Provide a sample for approval.

END OF SECTION 28 46 00

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and abandoning site utilities in place.
   8. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 01 50 00 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.03 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.05 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.06 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.07 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.08 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify TAMU UES and Texas 811 (Did Tess/Call Before You Dig) for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 01 50 00 "Temporary Facilities and Controls"

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.01 MATER.IALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."
   1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.
   1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Retain this article if erosion- and sedimentation-control are not included in Section 015000 "Temporary Facilities and Controls."

B. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

C. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

D. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

E. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.03 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 01 50 00 "Temporary Facilities and Controls"

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 01 50 00 "Temporary Facilities and Controls"

3.04 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with TAMU UES to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Engineer not less than 48 hours in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

E. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

3.05 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.06 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.07 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
   1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

3.08 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.09 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for walks, pavements, and turf and grasses.
   3. Subbase course for concrete walks and pavements.
   4. Subbase course and base course for asphalt and concrete paving.
   5. Subsurface drainage backfill for walls and trenches.
   6. Excavating and backfilling trenches for utilities and pits for buried utility structures.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
   2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   3. Section 31 23 19 "Dewatering" for lowering and disposing of ground water during construction.
   4. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.

1.03 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices.

1.04 DEFINITIONS

A. Backfill: Soil material or Cement Stabilized Sand material used to fill an excavation.
   1. Initial Backfill: Backfill placed below, beside, and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Top Soil: Dark surface soil containing organic matter for growing vegetation

C. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

D. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

E. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

F. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

G. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

H. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

I. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

J. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

K. Fill: Soil materials used to raise existing grades.

L. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D 1586.

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

O. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

P. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site.

B. Review methods and procedures related to earthmoving, including, but not limited to, the following:
   1. Personnel and equipment needed to make progress and avoid delays.
   2. Coordination of Work with utility locator service.
   3. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
   4. Extent of trenching by hand or with air spade.
   5. Field quality control.

1.06 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of product indicating compliance with the specifications regarding dimensions, thickness, weights, and materials. For each type of the following manufactured products required:
   1. Cement for cement stabilization.
   2. Cement stabilized sand mix design.
   3. Lime Slurry mix design.
   4. Geotextiles.
      a. Geotextile: 12 by 12 inches.
   5. Warning tapes.
      a. Warning Tape: 12 inches long; of each color.
   6. Shop Drawings: indicate dimensions, method of field assembly, and components.
   7. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

8. Samples for Verification: For the following products, in sizes indicated below:

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

C. Classification according to ASTM D 2487.

D. Laboratory compaction curve according to ASTM D 698.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.08 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.09 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

B. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

C. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

D. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

E. Do not proceed with work on adjoining property until directed by Architect.

F. Utility Locator Service: Notify TAMU UES and Texas 811 (Did Tess/Call Before You Dig) for area where Project is located before beginning earth-moving operations.

G. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in are in place.

H. Do not commence earth-moving operations until plant-protection measures specified in are in place.

I. The following practices are prohibited within protection zones:

J. Storage of construction materials, debris, or excavated material.

K. Parking vehicles or equipment.

L. Foot traffic.

M. Erection of sheds or structures.

N. Impoundment of water.

O. Excavation or other digging unless otherwise indicated.

P. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

Q. Do not direct vehicle or equipment exhaust towards protection zones.

R. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: All fill materials recommended in geotechnical report for each fill type; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Select Fill Plasticity Index: 8 – 20, a max gravel content (percent retained on #4 sieve) of 40 percent, and rocks no larger than 2 inches in their largest dimension.
   2. General Fill Plasticity Index: Maximum of 30, and shall be free of debris and organics.

C. Unsatisfactory Soils: Soil Classification Groups GC, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Sand: ASTM C 33/C 33M; fine aggregate.

2.02 BANK RUN SAND

A. Materials

B. Granular Material free of detrimental quantities of clay, debris, or organic material and which meet the following requirements:
   a. Maximum Liquid Limit (LL): 45
   b. Maximum Plasticity Index (PI): 15
   c. Maximum Percent Passing No. 200 Sieve: 35%
   d. Minimum Percent Passing ¾" Sieve: 100%

C. The material shall be free slowing and when wet, shall not adhere to form a ball.

2.03 CEMENT STABILIZED SAND

A. Materials
   1. Cement - Type I Portland Cement conforming to ASTM C150.
   2. Sand - Clean durable sand meeting grading requirements for fine aggregates of ASTM C33, and the following requirements:
      a. Classified as SW, SP, or SM by the United Soil Classification System of ASTM D2487.
      b. Deleterious materials:
         1) Clay lumps, ASTM C142; less than 0.5 percent.
         2) Lightweight pieces, ASTM C123; less than 5.0 percent.
         3) Organic impurities, ASTM C40; color no darker than standard color.
         4) Plasticity index of 4 or less when tested in accordance with ASTM D4318.
      c. Water: Potable water, free of oils, acids, alkalis, organic matter, or other deleterious substances, meeting requirements of ASTM C94.

B. Design sand-cement mixture to produce a minimum unconfined compressive strength of 50 pounds per square inch in 48 hours and 100 pounds per square inch in 7 days when compacted to 95% in accordance to ASTM D558 and when cured in accordance with ASTM D1632, and tested in accordance with ASTM D1633. Mix for general use shall contain a minimum of 1-½ sacks of cement per cubic yard. Mix for use as sanitary sewer embedment within 9 feet of waterlines shall contain 2.5 sacks of cement per cubic yard. Compact mix with moisture content between -2 to 2% above optimum.

2.04 LIME

A. Materials
   1. The lime to be used for stabilization shall meet with requirements of TX DOT DMS-6350, “Lime and Lime Slurry”.
   2. Use commercial lime slurry only. Powder or pellets shall not be used.
   3. The amount of lime required for stabilization will be the amount which produces a Plasticity Index (PI) less than 18 and a pH not less than 12.4.

B. Testing
   1. After each final mixing, a Ph Test, Atterberg Limit test and sieve analysis shall be performed in accordance with Tex-101-E, Part III.
   2. Moisture and density tests shall be taken at each construction station.

2.05 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

B. Survivability: Class 2; AASHTO M 288.

C. Survivability: As follows:
   a. Grab Tensile Strength: 157 lbf; ASTM D 4632.
   b. Sewn Seam Strength: 142 lbf; ASTM D 4632.
   c. Tear Strength: 56 lbf; ASTM D 4533.
   d. Puncture Strength: 56 lbf; ASTM D 4833.

D. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.

E. Permittivity: 0.5 per second, minimum; ASTM D 4491.

F. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

G. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

H. Survivability: Class 2; AASHTO M 288.

I. Survivability: As follows:
   a. Grab Tensile Strength: 247 lbf; ASTM D 4632.
   b. Sewn Seam Strength: 222 lbf; ASTM D 4632.
   c. Tear Strength: 90 lbf; ASTM D 4533.
   d. Puncture Strength: 90 lbf; ASTM D 4833.

J. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.

K. Permittivity: 0.02 per second, minimum; ASTM D 4491.

L. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.06 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 5 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried as indicated; APWA standard color coded as follows:
   1. Electric: Red

2. Telephone and other communications: Orange
3. Water: Blue
4. Sewer: Green
5. Gas: yellow

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

C. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

B. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

C. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
   1. Measurements in subparagraphs below are examples only; revise to suit Project conditions and office standards.
   2. 24 inches outside of concrete forms other than at footings.
   3. 12 inches outside of concrete forms at footings.
   4. 6 inches outside of minimum required dimensions of concrete cast against grade.
   5. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
   6. 6 inches beneath bottom of concrete slabs-on-grade.
   7. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.06 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

Clearance:

Nominal Pipe OD, in.	Minimum Trench Width, in.	Parallel Pipe Clearance, in.
< 3	12	4
3 – 24	Pipe OD + 12	6
> 24 – 63	Pipe OD +24	12

C. Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

D. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate for bells of pipe.

3.07 SUBGRADE INSPECTION

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 20 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

D. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

E. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.

F. Authorized additional excavation and replacement material will be paid for according to Contract provisions.

G. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Engineer.

B. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

B. Stockpile soil materials a minimum 2-feet away from edge of excavations. Do not store within drip line of remaining trees.

3.010 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring, bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
   8. Place backfill on subgrades free of mud, frost, snow, or ice.

3.011 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Place backfill in lifts according to paragraph 3.14 of this Part.

F. Initial Backfill:
   1. Non-Structural Areas
      a. Place and compact initial backfill of Bank Run River Sand, to a height of 6 inches over the pipe or conduit.
      b. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
   2. Areas to be Paved and Structural Areas. Extending 5’ beyond back of curb or edge of pavement.
      a. Place and compact initial backfill of Bank Run River Sand, to a height of 6 inches over the pipe or conduit.
      b. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
   3. Utility Crossing Areas
      a. At locations where proposed and existing domestic water cross proposed sanitary sewer, place and compact initial backfill of cement stabilized sand, to a height of 12 inches over the top most utility. The cement stabilized sand shall extend for 10 feet in each direction along each utility from the crossing point.

b. All utility crossing locations shall follow 30 TAC §217.53 (d) and 30 TAC §290.44 (e)(4).
c. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:
1. Non-Structural Areas, Utility Crossing Areas
a. Place and compact final backfill of Satisfactory Soil to 6 inches of final subgrade elevation.
b. Place and compact soil backfill with top soil to final subgrade elevation
2. Areas to be Paved and Structural Areas. Extending 5' beyond back of curb or edge of pavement.
a. Place and compact final backfill with Cement Stabilized Sand to pavement subgrade

H. Warning Tape: Install warning tape directly above utilities as indicated, except 12 inches below subgrade under pavements and slabs.

3.012 SOIL FILL

A. Plow, scarify, bench, or break up so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.013 SOIL/CEMENT STABILIZED SAND MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer, including cement stabilized sand, before compaction to within +/- 2 percent of optimum moisture content.

B. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

C. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

D. Tests shall be taken at a minimum of one test:
1. Embankment/Fill: per every 4000 square feet and for each 12" vertically
2. Trench: per every 200 linear feet and for each 12" vertically
3. Crossing: per every utility and street crossing

3.014 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698 for soil and ASTM D 558 for cement stabilized sand:

D. Under steps, and pavements, scarify and recompact top 12 inches of existing subgrade, extending 2’ past back of curb or edge of pavement, and each layer of backfill or fill soil material at 95 percent standard.

E. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 98 percent.

F. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.

G. For utility trenches in non-structural areas, compact and consolidate each layer of initial backfill manually and compact each layer of final satisfactory soil backfill material at 95 percent.

H. For utility trenches in utility crossing areas, compact each layer of initial cement sand backfill at 95 percent and compact each layer of final satisfactory soil backfill material at 95 percent.

I. For utility trenches in areas to be paved and structural areas (extending 2’ past back of curb or edge of pavement), compact each layer of initial and final cement stabilized sand backfill at 95 percent.

J. Tests shall be taken at a minimum of one test:

K. Embankment/Fill: per every 4000 square feet and for each 12” vertically

L. Trench: per every 100 linear feet and for each 12” vertically

M. Crossing: per every utility and street crossing

3.015 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Provide a smooth transition between adjacent existing grades and new grades.

C. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

D. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1/2-inch.
   3. Pavements: Plus or minus 1/2-inch.

E. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2-inch when tested with a 10-foot straightedge.

3.016 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: Specified in Section 334600 "Subdrainage."

B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

C. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

D. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

E. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.

F. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.017 LIME STABILIZATION

A. Application
1. Type B Lime Slurry shall be a pumpable suspension of solids in water. The slurry shall be furnished at or above the minimum "Dry Solids" content as approved by the Engineer or designated representative.
2. Lime slurry must be of a consistency that can be handled and uniformly applied without difficulty. The water of the liquid portion of the slurry shall not contain dissolved material in sufficient quantity and/or nature to make it injurious or objectionable for the purpose intended. The solids portion of the mixture, when considered on the basis of "solids content", shall consist principally of hydrated lime of a quality and fineness sufficient to meet the requirements as to chemical composition and residue identified below

B. Mixing
1. When sampled and tested according to prescribed TxDOT Standard Specification Item No. 264, hydrated lime shall conform to the following chemical and physical composition requirements.
2. Chemical Composition: The solids content of the lime slurry shall consist of a minimum of 90% by weight, of calcium and magnesium oxides (CaO and MgO), as determined by ASTM C25.
3. Residue: The percent by weight of residue retained in the solids content of lime slurry shall conform to the following requirements:
4. Residue (Wet Sieve)
   a. The percent by weight (mass) of residue retained in the "solids content" of lime slurry shall conform to the following requirements:

Residue retained on No. 6 (3.35 mm) sieve	Maximum 0.2%
Residue retained on No. 30 (600 µm) sieve	Maximum 0.4%

C. Sampling and Testing
1. The sampling and testing of lime slurry shall be conducted in accordance with TxDOT Test Methods: Tex-112-E, Tex-121-E and Tex-600-J.

D. Finishing and Curing
1. Apply seals or additional courses within fourteen (14) calendar days after final compaction, unless otherwise directed by the Engineer.

3.018 CEMENT STABILIZATION

A. The amount of cement required for stabilization will be the amount which produces a compressive strength of 50 psi in 48 hours and 100 psi in 7 days when compacted to 95% in accordance to ASTM D558 and when cured in accordance with ASTM D1632, and tested in accordance with ASTM D1633. Mix for general use shall contain a minimum of 1-½ sacks of cement per cubic yard. Mix for use as sanitary sewer embedment within 9 feet of waterlines shall contain 2 sacks of cement per cubic yard. Compact mix with moisture content between 0% to 2% above optimum. The maximum compressive strength in 7 days shall be 400 psi.

B. The stabilized layer shall extend 2 feet beyond the edge of pavement

C. Testing
   1. "Cement Series" tests to identify optimum percentage of cement per Tex-120-E, Part I
   2. After each final mixing, a unconfined compressive strength test in accordance with Tex-120-E, Part II.
   3. Moisture and density tests shall be taken at each construction station.
   4. Moisture and density tests shall be taken at each construction station.

D. Preparation and Pulverization
   1. The roadbed shall be shaped to conform to the lines, grades and typical sections shown on the Plans prior to beginning any cement treatment.
   2. The material to be treated shall be spread uniformly to the required cross-section, mixed and pulverized so that at least 80 percent passes the No. 4 sieve. This pulverization requirement may be waived when the material contains a substantial amount of aggregate and is approved by the Engineer.
   3. The Contractor may elect to use a cutting and pulverizing machine that will process the material to be stabilized in-place rather than excavate and windrow. This method will be permitted only if a machine is provided which will insure that the material is cut uniformly to the proper depth and which has cutters that will plane the secondary grade to a uniform surface over the entire width of the cut. The machine shall provide a visible indication of the depth of cut at all time. If this method is used the Contractor will be required to roll the subgrade prior to pulverization and correct any soft or unstable areas as directed by the Engineer.

E. Application and Mixing
   1. Portland cement shall be spread uniformly on the soil at the specified rate. Cement shall be applied only on an area where the mixing, compacting, and finishing operations can be completed during the same working day.
   2. The cement shall be spread by an approved spreader or by bag distribution. Cement distribution shall be at a uniform rate and in a manner to minimize scattering by wind.
   3. Single or multiple soil stabilizer mixers shall be used. The cement shall be dry-mixed with the soil prior to the addition of water. Immediately after dry-mixing, water shall be uniformly applied. After mixing, the cement treated soil shall be in a loose, evenly spread state ready for compaction. The soil and cement mixture shall not remain undisturbed for more than 30 minutes before compacting.

F. Finishing and Curing
   1. Immediately after compaction, the surface shall be bladed to a depth of 1/4 inch, removing all loosened materials. The loosened materials shall be disposed of at the Contractor's expense and at a location approved by the Engineer. The surface shall then be rolled with a pneumatic tire roller, adding small increments of moisture as needed during rolling.
   2. The completed section shall be moist cured for three (3) days or prevented from drying by addition of an asphaltic material at a rate of 0.10 to .030 gallons per square yard. The

Contractor will be responsible for protecting any asphalt membrane from being picked up by traffic.

3. The completed sections of soil cement may be opened immediately to local traffic and construction equipment, and to all traffic after the three (3) day curing period, provided the soil cement has hardened to prevent rutting and surface marring.

3.019 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Place base course material over subbase course under hot-mix asphalt pavement.
   2. Shape subbase course and base course to required crown elevations and cross-slope grades.
   3. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   4. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   5. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders, at least 24 inches wide, of satisfactory soil materials and compact simultaneously with each subbase layer to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

D. Tests shall be taken at a minimum of one test:
   1. Embankment/Fill: per every 4000 square feet and for each 12” vertically
   2. Crossing: per every utility and street crossing

3.020 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 98 percent of maximum dry unit weight according to ASTM D 698.

C. Tests shall be taken at a minimum of one test:
   1. Embankment/Fill: per every 4000 square feet and for each 12” vertically
   2. Crossing: per every utility and street crossing

3.021 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

D. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

E. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.022 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

C. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

SECTION 31 23 19- DEWATERING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes construction dewatering.

B. Related Requirements:

C. Section 312000 "Earth Moving" for excavating, backfilling, site grading, and controlling surface-water runoff and ponding.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

B. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

C. Review condition of site to be dewatered including coordination with temporary erosion-control measures and temporary controls and protections.

D. Review geotechnical report.

E. Review proposed site clearing and excavations.

F. Review existing utilities and subsurface conditions.

G. Review observation and monitoring of dewatering system.

1.04 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system, prepared by or under the supervision of a qualified professional engineer.

B. Include plans, elevations, sections, and details.

C. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

D. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.

E. Include written plan for dewatering operations including sequence of well and well-point placement coordinated with excavation shoring and bracings and control procedures to be adopted if dewatering problems arise.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by dewatering operations. Submit before Work begins.

2. Record Drawings: Identify locations and depths of capped wells and well points and other abandoned-in-place dewatering equipment.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

1.07 FIELD CONDITIONS

A. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.

B. Make additional test borings and conduct other exploratory operations necessary for dewatering according to the performance requirements.

C. The geotechnical report is referenced elsewhere in Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.08 PRODUCTS

1.09 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer.

C. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, prevention of flooding in excavation, and prevention of damage to subgrades and permanent structures.

D. Prevent surface water from entering excavations by grading, dikes, or other means.

E. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.

F. Remove dewatering system when no longer required for construction.

G. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with water- and debris-disposal regulations of authorities having jurisdiction.

1.010 EXECUTION

1.011 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

B. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site or surrounding area.

C. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

D. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

E. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

F. Provide temporary grading to facilitate dewatering and control of surface water.

G. Protect and maintain temporary erosion and sedimentation controls, which are specified in Section 311000 "Site Clearing," during dewatering operations.

1.012 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Space well points or wells at intervals required to provide sufficient dewatering.

C. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

D. Place dewatering system into operation to lower water to specified levels before excavating below ground-water level.

E. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails.

1.013 OPERATION

A. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

B. Operate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

C. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

E. Maintain piezometric water level a minimum of 24 inches below bottom of excavation.

F. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

G. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

1.014 FIELD QUALITY CONTROL

A. Observation Wells: Provide observation wells or piezometers, take measurements, and maintain at least the minimum number indicated; additional observation wells may be required by authorities having jurisdiction.

B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.

C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.

D. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

E. Survey-Work Benchmarks: Resurvey benchmarks regularly during dewatering and maintain an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

F. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

G. Prepare reports of observations.

1.015 PROTECTION

A. Protect and maintain dewatering system during dewatering operations.

B. Promptly repair damages to adjacent facilities caused be dewatering.

END OF SECTION 312319

SECTION 31 50 00 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes temporary excavation support and protection systems.

B. Related Requirements:
1. Section 01 32 33 "Photographic Documentation" for recording preexisting conditions and excavation support and protection system progress.
2. Section 31 20 00 "Earth Moving" for excavating and backfilling and for controlling surface-water runoff and ponding.
3. Section 31 23 19 "Dewatering" for dewatering excavations.

1.03 REFERENCES/STANDARDS

A. The publications listed below form a part of this Specification to the extent applicable. Except as modified or supplemented herein all pipe, coatings, fittings, appurtenances, and specials shall conform to the applicable requirements of the following standards, latest edition:
1. American Society for Testing and Materials (ASTM)
   a. ASTM A36/A36M – Standard Specification for Carbon Structural Steel.
   b. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile length.
   c. ASTM A328/A328M – Standard Specification for Steel Sheet Piling.
   d. ASTM A572/A572M – Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality.
   e. ASTM A588/A588M – Standard Specification for High-Strength Low-Alloy Structural Steel With 50 ksi (345 MPa) Minimum Yield Point to 4 inch (100 mm) thick.
   f. ASTM A690/A690M – Standard Specification for High-Strength Low-Alloy Steel H-Pipes and Sheet Piling for Use in Marine Environments.
2. American Welding Society, Inc. (AWS)
3. AWS D1.1 – Structural Welding Code – Steel
4. Occupation Safety and Health Administration (OSHA)
   a. 29 CFR Part 1926 – Excavations and Applicable Subparts.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project Site.

B. Review geotechnical report.

C. Review existing utilities and subsurface conditions.

D. Review coordination for interruption, shutoff, capping, and continuation of utility services.

E. Review proposed excavations.

F. Review proposed equipment.

G. Review monitoring of excavation support and protection system.

H. Review coordination with waterproofing.

I. Review abandonment or removal of excavation support and protection system.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

C. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified Professional Engineer licensed in the State of Texas.

D. Include plans, elevations, sections, and details.

E. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.

F. Indicate type and location of waterproofing.

G. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Registered Professional Land Surveyor and Professional Engineer licensed in the State of Texas.

B. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified Professional Engineer responsible for their preparation.

C. Existing Conditions: Using photographs or video recordings, show existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.

D. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support and protection systems, and other subsurface structural, electrical, or mechanical conditions.

1.07 FIELD CONDITIONS

A. Interruption of Existing Utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

B. Notify Owner and Engineer no fewer than forty-eight (48) hours in advance of proposed interruption of utility.

C. Do not proceed with interruption of utility without Owner’s written permission.

D. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of a Geotechnical Engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a Geotechnical Engineer. Owner is not responsible for interpretations or conclusions drawn from the data.

E. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection according to the performance requirements.

F. The geotechnical report is included elsewhere in Project Manual.

G. Survey Work: Engage a qualified Registered Professional Land Surveyor to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1.08 PRODUCTS

1.09 PERFORMANCE REQUIREMENTS

A. Provide, design, monitor, and maintain excavation support and protection systems capable of supporting excavation sidewalls and of resisting earth, hydrostatic pressures, and superimposed and construction loads.

B. Contractor Design: Design excavation support and protection system, including comprehensive Engineering analysis by a qualified licensed Professional Engineer in the State of Texas.

C. Prevent surface water from entering excavations by grading, dikes, or other means.

D. Install excavation support and protection systems without damaging existing buildings, structures, existing utilities, installed utilities, and site improvements adjacent to excavation.

E. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.

1.010 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Trench Boxes: Steel trench Boxes to be constructed of steel conforming to ASTM A36/A36M. Connecting bolts used to conform to ASTM A307. Welds shall conform to the requirements of AWS D1.1.

E. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of size and strength required for application.

F. Timber: Trench sheeting materials shall be full size, a minimum of 2 inches in thickness, solid and sound, free from weakening defects such as loose knots and splits.

G. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

H. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

I. Tiebacks: Steel bars, ASTM A 722/A 722M.

J. Tiebacks: Steel strand, ASTM A 416/A 416M.

1.011 EXECUTION

1.012 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

B. Shore, support, and protect utilities encountered.

C. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

D. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

E. Locate excavation support and protection systems clear of permanent construction so that construction and finishing of other work is not impeded.

1.013 SOLDIER PILES AND LAGGING

A. Install steel soldier piles before starting excavation. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges.

B. Install wood lagging within flanges of soldier piles as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.

1.014 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.

B. Accurately place the piling, using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling.

C. Cut tops of sheet piling to uniform elevation at top of excavation.

1.015 TIEBACKS

A. Drill, install, grout, and tension tiebacks.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

C. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.

D. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

1.016 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Architect.

C. Install internal bracing if required to prevent spreading or distortion of braced frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

1.017 FIELD QUALITY CONTROL

A. Survey-Work Benchmarks: Resurvey benchmarks daily during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open. Maintain an accurate log of surveyed elevations and positions for comparison with

original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

B. Supervision:

1. Provide competent supervisory personnel at each trench while work is in progress to ensure Contractor's methods, procedures, equipment and materials pertaining to the safety systems in this Section are sufficient to meet requirements of OSHA Standards.

C. Inspection:

1. The CONTRACTOR shall make daily inspection of trench safety system to ensure that the system meets OSHA requirements. Daily inspection shall be made by competent personnel. If evidence of possible cave-ins or slides is apparent, all work in the trench is to cease until necessary precautions have been taken to safeguard personnel entering trench. The CONTRACTOR shall maintain permanent record of daily inspections.
2. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
3. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.

1.018 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.

B. Remove excavation support and protection systems.

C. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 "Earth Moving."

D. Repair or replace, as approved by Engineer, adjacent work damaged or displaced by removing excavation support and protection systems.

END OF SECTION 315000

SECTION 316329 - DRILLED CONCRETE PIERS AND SHAFTS

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Dry-installed drilled piers.
   2. Slurry displacement-installed drilled piers.
   3. Dry-installed or slurry displacement-installed drilled piers at Contractor's choice.

1.03 SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement, detailing fabricating, bending, supporting, and placing.

D. Material Certificates: From manufacturer, for the following:
   1. Cementitious materials.
   2. Admixtures.
   3. Steel reinforcement and accessories.

E. Material Test Reports: For each material below, by a qualified testing agency:
   1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

F. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.05 TRIAL DRILLED PIER

A. Trial Drilled Pier: Construct trial drilled pier of diameter and depth and at location indicated or, if not indicated, of same diameter and depth as largest drilled piers, located at least three diameters clear of permanent drilled piers, to demonstrate Installer's construction methods, equipment, standards of workmanship, and tolerances.
   1. Install reinforcement, fill with concrete, remove temporary casings, and terminate trial drilled pier 24 inches (600 mm) below subgrade and leave in place.
   2. Install permanent casings, excavate bell, excavate rock socket, and place slurry, as required for permanent drilled piers.
   3. If Architect determines that trial drilled pier does not comply with requirements, excavate for and cast another until it is accepted.

1.06 FIELD CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.
   1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
   2. Do not proceed with interruption of utility without Owner's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
   1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
   2. The geotechnical report is referenced elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
   1. Record and maintain information pertinent to each drilled pier and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Drilled-Pier Standard: Comply with ACI 336.1 except as modified in this Section.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Epoxy-Coated Reinforcing Bars: deformed bars, ASTM A 775/A 775M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

D. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain. Cut bars true to length with ends square and free of burrs.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150/C 150M, Type I. Supplement with the following:
      a. Fly Ash: ASTM C 618.

B. Normal-Weight Aggregate: ASTM C 33/C 33M, graded, 3/4-inch- (19-mm-) nominal maximum coarse-aggregate size. Provide aggregate from a single source.
   1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Sand-Cement Grout: Portland cement, ASTM C 150/C 150M, Type II; clean natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi (6.9 MPa), of consistency required for application.

2.04 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

B. Corrugated-Steel Pipe Casings: ASTM A 929/A 929M, steel sheet, zinc coated.

C. Liners: Comply with ACI 336.1.

2.05 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 (ACI 301M) limits as if concrete were exposed to deicing chemicals.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Proportion normal-weight concrete mixture as follows:
   1. Compressive Strength (28 Days): 3500 psi (24.1 MPa).
   2. Minimum Slump: Capable of maintaining the following slump until completion of placement:

      a. 4 inches (100 mm) for dry, uncased, or permanent-cased drilling method.
      b. 6 inches (150 mm) for temporary-casing drilling method.
      c. 7 inches (175 mm) for slurry displacement method.

   3. Air Content: Do not air entrain concrete.

2.06 REINFORCEMENT FABRICATION

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.02 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
   1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time are authorized for removal of obstructions.
   2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.

B. Classified Excavation: Excavation is classified as standard excavation, special excavation, and obstruction removal and includes excavation to bearing elevations as follows:
   1. Standard excavation includes excavation accomplished with conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work.
   2. Special excavation includes excavation that requires special equipment or procedures where drilled-pier excavation equipment used in standard excavation, operating at maximum power, torque, and downthrust, cannot advance the shaft.
      a. Special excavation requires use of special rock augers, core barrels, air tools, blasting, or other methods of hand excavation.
      b. Earth seams, rock fragments, and voids included in rock excavation area are considered rock for full volume of shaft from initial contact with rock.

   3. Obstructions: Payment for removing unanticipated boulders, concrete, masonry, or other subsurface obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.

C. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

D. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.
   3. Excavate rock sockets of dimensions indicated.
   4. Cut series of grooves about perimeter of shaft to height from bottom of shaft, vertical spacing, and dimensions indicated.

E. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.

F. End-Bearing Drilled Piers: Probe with auger to a depth below bearing elevation, equal to diameter of the bearing area of drilled pier. Determine whether voids, clay seams, or solution channels exist.
   1. Test first three drilled piers and one of every six drilled piers thereafter.
   2. Fill augur-probe holes with grout.

G. End-Bearing Drilled Piers: Probe with auger to a depth of 96 inches (2450 mm) below bottom elevation of shaft, and visually inspect and classify soil. Verify continuity and thickness of strata.
   1. Test first three drilled piers and one of every six drilled piers thereafter.

H. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

I. Slurry Displacement Method: Stabilize excavation with slurry maintained a minimum of 60 inches (1500 mm) above ground-water level and above unstable soil strata to prevent caving or sloughing of shaft. Maintain slurry properties before concreting.

1. Excavate and complete concreting of drilled pier on same day, or redrill, clean, and test slurry in excavation before concreting.

J. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.

1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete, or leave temporary casings in place.

K. Bells: Excavate bells for drilled piers to shape, base thickness, and slope angle indicated. Excavate bottom of bells to level plane and remove loose material before placing concrete.

1. Shore bells in unstable soil conditions to prevent cave-in during excavation, inspection, and concreting.

L. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.

1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to Architect for review before proceeding.

3.03 PERMANENT STEEL CASING INSTALLATION

A. Install permanent steel casings of minimum wall thickness indicated and of diameter not less than diameter of drilled pier.

1. Install casings as excavation proceeds, to maintain sidewall stability.
2. Fabricate bottom edge of lowest casing section with cutting shoe capable of penetrating rock and achieving water seal.
3. Connect casing sections by continuous penetration welds to form watertight, continuous casing.
4. Remove and replace or repair casings that have been damaged during installation and that could impair strength or efficiency of drilled pier.
5. Fill annular void between casing and shaft wall with grout.

B. Corrugated-Steel Casings: Provide corrugated-steel casings formed from zinc-coated steel sheet.

1. Corrugated casings may be delivered in sections or panels of convenient length and field connected according to manufacturer's written instructions.

3.04 STEEL REINFORCEMENT INSTALLATION

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.05 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by either a qualified Special Inspector or testing agency.
   1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete and insert joint dowel bars. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
   1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
   2. Vibrate top 60 inches (1500 mm) of concrete.

C. Slurry Displacement Method: Place concrete in slurry-filled shafts by tremie methods or pumping. Control placement operations to ensure that tremie or pump pipe is embedded no less than 60 inches (1500 mm) into concrete and that flow of concrete is continuous from bottom to top of drilled pier.

D. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch (1500-mm) head of concrete above bottom of casing.
   1. Vibrate top 60 inches (1500 mm) of concrete after withdrawal of temporary casing.

E. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

F. Protect concrete work, according to ACI 301 (ACI 301M), from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

G. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 (ACI 301M) to maintain delivered temperature of concrete at no more than 90 deg F (32 deg C).

1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.06 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by Architect.

C. Concrete Tests and Inspections: ASTM C 172/C 172M except modified for slump to comply with ASTM C 94/C 94M.
1. Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
2. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
3. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
4. Compressive-Strength Tests: ASTM C 39/C 39M; one set for each drilled pier but not more than one set for each truck load. Test one specimen at seven days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
5. If frequency of testing provides fewer than five strength tests for a given class of concrete, conduct tests from at least five randomly selected batches or from each batch if fewer than five are used.
6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture is satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency to make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if

observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.

11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

D. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Depth of rock socket.
11. Levelness of bottom and adequacy of cleanout.
12. Properties of slurry and slurry test results at time of slurry placement and at time of concrete placement.
13. Ground-water conditions and water-infiltration rate, depth, and pumping.
14. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
15. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
16. Bell dimensions and variations from original design.
17. Date and time of starting and completing excavation.
18. Inspection report.
19. Condition of reinforcing steel and splices.
20. Position of reinforcing steel.
21. Concrete placing method, including elevation of consolidation and delays.
22. Elevation of concrete during removal of casings.
23. Locations of construction joints.
24. Concrete volume.
25. Concrete testing results.
26. Remarks, unusual conditions encountered, and deviations from requirements.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 31 63 29

SECTION 32 05 23 - CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
   2. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture.

1.04 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. Comply with the following sections of ACI 301 unless modified by requirements in the Contract Documents:
   1. "General Requirements."
   2. "Formwork and Formwork Accessories."
   3. "Reinforcement and Reinforcement Supports."
   4. "Concrete Mixtures."
   5. "Handling, Placing, and Constructing."

B. Comply with ACI 117.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.

B. Plain-Steel Wire: Not Allowed

C. Plain-Steel Welded-Wire Reinforcement: Not Allowed

D. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.03 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: conforming to ASTM C 150, Type I, Type II, or Type III.
2. Fly Ash: ASTM C 618, Class C or F.

C. Normal-Weight Aggregate: ASTM C 33, 1-1/2-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C 260.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494, Type A.
2. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
3. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

F. Water: ASTM C 94

2.04 RELATED MATERIALS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.05 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.06 CONCRETE MIXTURES

A. Comply with ACI 301.

B. Normal-Weight Concrete:
1. Minimum Compressive Strength: 4000 psi or as indicated at 28 days.
2. Maximum W/C Ratio: 0.45 or as indicated.
3. Slump Limit: 5 inches, plus or minus 1 inch.
4. Air Content: Maintain within range permitted by ACI 301.

2.07 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is above 75 deg F and below 90 95 deg F, reduce mixing and delivery time to a maximum of 60 minutes
2. When air temperature is above 90 95 deg F, reduce mixing and delivery time to a maximum of 45 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.01 FORMWORK INSTALLATION

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.02 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 VAPOR-RETARDER INSTALLATION

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
   1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.04 STEEL REINFORCEMENT INSTALLATION

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
   1. Reinforcement shall be accurately positioned and, unless otherwise shown or specified, shall be secured against displacement by using at intersection, annealed iron wire of not less than No. 18 gauge or suitable metal clips. It shall be supported by plastic or metal chairs or spacers.
   2. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.05 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction/Expansion Joints: Install so strength and appearance of concrete are not impaired, at a spacing equal to twenty-four (24) times the thickness of the concrete in inches or at locations indicated or approved by Engineer.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.

3.06 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Site concrete tolerances shall be per current ACI 301 requirements.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Consolidate concrete with mechanical vibrating equipment according to ACI 301.

E. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.
   2. Construct concrete bases 6 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
   3. Minimum Compressive Strength: 4000 psi or as indicated at 28 days.
   4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor them into structural concrete substrate.
   6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.07 FINISHING FORMED SURFACES

A. Chamfer edges by grinding or dry rubbing.

B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding 1/2 inch.
   1. Apply to concrete surfaces not exposed to public view.

C. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum number of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

D. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301, to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-rubbed finish.
   2. Grout-cleaned finish.
   3. Cork-floated finish.

E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.08 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes unless otherwise indicated.

D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.

E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.

G. Slip-Resistive Broom Finish: Apply a slip-resistive finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.09 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall

within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.010 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.
   1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 1 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

END OF SECTION 320523

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes Concrete Paving Including the Following:
   1. Roadways.
   2. Intersections.
   3. Curbs and gutters.

B. Related Requirements:
   1. Section 033053 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
   2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   3. Section 321723 "Pavement Markings."

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.

   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving Subcontractor.
      e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

C. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Steel reinforcement and reinforcement accessories.
   3. Fiber reinforcement.
   4. Admixtures.
   5. Curing compounds.
   6. Applied finish materials.
   7. Bonding agent or epoxy adhesive.
   8. Joint fillers.

C. Material Test Reports: For each of the following:
   1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.07 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.09 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below ~~90~~ 95 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60; deformed.

B. Joint Dowel Bars: ASTM A 615, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A 767, Class I coating. Cut bars true to length with ends square and free of burrs.

C. Tie Bars: ASTM A 615, Grade 60; deformed.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
   2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

E. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

2.04 CONCRETE MATERIALS

A. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type I/II.
   2. Fly Ash: ASTM C 618, Class C.
   3. Slag Cement: ASTM C 989, Grade 100 or 120.
   4. Blended Hydraulic Cement: ASTM C 595, Type IL, Portland-limestone cement.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory

service in similar paving applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Air-Entraining Admixture: ASTM C 260.

D. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

E. Water: Potable and complying with ASTM C 94.

2.05 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. BASF Corporation; Construction Systems.
b. Sika Corporation.
c. W. R. Meadows, Inc.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.
b. W. R. Meadows, Inc.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
a. Anti-Hydro International, Inc.
b. W. R. Meadows, Inc.

2.06 RELATED MATERIALS

A. Joint Fillers:
1. Asphalt-saturated cellulosic fiber in preformed strips meeting ASTM D 1751.

2. Polypropylene joint filler plank meeting ASTM D 1751, ASTM D 8139, and ASTM D 545.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Sika Corporation.

2.07 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 5 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.
1. Compressive Strength (28 Days): 4000 psi or as indicated at 28 days.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 5 inches, plus or minus 1 inch.

2.08 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 95 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 95 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
   1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of as indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:
   1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting

action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

2. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 3/8-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.06 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
      a. Water.
      b. Continuous water-fog spray.
      c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
   2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
   3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.09 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-feet- long; unleveled straightedge not to exceed 1/8 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch.
   6. Vertical Alignment of Dowels: 1/4 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
   8. Joint Spacing: 3 inches.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

3.010 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 75 cu. yd. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C 39; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.011 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 32 13 73 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cold-applied joint sealants.
   2. Integrated Cap System

B. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of joint sealant and accessory.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.06 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Self-Leveling, Silicone Joint Sealant: ASTM D 5893, Type SL.

B. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

2.03 INTEGRATED CAP SYSTEM

A. Integrated expansion board cap water stop system for ¾" expansion board.
   1. G-Seal by Greenstreak, Inc.
   2. Earthshield by JP Specialties, Inc.
   3. EB-CAP Waterstop by Westec
      a. Use of asphalt impregnated fiber board over red wood is preferred; however, redwood is allowed to be used in combination with a G-Seal. With either material, it is the responsibility of the contractor to ensure the pour is reinforced.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of joint-sealant backings.

2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:
1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:
1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.05 PAVING-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within concrete paving.
1. Joint Location:
a. Expansion and isolation joints in concrete paving.
b. Contraction joints in concrete paving.
c. Other joints as indicated.

2. Joint Sealant: Single-component, nonsag, silicone joint sealant, Single-component, self-leveling, silicone joint sealant, and Single component, pourable, urethane, elastomeric joint sealant.

3. Joint-Sealant Color: As approved by Architect.

B. Joint-Sealant Application: Joints within concrete paving and between concrete and asphalt paving.
1. Joint Location:
a. Joints between concrete and asphalt paving.
b. Joints between concrete curbs and asphalt paving.
c. Other joints as indicated.
2. Joint-Sealant Color: As approved by Architect.

END OF SECTION 321373

SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to marking pavement including, but not limited to, the following:
      a. Pavement aging period before application of pavement markings.
      b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.
   1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
   2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Texas MUTCD for pavement-marking work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials and 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Conco Paints.
   2. Dow Chemical Company (The).
   3. PPG Architectural Coatings.

4. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.

2.02 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Pavement-Marking Paint: Pavement-Marking Paint: Type II Pavement Marking Materials in accordance with TxDOT ITEM 666 and DMS-8200.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.02 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond the stencil. Apply paint so that it cannot run beneath the stencil.

3.03 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 33 05 00 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
1. Identification devices.
2. Grout.
3. Flowable fill.
4. Piped utility demolition.
5. Piping system common requirements.
6. Equipment installation common requirements.
7. Concrete bases.

1.03 RELATED REQUIREMENTS

1. Section 02 41 19 "Selective Demolition" for general demolition requirements and procedures.
2. Section 03 30 00 “Cast-In-Place Concrete” for blocking and fitting support
3. Section 31 20 00 “Earth Moving” for excavating, trenching, and backfilling
4. Section 31 23 19 “Dewatering” for lowering and disposing of ground water during construction.
5. Section 31 50 00 “Excavation Support and Protection” for shoring, bracing, and sheet piling excavations.
6. Section 33 14 16 “Site Water Utility Distribution Piping”
7. Section 33 31 13 “Site Sanitary Sewerage Gravity Piping”

1.04 DEFINITIONS

A. Retain terms and abbreviations that remain after this Section has been edited.

B. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

C. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

D. ABS: Acrylonitrile-butadiene-styrene plastic.

E. CPVC: Chlorinated polyvinyl chloride plastic.

F. PE: Polyethylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.05 ACTION SUBMITTALS

A. Product Data: Submit manufacturer’s data for each type of product indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Mix Design

C. Shop Drawings: indicate dimensions, method of field assembly, and components.

D. Manufacturers recommended fusion/connection procedures for the products

E. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 QUALITY ASSURANCE

A. Delete first paragraph below if no welding. Retain "Welding certificates" Paragraph in "Informational Submittals" Article if retaining below. AWS states that welding qualifications remain in effect indefinitely unless welding personnel have not welded for more than six months or there is a specific reason to question their ability.

B. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
   1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
   2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

D. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.09 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete.".

PART 2 - PRODUCTS

2.01 IDENTIFICATION DEVICES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 5 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried as indicated; APWA standard color coded as follows:
   1. Electric: Red
   2. Telephone and other communications: Orange
   3. Water: Blue
   4. Sewer: Green

5. Gas: Yellow

2.02 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
   1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
   2. Design Mix: 500-psi, 28-day compressive strength.
   3. Packaging: Premixed and factory packaged.

2.03 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.
   1. Cement: ASTM C 150, Type I, portland.
   2. Density: 115- to 145-lb/cu. ft..
   3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
   4. Retain subparagraph above or first two subparagraphs below.
   5. Aggregates: ASTM C 33, natural sand, fine.
   6. Admixture: ASTM C 618, fly-ash mineral.
   7. Water: Comply with ASTM C 94/C 94M.
   8. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.01 PIPED UTILITY DEMOLITION

A. Delete this Article if no piped utility demolition is required. Edit paragraphs and subparagraphs below as required for piped utility demolition. Show items for demolition on Drawings and supplement Drawings with descriptions in this Article.

B. Refer to Section 02 41 19 "Selective Demolition" for general demolition requirements and procedures.

C. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.
   1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
   2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or concrete bulkheads.
   3. Equipment to Be Removed: Disconnect and cap services and remove equipment.

D. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
   1. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

E. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.02 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping to permit valve servicing.

D. Install piping at indicated slopes.

E. Install piping free of sags and bends.

F. Install fittings for changes in direction and branch connections.

G. Select system components with pressure rating equal to or greater than system operating pressure.

3.03 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
   1. Plain-End PE Pipe and Fittings: Use butt fusion or electrofusion
   2. Plain-End PE Pipe and Valves: Flange Adaptor.

L. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.04 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 330500

SECTION 33 14 16 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Water-distribution piping and related components for combined water service and fire-service mains.
2. Pipe-laying
3. Coupling
4. Fittings
5. Valves and valve boxes
6. Combination Air Release Valves
7. Fire Hydrants
8. Wet connections
9. Testing

B. Related Requirements
1. Section 03 30 00 “Cast-In-Place Concrete” for blocking and fitting support
2. Section 31 20 00 “Earth Moving” for excavating, trenching, and backfilling
3. Section 31 23 19 “Dewatering” for lowering and disposing of ground water during construction.
4. Section 31 50 00 “Excavation Support and Protection” for shoring, bracing, and sheet piling excavations.
5. Section 33 05 00 “Common Work Results for Utilities”

C. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.03 REFERENCES/STANDARDS

The publications listed below form a part of this Specification to the extent applicable. Except as modified or supplemented herein all pipe, coatings, fittings, appurtenances, and specials shall conform to the applicable requirements of the following standards, latest edition:

A. American Society for Testing and Materials (ASTM)
1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds (Latest Edition)
2. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe (Latest Edition)
3. ASTM F 1483 – Standard Specification for Oriented Poly (Vinyl Chloride), (PVCO) Pressure Pipe (Latest Edition)
4. ASTM C33 – Standard Specification for Concrete Aggregates
5. ASTM C150 – Standard Specification for Portland Cement
6. ASTM D1598 – Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
7. ASTM D1599 – Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
8. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

9. ASTM D2152 – Standard Test Method for Adequacy of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
10. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
11. ASTM D2672 – Standard Specification for joint for IPS PVC Pipe Using Solvent Cement
12. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

B. American Water Works Association (AWWA)
1. AWWA C104 – Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
2. AWWA C105 – Polyethylene Encasement for Ductile Iron Pipe Systems
3. AWWA C111 – Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
4. AWWA C115 – Flanged Ductile Iron Pipe with Threaded Flanges
5. AWWA C116 – Protective Fusion Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings for Water Supply Services
6. AWWA C153 – ANSI Standard for Ductile-Iron Compact Fittings, 3 inch through 64 inch.
7. AWWA C207 – Steel Pipe Flanges for Waterworks Service, 4 inch through 144 inch.
8. AWWA C512 – Air-release, Air/Vacuum, and Combination Air Vales for Waterworks Service.
9. AWWA C515 – Reduced-Wall, Resilient Seated Gate Valves for Water Supply Service
10. AWWA C651 – Disinfecting Water Mains.
11. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe, 4-Inch through 12 – Inch for Water Distribution (Latest Edition)
12. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in – 48in.
13. AWWA C909 – Molecularyly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe. 4-Inch Through 12-Inch for Water Distribution (Latest Edition)

C. American National Standards Institute (ANSI)
1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings

D. National Sanitary Foundation (NSF)
1. NSF/ANSI Standard 14 – Plastics Piping System Components and Related Materials
2. NSF/ANSI Standard 61 – Drinking Water System Components

E. Plastics Pipe Institute (PPI)
1. PPI TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strengths (MRS) for Thermoplastics Piping Materials for Pipe.
2. PPI TR-4 – PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strengths (MRS) for Thermoplastics Piping Materials for Pipe.
3. PPI TR-33 – Generic Butt Fusion Joining Procedure for Polyethylene Gas Pipe.
4. PPI TR-41 – Generic Saddle Fusion Joining Procedure for Polyethylene Gas Piping.

F. Texas Commission on Environmental Quality (TCEQ)
1. 30 TAC 290 Subchapter D – Rules and Regulations for Public Water Systems.

1.04 DEFINITIONS

A. PE: Polyethylene plastic.

B. PVC: Polyvinyl chloride plastic.

1.05 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of product indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Shop Drawings: indicate dimensions, method of field assembly, and components.

C. Manufacturers recommended fusion/connection procedures for the products

D. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

B. Testing and Bacteriologic reports

1.07 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
   2. Comply with rules and regulations of the Texas Comission of Environmental Quality (TCEQ) 30 TAC 290 for potable-water-service piping, including materials, installation, testing, and disinfection.
   3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Manufacturers shall have a quality management system that is certified to ISO 9001 be an accredited, certifying body.

C. Pipe, tubing, and fittings shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, or other injurious defects.

D. Piping materials shall be permanently marked to identify size, dimension ratio, pressure class, material, and the manufacturer's production code per AWWA C906. Marking shall be heat stamped indent print and shall remain legible under normal handling and installation practices.

E. Fittings shall be marked on the body or hub. Marking shall be in accordance with the applicable standard depending upon the fitting type. Mechanical fittings shall be marked with size, body material designation code, pressure rating and the Manufacture's name or trademark.

F. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

G. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

H. NSF Compliance: Comply with NSF 61 Annex G for materials for water-service piping and specialties for domestic water.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare piping, valves including fire hydrants, fabrications, and appurtenances according to the following:

1. All components shall be prepared for shipment to afford maximum protection from normal hazards of transportation and all the components to reach the Site in an undamaged condition.
2. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
3. Ensure that valves including fire hydrants and appurtenances are dry and internally protected against rust and corrosion.
4. Protect valves including fire hydrants and appurtenances against damage to threaded ends and flange faces.
5. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Unloading: Use precautions for piping, valves including fire hydrants, fabrications, and appurtenances according to the following:
1. Each manufacturer's recommendations for their product.
2. Prior to unloading, inspect all products for damage and report to manufacturer and remove from site.
3. Appropriate unloading and handling equipment of adequate capacity shall be used to unload delivery trucks.
4. Only properly trained personnel should operate unloading and handling equipment.
5. Components shall not be pushed or dumped off the delivery vehicle or dropped.

C. During Storage: Use precautions for piping, valves including fire hydrants, fabrications, and appurtenances according to the following:
1. Each manufacturer's recommendations for their product
2. Pipe, fittings, fabrications, and appurtenances shall be separated so that they do not bear against each other.
3. All components shall be supported off of the ground by cribs, pallets, dunnage, or stulls.
4. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
5. Protect from weather. Store indoors, if required, and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
6. Store plastic piping protected from direct sunlight.
7. Protect piping, flanges, fittings, fabrications, and appurtenances from moisture and dirt.

D. Handling:
1. Follow manufacturer's recommendations when handling their product
2. Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts.
3. Avoid placing slings where they will bear against outlets or fittings.
4. Do not use handwheels, stems, stub outs, outlets, or fittings as lifting or rigging points.

1.09 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
1. Notify Engineer, Construction Manager, and Owner no fewer than forty-eight (48) hours in advance of proposed interruption of service.
2. Do not proceed with interruption of water-distribution service without Owner's written permission.

1.010 COORDINATION

A. Coordinate all connections with UES.

B. Notify Engineer and Owner no fewer than forty-eight (48) hours in advance of proposed connections.

C. Do not proceed with the proposed connection inside the water tower service yard without Owner's written permission.

PART 2 - PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
   2. Copper, Pressure-Seal Fittings:
      a. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
      b. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

2.02 PVC PIPE AND FITTINGS

A. PVC AWWA Pipe
   1. Blue colored Polyvinyl chloride (PVC) pressure pipe, six inch (6") through twelve inch (12"), shall conform to the current AWA – C900 DR 14, be UL listed, be approved by the Texas State Board of Insurance and the National Sanitation Foundation. The outside diameter shall be identical to ductile-iron pipe (CIOD Standard, Table 2, AWWA – C900). All pipes shall be new and have the AWWA designation, pressure class, DR pressure rating and size of pipe stamped on the outside of each joint (follow requirements of C900 2.5.2 Markings). All piping shall be new. Partial pieces from other projects shall not be approved for installation. Metal detector tape shall be installed above all PVC pipe at an elevation for 2 feet below natural ground.
   2. PVC pipe smaller than four inches (4") shall be SCH 40 PVC piping.
   3. PVC Pressure Pipe shall be designed and tested in accordance with ATM D1598, D1599, and D2152.

B. Fittings
   1. Fittings for PVC water pipe shall be ductile-iron, and shall conform to AWWA C153, unless otherwise specified.
   2. Fitting joints shall be mechanical joints. Bolts and nuts for mechanical joints or flanged ends will be of a high strength corrosion resistant low-alloy steel and shall conform to AWWA C111.
   3. Flange bolts and nuts for above ground installation shall conform to Appendix A of AWWA C115. Flange bolts and nuts for below ground installation shall be 316 stainless steel. All fittings shall be epoxy coated and line unless stainless steel is used.
   4. Where joints are to be retrained, mega-lug type fittings are required for pipe three inches in size and larger.
   5. Polyethylene wrap or encasement of metal fittings shall conform to AWWA C105. Joint tape shall be self-sticking PVC or 8-mil-thick polyethylene.
   6. Joints: PVC water pipe shall be finished with an elastomeric gasket at each joint and an integral thickened bell as part of each joint. Pipe and fittings must be assembled with a non-toxic lubricant. Provisions must be made at each joint for expansion and contraction. Refer to ASTM F477, D3139 and D3212.

2.03 JOINING AND JOINING MATERIALS

A. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

B. Refer to Section 33 05 00 "Common Work Results for Utilities" for commonly used joining materials.

2.04 GATE VALVES

A. AWWA, Gate Valves:
   1. Acceptable Manufactures:
      a. American Flow Control Series 2500
      b. Clow Model No. 2638
      c. Approved Equal
   2. Nonrising-Stem, Resilient-Seated Gate Valves:
      a. Description: ductile-iron body and bonnet; with cast-iron gate, resilient seat, bronze stem, and stem nut. Brass nut is not allowed.
         1) Standard: AWWA C515.
         2) Minimum Pressure Rating: 250 psig.
         3) End Connections: Flanged.
         4) Interior Coating: Complying with AWWA C550.
   3. Valves shall be installed in a vertical position
   4. Gate valves shall be installed seated on a 12-inch x 12-inch x 4-inch solid concrete block.
   5. All valves shall be square nut operated and opened by turning to the left (counter clockwise). Operator nuts shall be 2-inch square.

2.05 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:
   1. Description: Sleeve and valve compatible with drilling machine.
      a. Standard: MSS SP-60.
      b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
      c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter. Concrete valve box collars (24-inch x 24-inch x 6-inch) shall be installed with each gate valve.
   1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Operator extension shafts are required on all valves when the operating nut is over 2-feet below finished grade. Extension shaft is to bring the operating nut to within 1-foot of the top of the valve box. Extension shaft shall have a centering collar placed directly below the operating nut and shall be bolted to the valve operating nut with stainless steel set screw. The extension shaft shall be stainless steel.

D. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.06 FIRE HYDRANTS

A. Dry-Barrel Fire Hydrants:
   1. Acceptable Manufactures:
      a. American Flow Control 5-1/4” B-84-B

2. Description: Freestanding, with one 5” Storz and two NSH 2-1/2 outlets, 5-1/4-inch main valve, drain valve, and NPS 6 mechanical-joint inlet. Include interior coating according to AWWA C550. Hydrant shall have cast-iron body, compression-type valve opening against pressure and closing with pressure.
   a. Standard: AWWA C502.
   b. Pressure Rating: 250 psig tested to 500 psig hydrostatic pressure.
   c. Operating and Cap Nuts: Non-rising, Pentagon, 1-1/2 inches from point to flat as base of nut; bronze.
   d. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.
   e. Exterior Finish: Red alkyd-gloss enamel paint, unless otherwise indicated.
   f. Color: Coordinate with owner on paint color prior to submittal.
3. Hydrants shall be traffic-model type having upper and lower barrels joined approximately 2-inches above the ground line by a separated and breakable “swivel” flange providing 260 degree rotation of the upper barrel for proper nozzle facing. This flange must employ not less than eight bolts.

2.07 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:
1. Description: Freestanding, with cast-bronze body, matching local fire department hose thread. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; sleeve; and signage.
   a. Standard: NFPA 13, NFPA 13R, NFPA 14; Annex D of the “Texas A&M University Supplemental Design, Installation, and Acceptance Guide for Fire and Life Safety Systems”, latest edition.
   b. Connections:
      1) Supply lines of 4” or greater: Single 5” Storz fire department connection with Knox StorzGuard Cap (Model 5002)
      2) Supply lines smaller than 4”: Two NSH 2-1/2” with Knox Caps (Model 3043)
   c. Finish Including Sleeve: Polished bronze.
   d. Remote FDC signage shall be red with white letters not less than 6” high and not less than a 1” stroke. Wording shall indicate building number, “AUTO SPKR” and/or “STANDPIPE”, and floors served by FDC. Coordinate with MEP, Architect, and EH&S.
   e. Attached FDCs shall be red with white letters not less than 6” high and not less than a 1” stroke. Wording shall be “FDC”.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

B. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install PVC corrosion-protection encasement according to AWWA C105.
2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

C. Install PVC, AWWA pipe and fittings according to ASTM D 2564 and AWWA C905.

D. Bury piping with depth of cover over top at least 36-inches, and according to the following:
1. Under Driveways: With at least 48 inches cover over top.
2. Under Railroad Tracks: With at least 48 inches cover over top.

E. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

F. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

G. Sleeves are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

H. Mechanical sleeve seals are specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

I. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.03 JOINT CONSTRUCTION

A. See Section 330500 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:
   1. PVC Piping, push-on or mechanical joints: Use joining materials and methods according to AWWA C905 and according to fitting manufacturer's written instructions.

3.04 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Heat-fused joints.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.05 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.06 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. AWWA Fire Hydrants: Comply with AWWA M17.

3.07 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

B. Install protective pipe bollards on two sides of each fire department connection.

3.08 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Prepare reports of testing activities.

3.09 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

B. Install electrically continuous trace wire with access points as described below to be used for locating pipe with an electronic pipe locator after installation.
   1. Tracer wire to be 14 gauge minimum solid copper with thermoplastic insulation recommended for direct burial. Each trace wire access point to be composed of one Copperhead® SnakePit® Magnetized Tracer Box, Traffic Rated, Test and Monitoring Station or per-approved equal installed in each 24-inch x 24-inch x 6-inch concrete pad.
   2. Trace wire access points shall in general be no more than five-hundred (500) feet and at every proposed 24” x 24” x 6” concrete valve box collar. Concentrations of multiple proposed valves near pipe intersections, i.e. tees or crosses, may require more than one access point assembly in each concrete valve box collar. Trace wire access points shall be within public right-of-way or public utility easements.
   3. Trace wire shall be installed on all water mains. The wire shall be installed in such a manner as to be able to properly trace all water mains and/or sewer force mains without loss or deterioration of signal or without the transmitted signal migrating off the tracer wire
   4. Trace wire shall be installed in the same trench and inside bored holes and casing with pipe during pipe installation. It shall be secured to the pipe as required to insure that the wire remains adjacent to the pipe.
   5. Tracer wire shall be laid flat. The wire shall be protected from damage during the execution of the works. No breaks or cuts in the tracer wire or tracer wire insulation shall be permitted. At water service saddles, the tracer wire shall not be allowed to be placed between the saddle and the water main.

3.010 CLOSING ABANDONED WATER DISTRIBUTION SYSTEM PIPING

A. Abandoned Piping to Section 33 05 00 “Common Work Results for Utilities”

B. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.011 HYDROSTATIC TESTING, CLEANING, AND DISINFECTING

A. Test and perform all disinfection in sections.

B. Hydrostatic Tests: Test at not less than 150 psi for one hour, or per manufacturer’s recommendations or jurisdictional requirements, whichever is more stringent.
   1. The Contractor shall provide all necessary taps and equipment to complete this section.
   2. Hydrostatic testing shall take place prior to placement of pavement.
   3. Fill the restrained test section completely with potable water per manufacturers recommendations. A fill rate of 10-feet per minute axial velocity is suggested per PPI TN-46. After filling, allow time for the system to reach thermal equilibrium and allow for any dissolved air to exit the system air vents. Provide venting as necessary.
   4. Initial Expansion Phase: Gradulaly pressurize the test section to 10-psi greater than test pressure and add make-up water as necessary to maintain pressure for four (4) hours. Additional potable water will be required to maintain pressure due to expansion of the

pipe. The amount of additional potable water will vary because of non-linear expansion of the pipe. If pressure cannot be attained, or if there is an unreasonable time to reach pressure, there may be faults such as excessive leakage, entrapped air, open valves, or the pressurizing equipment may be inadequately sized. Correct faults before continuing.

5. Test Phase: Immediately following the initial expansion phase, reduce pressure to test pressure and stop adding potable water. Monitor the pressure for 1 hour. Pressure must be maintained for 1 hour within 5% of test pressure.
6. Depressurize the test section by reducing pressure or releasing test liquid at a controlled rate. Sudden depressurization can cause a water hammer.

C. Clean and disinfect water-distribution piping as follows:
   1. The Contractor shall provide all necessary taps, equipment, and chemicals to complete this section.
   2. Flush new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
      a. The flushing velocity shall be greater than 2.5 feet per second. Continue flushing until dirty water does not appear at outlet.
   3. Disinfecting procedure described in AWWA C651.

   4. Final Flushing
      a. After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is less than three milligrams per liter (3 mg/1). Chlorine residual determination shall be made by the Inspector to ascertain that the heavily chlorinated water has been removed from the pipeline.

   5. Bacteriologic Tests
      a. Before the water main is placed in service, a sample or samples shall be collected from points designated by the Inspector and tested for bacteriologic quality. This sample shall be collected 24 hours after final flushing. The test shall show the absence of coliform organisms before the water main may be placed in service. At least one (1) sample per one thousand (1000) feet of new line or portion thereof shall be taken. Sampling shall be supervised by the Inspector. Samples shall be submitted by the city to a TCEQ approved laboratory and/or County Health Department for analysis.
      b. Samples of bacteriologic analysis shall be collected in sterile bottles obtained from the Brazos County Health Department. Samples shall be collected at points specified by the Engineer.
      c. A suggested sampling tap consists of a standard corporation cock installed in the main with a copper tube gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

   6. Repetition of procedure
      a. If the initial disinfection fails to produce samples with no coliform present, the contractor shall re-disinfect the line following the procedures stated in 695.04 of this specification until samples indicating no coliform present have been obtained. When the samples indicate no coliform present and the Engineer has received original copies of the test report, the main may be placed in service.

D. Prepare reports of hydrostatic testing, flushing, and disinfecting activities.

END OF SECTION 331416

SECTION 33 31 13 - SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. PVC pipe and fittings.
2. Cleanouts.
3. Manholes.
4. Concrete.
5. Closing Abandoned Sanitary Sewer Systems
6. Bypass Pumping
7. Testing

1.03 RELATED REQUIREMENTS

1. Section 03 30 00 “Cast-In-Place Concrete” for blocking and fitting support
2. Section 31 20 00 “Earth Moving” for excavating, trenching, and backfilling
3. Section 31 23 19 “Dewatering” for lowering and disposing of ground water during construction.
4. Section 31 50 00 “Excavation Support and Protection” for shoring, bracing, and sheet piling excavations.
5. Section 33 05 00 “Common Work Results for Utilities”

1.04 REFERENCES/STANDARDS

The publications listed below form a part of this Specification to the extent applicable. Except as modified or supplemented herein all pipe, coatings, fittings, appurtenances, and specials shall conform to the applicable requirements of the following standards, latest edition:

A. American Society for Testing and Materials (ASTM)
1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds (Latest Edition)
2. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe (Latest Edition)
3. ASTM F 1483 – Standard Specification for Oriented Poly (Vinyl Chloride), (PVCO) Pressure Pipe (Latest Edition)
4. ASTM C33 – Standard Specification for Concrete Aggregates
5. ASTM C150 – Standard Specification for Portland Cement
6. ASTM D1598 – Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
7. ASTM D1599 – Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
8. ASTM D2122 – Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
9. ASTM D2152 – Standard Test Method for Adequacy of Fusion of Extruded Poly (Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
10. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
11. ASTM D2672 – Standard Specification for joint for IPS PVC Pipe Using Solvent Cement

12. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
13. ASTM F679 – Standard Specification for Poly (Vinyl Chloride) (PVC) Large – Diameter Plastic Gravity Sewer Pipe and Fittings
14. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
15. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

B. American Water Works Association (AWWA)
1. AWWA C105 – ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
2. AWWA C905 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 in – 48in.

C. National Sanitary Foundation (NSF)
1. NSF/ANSI Standard 14 – Plastics Piping System Components and Related Materials
2. NSF/ANSI Standard 61 – Drinking Water System Components

D. Plastics Pipe Institute (PPI)
1. PPI TR-3 – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strengths (MRS) for Thermoplastics Piping Materials for Pipe.
2. PPI TR-4 – PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strengths (MRS) for Thermoplastics Piping Materials for Pipe.

E. Texas Commission on Environmental Quality (TCEQ)
1. 30 TAC 217 Subchapter C – Conventional Collection Systems

1.05 DEFINITIONS

A. PVC: Polyvinyl chloride

B. FRP: Fiberglass-reinforced plastic.

1.06 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's data for each type of product indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Shop Drawings: indicate dimensions, method of field assembly, and components.
1. For manholes, include plans, elevations, sections, details, and rings and covers.

C. Manufacturers recommended fusion/connection procedures for the products

D. Submit manufacturer's "Certificate of Compliance", stating that the materials furnished comply with this specification.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

B. Testing and field quality reports

1.08 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with requirements of utility company collecting wastewater.

2. Comply with rules and regulations of the Texas Commission of Environmental Quality (TCEQ) 30 TAC 217 for wastewater collection system piping, including materials, installation, and testing.

B. Manufacturers shall have a quality management system that is certified to ISO 9001 be an accredited, certifying body.

C. Pipe, tubing, manholes, and fittings shall be homogenous throughout and free of visible cracks, holes, foreign inclusions, blisters, dents, or other injurious defects.

D. Piping materials shall be permanently marked to identify size, dimension ratio, pressure class, material, and the manufacturer's production code per SDR26 – ASTM D3034. Marking shall be heat stamped indent print and shall remain legible under normal handling and installation practices.

E. Fittings shall be marked on the body or hub. Marking shall be in accordance with the applicable standard depending upon the fitting type. Mechanical fittings shall be marked with size, body material designation code, pressure rating and the Manufacture's name or trademark.

F. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare piping, manholes, fabrications, and appurtenances according to the following:
1. All components shall be prepared for shipment to afford maximum protection from normal hazards of transportation and all the components to reach the Site in an undamaged condition.
2. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. During Unloading: Use precautions for piping, manholes, fabrications, and appurtenances according to the following:
1. Each manufacturer's recommendations for their product.
2. Prior to unloading, inspect all products for damage and report to manufacturer and remove from site.
3. Appropriate unloading and handling equipment of adequate capacity shall be used to unload delivery trucks.
4. Only properly trained personnel should operate unloading and handling equipment.
5. Components shall not be pushed or dumped off the delivery vehicle or dropped.

C. During Storage: Use precautions for piping, manholes, fabrications, and appurtenances according to the following:
1. Each manufacturer's recommendations for their product
2. Pipe, fittings, fabrications, and appurtenances shall be separated so that they do not bear against each other.
3. All components shall be supported off of the ground by cribs, pallets, dunnage, or stulls.
4. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
5. Protect from weather. Store indoors, if required, and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
6. Store plastic piping protected from direct sunlight.
7. Protect piping, fittings, fabrications, and appurtenances from moisture and dirt.

D. Handling:

1. Follow manufacturer's recommendations when handling their product
2. Handle manholes according to manufacturer's written instructions
3. Avoid placing slings where they will bear against outlets or fittings.
4. Do not use stub outs, outlets, or fittings as lifting or rigging points.

1.010 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Engineer, Construction Manager, and Owner no fewer than fourty-eight (48) hours in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Gravity Sewer Piping
   1. Pipe and Fittings: Flexible pipe and fittings shall be unplasticized polyvinyl chloride gravity sewer pipe shall be green in color, made from clean, virgin, NSF approved Class 12454-B PVC conforming to ASTM D1784. All pipe shall be new and have the ASTM designation, SDR, pressure rating and size stamped on the outside of each joint. All markings shall follow requirements of ASTM D3034. All piping shall be SDR 26. Green colored polyvinyl chloride (PVC) gravity pipe and fittings in sizes six inch through twelve-inch shall conform to ASTM D3034, and be UL listed and approved by the National Sanitation Foundation.

2.02 CLEANOUTS

A. PVC Cleanouts:
   1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.03 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 478, precast, reinforced concrete, and of depth indicated.
   2. Joints: Joints shall be O-ring gasketed.
   3. Diameter: 48 inches minimum unless otherwise indicated.
   4. Base Section: 8-inch minimum thickness for floor slab and 5-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor. The base shall have a minimum diameter 12 inches greater than the outside of the manhole.
   5. Riser Sections: 5-inch minimum thickness, of length to provide depth indicated.
   6. Top Section: Eccentric-cone or concentric-cone type unless flat-slab-top type is indicated; with top of cone of size that matches grade rings.
   7. Joint Sealant: Adeka Sealant or approved equal
   8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   9. Grade Rings: Reinforced-concrete rings, 6- to 12-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
   10. Cast bottom section of precast manhole riser ring in manhole base as shown on the Plans. Place "Synko-Flex" waterstop (or pre-approved equal) per manufacturer's recommendations prior to setting precast starter ring.

11. All invert channels shall be smooth and accurately shaped to a semi-circular bottom conforming to the outside of the adjacent sewer section. Inverts shall be formed directly in the concrete of the manhole base or may be constructed by laying full section sewer pipe straight through the manhole and cutting out the top half after the base is constructed. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit. Where the largest pipe at a manhole is less than 12", the channel depth shall be one half of the largest pipe diameter. When the largest pipe at the manhole is between 12 and 24 inches (inclusive,) the channel depth shall be three fourths of the largest pipe diameter. When the largest pipe at a manhole is greater than 24", the channel depth shall match the largest pipe. In all cases, the edges of the pipe along the invert and at the walls of the manhole shall be plastered and brush-finished. Plaster shall be nonshrink or hydraulic grout.

B. Manhole Frames and Covers:
   1. Description: Ferrous; 30-inch ID by 4 1/2 -inch riser, and 32-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
   2. Material:
      a. Cover: ASTM A 536, Grade 70-50-05 Ductile Iron
      b. Ring: ASTM A 48/A 48M, Class 35 Gray Iron
   3. Manufacturer:
      a. East Jordan Iron Works
         1) Standard Assembly: V1420-1495A
         2) Watertight Assembly: V1420Z1PT-1495APT

2.04 SANITARY SEWER SERVICE CONNECTIONS

A. Inserta Tee:
   1. Description: Inserta Tee Sanitary Sewer service connection for use in gravity-flow sewer applications.
   2. Stainless Steel Clamp: made from a minimum 301 grade steel
   3. Rubber Sleeve and Gasket: ASTM F477
   4. Inserta Tee connection shall be installed per manufacturer recommendations.
   5. Specifically designed for connection to pipe material and lateral material.

2.05 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Ring-Type, Flexible Couplings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fernco Inc, Strong Back 1000 RC & 6000 RC Series Couplings
   2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.06 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
   1. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides as required in paragraph 2.3 MANHOLES. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 1 inch per foot minimum.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 0.5 inch per foot minimum.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcing Bars: ASTM A 615, Grade 60 deformed steel.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning downstream, true to grades and alignment indicated with unbroken continuity of invert. Install according to manufacturer's written instructions for installation requirements.

C. Install manholes for changes in direction, slope, material, or diameter. Use fittings for service connections.

D. Install gravity-flow, nonpressure, piping according to the following:
   1. Install piping pitched down in direction of flow, at slope indicated on drawings.
   2. Install piping with 36-inch minimum cover.
   3. Install PVC sewer piping according to ASTM D3034

E. Install force-main, pressure piping according to the following:
   1. Install PE, AWWA pipe and fittings according to ASTM D 2774 and AWWA M55.
   2. Install piping with 48-inch minimum cover.

F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

G. Pipes shall be leakage tested, deflection tested, and Inspected by CCTV according to Article 3.10 of this Section. Stub-outs, boots, and pipe plugs shall be secured to prevent movement while the vacuum is being drawn.

H. Place plug in end of incomplete piping at end of day and when work stops.

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, piping and force-main, pressure piping according to the following:

1. Join PVC sewer piping according to ASTM D3034, ASTM D3212

3.04 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Precast Manhole bases shall be placed on a 6" minimum depth layer of cushion sand, gravel or pre-approved material.

C. Install precast concrete manhole sections with sealants according to ASTM C 891 and manufacturer's recommendations.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 6 inches above finished surface elsewhere unless otherwise indicated.

F. Where inlet leads, main or lateral pipe sewers enter manholes, pipes shall be cut off flush with inside of manhole any irregularities shall be grouted up with non-shrink grout. Install stub outs, where shown, to line and grade. Use one full joint of pipe, of size indicated, for stub out. Seal stub out with plug. Install plug in such a manner as to prevent seepage of leakage through stub outs. Installation of plug shall be such that it may easily be removed in future without damaging bell or groove end of stub out.

G. Backfilling will be performed evenly and carefully around the manhole after the full strength of the concrete is attained.

H. Carefully place the O-ring gasket and check for proper alignment

I. Plug lift holes, interior joints, and exterior joints with "Water Plug" grout.

J. Each manhole shall be individually vacuum tested according to Article 3.10 of this Section. Stub-outs, boots, and pipe plugs shall be secured to prevent movement while the vacuum is being drawn.

K. Service connections at manholes will meet all other requirements of this specification and shall be tied into the manhole with a manhole boot. At the time of construction, the Engineer will designate the locations of the service outlets and the depth to the top of the lateral pipe, if depth is not indicated on the plans. The minimum depth of cover over the end of the lateral pipe shall be no deeper than what is required to serve the intended lot.

3.05 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.06 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use PVC pipe fittings in sewer pipes at branches for cleanouts, and use PVC for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18-inch x 18-inch x 12 inch deep. Set with tops 1-inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.07 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping according to Section 33 05 00 "Common Work Results for Utilities"

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and grout open ends of remaining piping.
2. Punch a minimum of 4 2-inch holes in the bottom floor of the manholes.
3. Remove top of manhole down to at least 36-inches below final grade. Fill to within12-inches with compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.08 IDENTIFICATION

1. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning detectable tapes directly over piping and at outside edges of underground manholes.
2. Use detectable warning tape over piping.
3. Detectable warning tape for Force-main pipes shall bear the label “PRESSURIZED WASTEWATER” continuously repeated in at least 1.5 tall letters and meet all other requirements in Section 31 20 00 “Earth Moving”.

3.09 BYPASS PUMPING

A. Prepare with the vendor a specific, detailed description of the proposed pumping system and submit a Bypass Pumping Plan and vendor’s references.

B. The Bypass Pumping Plan shall show detailed plans and descriptions outlining all provisions and precautions to be taken by the Contractor regarding the handling of existing wastewater flows. This plan must be specific and complete, including such items as schedules, locations, elevations, capacities of equipment, materials and all other incidental items necessary and/or required to insure proper protection of the facilities, including protection of the access and bypass pumping locations from damage due to the discharge flows, and compliance with the requirements and permit conditions specified in these Contract Documents. No construction shall begin until all provisions and requirements have been reviewed by the Engineer.

C. The plan shall include at a minimum:
1. Staging areas for pumps;
2. Sewer plugging method and types of plugs;
3. Number, size, material, location and method of installation of suction piping;
4. Number, size, material, method of installation and location of installation of discharge piping;
5. Bypass pump sizes, capacity, number of each size to be on site and power requirements;
6. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump operating range shall be submitted);
7. Standby power generator size, location;
8. Downstream discharge plan;
9. Method of protecting discharge manholes or structures from erosion and damage;
10. Thrust and restraint block sizes and locations;
11. Design plan.

D. Bypass pumping systems shall have sufficient capacity to pump the expected peak flow. The Contractor shall provide all pipeline plugs, pumps of adequate size to handle peak flow, and temporary discharge piping to ensure that the total flow of the main can be safely diverted around the section to be repaired. Bypass pumping system will be required to be operated 24 hours per day.

E. The Contractor shall have adequate standby equipment available and ready for immediate operation and use in the event of an emergency or breakdown. One standby pump for each size pump utilized shall be installed at the mainline flow bypassing locations, ready for use in the event of primary pump failure.

F. Bypass pumping system shall be capable of bypassing the flow around the work area and of releasing any amount of flow up to full a

3.010 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate report for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of mandrel of size equal to 95% of the inside diameter of the pipe.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping or manhole.
      e. Exfiltration: Water leakage from or around piping or manhole
   3. Replace defective piping or manhole using new materials, and repeat inspections until defects are within allowances specified.
   4. Re-inspect and repeat procedure until results meet specification.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.

C. Manhole Testing

After completion of manhole construction test manholes for leakage using Vacuum Testing Procedures as specified herein.
   1. General
      Plug influent and effluent lines, including service lines, with suitably sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required in this test; follow Manufacturer’s safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls.
   2. Vacuum Testing
      a. To perform a vacuum test, all lift holes and exterior joints shall be plugged with a non-shrink grout and all pipes entering a manhole shall be plugged.
      b. No grout must be placed in horizontal joints before testing.
      c. Stub-outs, manhole boots, and pipe plugs must be secured to prevent movement while a vacuum is drawn.
      d. Contractor shall use a minimum 60 inch/lb torque wrench to tighten the external clamps that secure a test cover to the top of a manhole.
      e. A test head must be placed at the inside of the top of a cone section, and the seal inflated in accordance with the manufacturer’s recommendations.
      f. There must be a vacuum of 10 inches of mercury inside a manhole to perform a valid test.
      g. A test does not begin until after the vacuum pump is off.
      h. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury.

D. Gravity Pipe Testing
   1. General

a. Tests shall be made by the low-pressure air test, the infiltration test or the joint test. The infiltration test shall be used when the groundwater level is at least 2 ft above the crown of the pipe measured at the upstream manhole. The joint test shall be used for pipe sections greater than 36-inch inside diameter. The Contractor may use the joint test for pipe with a 27-inch through 36-inch average inside diameter at the approval of the Engineer or his representative. The low-pressure air test, the infiltration test and the exfiltration test shall be conducted from manhole to manhole. Trenches shall be completely backfilled and sewer line should be free of debris prior to testing. Plug all pipe outlets including laterals and secure plugs to prevent leakage blowout due to testing pressure.

2. Air Test
   a. Performance:

      The pipe shall be pressurized to 5 pounds per square inch gauge (psig) greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop 1.0 psig shall be 5 minutes per every 100 feet of pipe plus (+) 5 minutes per each service connection. Pipe sizes larger than 27 inches shall be tested as per TCEQ 217.57 requirements.

      The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined in this subparagraph or until failure.

   b. Execution:

      Add air until the internal air pressure of the sewer line is raised to approximately 5.5 psig. Allow the air pressure to stabilize. The pressure will normally drop until the temperature of the air in the line stabilizes.

      When the pressure has stabilized and is at or above the starting test pressure of 5 psig, commence the test by allowing the gage pressure to drop to 5 psig at which point the time recording is initiated. Record the drop in pressure for the test period.

3. Infiltration Test
   a. Performance:

      The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch of diameter per mile of pipe per 24 hours at a minimum test head of 2.0 feet above the crown of a pipe at an upstream manhole. For construction within the 100-year flood plain, the total infiltration shall not exceed ten gallons per inch of diameter per mile of pipe per 24 hours.

      The total leakage in cubic inches shall be the total cross-sectional area in square inches of the inside of the two risers and of any stacks in the sewer multiplied by the drop in water level in inches. For diameters not listed in chart, multiply the square of the diameter by the following chart value for 1" diameter.

   b. Execution:

      Stop all dewatering operations and allow the groundwater to return to its normal level and allow to remain so for at least 24 hours. Leakage shall be determined by measuring the flow through the opening in the downstream plug for at least 15 minutes. Five separate measurements shall be made. The average of the measurements shall be used, discarding any one of the five measurements except the last that varies by more than 50% from the average of the other four. If the results of the tests are otherwise satisfactory, but the last of the five measurements show leakage in excess of that permitted, the tests shall be continued to determine if additional leaks may have developed during testing.

4. Deflection Testing

Deflection tests shall be performed on all flexible pipes. For pipelines with inside diameters less than 27 inches, a rigid mandrel shall be used to measure deflection. For pipelines with an inside diameter 27 inches and greater, a method pre-approved by the Engineer shall be used to test for vertical deflections. Other methods shall provide a precision of two tenths of one percent (0.2%) deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5.0%. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices.

a. Mandrel Sizing

The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

b. Mandrel Design

The rigid mandrel shall be constructed of a metal or rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

c. Method Options

Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test. Mandrels with removable legs or runners may be accepted on a caseby-case basis. Mechanical devices will not be used to pull the mandrel.

5. CCTV Camera Inspection

T.V. Camera Inspection shall be performed on all sewer pipe installed before acceptance. When the Contractor performs the inspection, the Engineer or his representative shall be notified one working day prior so that he can view the procedure. The inspection shall be in digital video format, saved to a DVD or CD (enclosed within a protective case) and shall be given to the Engineer or his representative for review and final records.

The lines shall be completely filled with potable water between manholes to fill the service connections and drained prior to T.V. Camera Inspection. Line shall be cleaned prior to T.V. inspection. All dirt/debris in the line which could cover a defect shall be removed. Line should be cleaned before being filled with water. Jetting of the lines in conjunction with the T.V. Inspection is prohibited. If the line to be televised is discovered to contain foreign material, which prohibits an acceptable T.V. inspection, the line shall be jetted and televised again.

Select and use closed circuit television equipment that will produce a color digital video that clearly shows pipe, joints and all appurtenances, and shall be a self propelled tractor-type system. Produce and use closed circuit television equipment using a panorama tilt, radial viewing, pipe inspection camera that pans plus and minus 75 degrees, rotates 360 degrees and has optical zoom from 6 or less inches to infinity. The camera must have an accurate footage counter accurate to within 1 foot per 500 foot of pipe. Footage shall be continuously displayed on the video at all times. The camera operator shall pause at each tee, tilt camera and view up into the branch for inspection of joints and fittings maintaining a clear in focus picture at all times while zooming to the full extent of the camera. The camera operator shall stop at each fitting and change in pipe type and complete a 360 degree view of the fitting slow enough to identify all defects. Glare shall

be avoided and shall not interfere with viewing the pipe segment. Maximum rate of travel for the camera shall be 30 feet per minute. DVDs or CDs shall be continuous from pipe segments between manholes. Provide DVDs or CDs with labels indicating project number, segment number, date televised, date submitted, starting manhole number, ending manhole number, pipe diameter, pipe length and street name.

The T.V. inspection shall be used to identify defective construction such as sags, debris, separated joints, etc. The owner shall make all final determinations if the severity of the defect constitutes failure and subsequent removal of the segment in question.

E. Retesting

Manholes or sewers which fail to meet the testing requirements shall be repaired and retested by the Contractor. All repairs and retesting shall be performed at the expense of the Contractor.

F. Leaks and loss in test pressure constitute defects that must be repaired.

G. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.011 CLEANING

A. Clean dirt and superfluous material from interior of piping.

END OF SECTION - 333113

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
1. Pipe and fittings.
2. Nonpressure transition couplings.
3. Drains.
4. Manholes.
5. Stormwater inlets.
6. Pipe outlets.

1.03 DEFINITIONS

A. PE: Polyethylene

B. HDPE: High-Density Polyethylene

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Manholes: Include plans, elevations, sections, details, frames, and covers.
2. Stormwater inlets. Include plans, elevations, sections, details, frames, covers, and grates.
3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

D. Handle stormwater inlets according to manufacturer's written rigging instructions.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Engineer, Architect, Construction Manager, and Owner no fewer than two days in advance of proposed interruption of service.
   2. Do not proceed with interruption of service without Owner's written permission.

PART 2 - PRODUCTS

2.01 PVC PIPE AND FITTINGS

A. PVC Type PSM Sewer Piping:
   1. Pipe: ASTM D3034, SDR 26, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

2.02 PE PIPE AND FITTINGS

A. Corrugated PE Drainage Pipe and Fittings meeting AASHTO M252 (4”-10”), AASHTO M294 (12”-60”), and ASTM F2306 (12”-60”), Type S, with smooth waterway.
   1. Water tight reinforced integral bell & gasketed spigot meeting ASTM D3212

2.03 REINFORCED CONCRETE PIPE

A. Reinforced Concrete Pipe meeting ASTM C76, Class III, Wall B, Rubber Gasketed Joint.

2.04 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Ring-Type, Flexible Couplings:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Fernco Inc, Strong Back 1000 RC & 6000 RC Series Couplings
   2. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.05 CLEANOUTS

A. Cast-Iron Cleanouts:
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. MIFAB, Inc.
      b. Neenah Foundry Company.
      c. Zurn Industries, LLC.
   2. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   3. Top-Loading Classification(s): Extra-Heavy Duty.
   4. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

B. Plastic Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. NDS Inc.
   b. Zurn Industries, LLC.
2. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.06 DRAINS

A. Cast-Iron Area Drains:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. MIFAB, Inc.
   b. Neenah Foundry Company.
   c. Zurn Industries, LLC.
2. Description: ASME A112.6.3 gray-iron round body with anchor flange and round secured grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
3. Top-Loading Classification(s): Light Duty.

B. Cast-Iron Grate Inlets
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. MIFAB, Inc.
   b. Neenah Foundry Company
2. Description: ASTM-A-48, Class 35B gray-iron square body with anchor flange and square secured grate.
3. Top-Loading Classification(s): Heavy Duty.

2.07 MANHOLES

A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
9. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 96 inches.
10. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole

frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.

11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Designed Precast Concrete Manholes:
   1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.
   2. Ballast: Increase thickness of one or more precast concrete sections or add concrete to manhole as required to prevent flotation.
   3. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
   4. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
   5. Steps: ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 96 inches.
   6. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
   7. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers:
   1. Description: Ferrous; 30-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
   2. Material: ASTM A 536, Grade 60-40-18 ductile iron unless otherwise indicated.

2.08 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:
   1. Cement: ASTM C 150, Type II.
   2. Fine Aggregate: ASTM C 33, sand.
   3. Coarse Aggregate: ASTM C 33, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A 615, Grade 60 (420 MPa) deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 1 percent through manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 4 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A 185, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A 615, Grade 60 (420 MPa) deformed steel.

2.09 STORMWATER INLETS

A. Curb Inlets: Made with vertical curb opening, of materials and dimensions according to utility standards.

B. Gutter Inlets: Made with horizontal gutter opening, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

C. Combination Inlets: Made with vertical curb and horizontal gutter openings, of materials and dimensions according to utility standards. Include heavy-duty frames and grates.

D. Frames and Grates: Heavy duty, according to utility standards.

2.010 PIPE OUTLETS

A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.

B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
   1. Average Size: NSSGA No. R-3, screen opening 2 inches.
   2. Average Size: NSSGA No. R-4, screen opening 3 inches.
   3. Average Size: NSSGA No. R-5, screen opening 5 inches.

C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.

D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

PART 3 - EXECUTION

3.01 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping according to the following:
   1. Install piping pitched down in direction of flow.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   3. Install piping with 12 inch minimum cover.
   4. Install PE corrugated sewer piping according to ASTM D 2321.
   5. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.03 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping according to the following:
   1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.
   2. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   3. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.04 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Extra-Heavy-Duty, top-loading classification cleanouts in all areas.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.05 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Extra-Heavy-Duty, top-loading classification drains in all areas.

B. Embed drains in 4-inch minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4-inch minimum concrete around bottom and sides.

3.06 MANHOLE INSTALLATION

A. General: Install manholes, complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C 891.

C. Where specific manhole construction is not indicated, follow manhole manufacturer's written instructions.

D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops as indicated.

3.07 STORMWATER INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated.

C. Install outlets that spill onto grade, anchored with concrete, where indicated.

D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.

E. Construct energy dissipaters at outlets, as indicated.

3.08 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.09 CONNECTIONS

A. Make connections to existing piping and underground manholes.
   1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
   3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
      a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
      b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
   4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

B. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   2. Use pressure-type pipe couplings for force-main joints.

3.010 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
   1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
   2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.
   3. Remove all pipes and structures that conflict with installation of proposed improvements.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:

1. Remove manhole or structure and close open ends of remaining piping.
2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 312000 "Earth Moving."

3.011 IDENTIFICATION

A. Materials and their installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use warning tape or detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.012 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping according to ASTM F 1417.
      c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.013 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with potable water.

END OF SECTION 334100