Request for Proposals ("RFP")
Brenham City Hall RTU-5 Replacement

RFP NO. 26-013

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Prepared for: The City of Brenham, TX

Date: 5/28/2026

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Request for Proposals ("RFP")
Brenham City Hall -RTU 5 Replacement

RFP NO.26-013

EVENT	DATE
1st Publication Date	Thursday, May 28, 2026
2nd Publication Date	Thursday, June, 4, 2026
Pre-Bid Meeting (Mandatory) (2:00 p.m.)	Wednesday, June 10, 2026
RFP Question Deadline (5:00 p.m.)	Thursday, June 11, 2026
Proposal Submission Deadline (2:00 p.m.)	Tuesday, June 23, 2026
Possible City Council Consideration/Award	Thursday, July 16, 2026

INTENT

The City of Brenham (hereinafter referred to as "City") is requesting proposals from qualified and capable Contractors or General Contractors to demolish and remove existing rooftop package unit RTU-5 and modify the associated HVAC system as describe in Exhibit "B". located at Brenham City Hall

All proposals must be submitted on the form provided by the city and further must be properly executed in the space(s) provided.

* **MANDATORY PRE-BID** meeting/ facility visit is scheduled to discuss the City's requirements under this RFP. Proposals will not be accepted from proposers who did not attend. Pre-bid meeting will be on Wednesday, June 10, 2026, at 2:00 P.M. Brenham City Hall, 200 W. Vulcan St. Brenham, TX 77833

RECEIPT AND OPENING OF PROPOSALS

Proposers shall submit **one (1) original and one (1) copy** of the Proposal on the form provided by the City. The original Proposal must be clearly marked "**Proposal for RFP No. 26-013** and include an original signature, in ink, in order to be accepted. Proposals must be received in the Purchasing Services Office no later than **2:00 p.m. (CST) on Tuesday, June 23, 2026**. It is the Proposer's sole responsibility to ensure that the Proposal is delivered in a timely fashion. Proposals received after this time will be rejected and returned unopened. All proposals will be opened and read aloud at the City of Brenham City Hall, 1st Floor Conference Room, 200 W. Vulcan Street, Brenham, Texas 77833. **Any proposal received after 2:00 p.m. on Tuesday, June 23, 2026 shall not be considered.**

To the extent allowed by applicable law, and subject to the ruling of any administrative agency or court having jurisdiction, the City intends that trade secrets and confidential information contained in the proposals and clearly identified as "Confidential" in **bolded font** will not be open for public inspection at any time, even after a contract has been awarded and executed, whether or not the proposer wins the contract.

Proposals should be prepared simply, providing a straightforward, concise description of the Proposer's approach and capabilities necessary to satisfy the requirements of the RFP. Technical literature and elaborate promotional materials, if any, must be submitted separately. Emphasis in the proposal should be on completeness, clarity of content, and adherence to the presentation structure required by the RFP. Proposers are encouraged to suggest creative and economical means to provide the services requested in the RFP.

Proposals shall be delivered using one of the following methods:

Hand-deliver to:	**Mail to:**	**Ship to (FedEx, UPS, DHL, etc.):**
200 W. Vulcan Street	P.O. Box 1059	200 W. Vulcan Street
Suite 203	Brenham, TX 77834-1059	Brenham, TX 77833
Brenham, TX 77833	ATTN: City Secretary	ATTN: City Secretary

CHANGES, QUESTIONS, AND INQUIRIES

Any and all questions regarding this RFP must be submitted in writing and addressed to Kyle Branham, Purchasing and Public Works Project Manager, P. O. Box 1059 (200 W. Vulcan St), Brenham, Texas 77834, or e-mailed to kbranham@cityofbrenham.org. All e-mails must indicate "RFP No. 26-013" in the subject line. It is the sender's responsibility to verify receipt of email; read receipt is acceptable. The deadline for submittal of questions regarding this RFP is **5:00 p.m. (CST) on Thursday, June 11, 2026.**

No person has the authority to verbally alter the terms of this RFP. Any changes to this RFP will be made in the form of an Addendum which will be made available online at www.cityofbrenham.org. It shall be the responsibility of interested bidders to check the website for addenda up to the proposal submission deadline. The complete RFP and all addendums will be posted on the City's website.

GENERAL TERMS

This RFP does not commit the City of Brenham to award a contract. No other party, including any proposer, is intended to be granted any rights hereunder. Proposals which, in the sole discretion of the City of Brenham, do not meet minimum qualification requirements will not be reviewed. This RFP and the process it describes are proprietary to the City of Brenham and are for the sole and exclusive benefit of the City of Brenham. Any response to this RFP will become the property of the City of Brenham and subject to the Public Information Act of Texas. The City of Brenham is not liable for any costs associated with the development, preparation, transmittal or presentation of any proposal or material submitted in response to this RFP.

Proposals will be evaluated by the City. The City will consider the completeness of a proposal and how well the proposal meets the needs of the City. This RFP may be awarded either to the lowest responsible Proposer or to the Proposer who will provide goods or services at the best value for the City, in compliance with Texas Local Government Code, Section 252.043. In determining the best value for the city, the city may consider:

(1) The purchase price.
(2) Construction Time
(3) The reputation of the bidder, subcontractors, and of the bidder's goods or services
(4) The quality of the bidder's goods or services.
(5) The extent to which the goods or services meet the city's needs.
(6) The bidder's past relationship with the city.
(7) The impact on the ability of the city to comply with laws and rules relating to contracting with HUB'S and nonprofit organizations employing person with disabilities.
(8) The total long-term cost to the city to acquire the bidder's goods or services.
(9) Any relevant criteria specifically listed in the request for bids or proposals.

The City reserves the right to waive any informalities or technical errors, or consider alternate proposals and award as lump sum, individual basis, or any combination that in its judgment will best serve the interests of the CITY. By submission of a proposal, the selected proposer agrees to be legally bound if the City of Brenham accepts the proposal.

The City of Brenham reserves the right to make an award without further discussion of the proposals. The selected Proposer will be expected to enter into an Agreement with the City. The Agreement shall incorporate the City's standard terms and conditions, attached hereto as "EXHIBIT A" to this RFP.

PROPOSAL BOND REQUIREMENTS

Proposal amounts in excess of $100,000, shall be required to submit a Proposal Guaranty in the amount of five percent (5%) of the total bid amount payable to the City of Brenham, from a surety company authorized to do business in Texas as a guarantee that the Proposer will enter into a contract and provide required insurance within ten (10) business days after receiving a Notice of Intent to Award, and will provide to City all submittals required by this contract within ten (10) business days from Notice of Intent to Award, and will provide to the City executed Performance, Maintenance and Payment bonds within ten (10) business days after City Council Award of Contract.

The bond shall be on the forms provided, each in the amount of 100% of the contract price from a Surety Company holding a permit in the State of Texas and approved by the Federal Government, and must bear the impressed seal of the surety company and the name of the Proposer, and be signed by the Proposer and an authorized representative of the surety company. Powers of attorney must be attached to the Proposal Guaranty.

A proposal that has been fully completed and signed by the person authorized to represent the company submitting the proposal. The proposal must use the same form or a photocopy of the form provided in the RFP document. Acknowledgment of the receipt of any and all addenda must be provided on the proposal.

If the Proposer is a corporation or other legal entity subject to the Texas franchise tax, a copy of its "Franchise Tax Certificate of Account Status" showing all franchise taxes are current (this item may be submitted to the City within three (3) business days of the proposal opening for the proposal to be considered).

CONTRACT TERMS AND CONDITIONS

1. **GENERAL TERMS AND CONDITIONS**

   General Terms and Conditions for Request for Proposals from the City of Brenham may be found in Exhibit "A" of this document. Should any contradiction be found to exist between those terms and conditions and the body of this RFP, the RFP will prevail.

2. **INDEMNITY**

   The Contractor agrees to indemnify and hold harmless the City of Brenham and its officers, agents, and employees from any and all claims, causes of action, and damages of every kind, for injury to or death of any person and damages to property arising out of or in connection with the work done by the Contractor, and including acts or omissions of the City of Brenham, its officers, agents or employees in connection with said Contract.

3. H.B. 1295 COMPLIANCE

The Awarded Vendor for the contract shall comply with the requirements of Section 2252.908 of the Texas Government Code as adopted in 2015 as House Bill 1295. The law requires that a governmental entity may not enter in certain contracts with a business entity unless the business entity submits a Disclosure of Interested Parties to the governmental entity. The law applies only to a contract that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least $1 million.

Compliance with the law requires that the awarded Vendor utilize the Texas Ethics Commission website to enter the required information on Form 1295 and print a copy of the complete form. The form must be signed and submitted to the contracting government entity

The City of Brenham, in the case of contracts formalized by Purchase Order or by other written contract, will notify the Vendor of Award by Council and request the completed Form 1295 within five (5) working days thereafter.

4. CHAPTER 220 COMPLIANCE

The Awarded Vendor for the contract shall comply with the requirements of Subtitle F, Title 10, Government Code Chapter 2270 and shall be required to provide conformation that the Vendor:

1. Does not boycott Israel currently; and
2. Will not boycott Israel during the term of the contract the above-named Company, business or individual with the City of Brenham, Texas.
   Pursuant to Section 2270.001, Texas Government Code:

1. "Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes; and

2. "Company" means a for-profit sole proprietorship, organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or any limited liability company, including a wholly- owned subsidiary, majority-owned subsidiary, parent company or affiliate of those entities or business associations that exist to make a profit.

The City of Brenham, in the case of contracts formalized by Purchase Order or by other written contract, will notify the Vendor of Award by Council and request the required confirmation within five (5) working days thereafter. Confirmation shall, by reference, be included as a part of the contract.

4. **INSURANCE**

The awarded contractor shall obtain insurance as specified in Attachment "A" of this RFP and shall maintain coverage in full effect through the duration of the contract. Certificates of Insurance shall be provided to the City within five (5) working days of formal notice of award by the City.

SCOPE

In accordance with the Construction Documents, the Bidder shall furnish all supervision, labor, materials, and equipment to perform the following:

1. Replace the existing roof-mounted packaged multizone air conditioning unit (RTU-5) with new RTU equipment.
2. Provide and install new Fan-Powered Variable Air Volume (FPVAV) air terminal units and connect to the new RTU and the existing zone ducts.
3. Modify the existing electrical system to accommodate the equipment components
4. Provide temperature and other operating controls with hardware and software that are compatible with the existing Building Management System (BMS).
5. Perform factory start-up of equipment, commissioning, and test and balance of associated systems.

PROPOSAL SUBMISSION AUTHORIZATION

- An authorized representative must sign bids, with the Proposer's address, telephone and email information provided. Unsigned proposals may not be considered.
- If the proposal is made by an individual, the name, mailing address and signature of the individual must be shown.
- If the proposal is made by a firm or partnership, the name and mailing address of the firm or partnership and the signature of at least one of the general partners must be shown.
- If the proposal is made by a corporation, the name and mailing address of the corporation and the signature and title of the person who signs on behalf of the corporation must be shown.
- The CITY reserves the right to request documentation showing the authority of the individual signing the proposal to execute contracts on behalf of anyone, or any corporation, other than himself/herself. Refusal to provide such information upon request may cause the proposal to be rejected as non-responsive.

The undersigned certifies that the information provided above is a true representation of its company's qualifications and agrees to comply with these assurances following award of the RFP and during the performance of the Agreement, once executed.

Signature: _____

Printed Name: _____

Title: _____ Date: _____

NON-COLLUSION CERTIFICATE

STATE OF _____

COUNTY OF _____

The undersigned, being duly sworn, deposes and says that the person, firm, association, co-partnership or corporation herein named, has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competition in the preparation and submission of a bid to the City of Brenham for consideration in the award of a contract on the improvement described as follows:

RFP NO. 26-013 Brenham City Hall RTU-5 HVAC Replacement

_____
(Name of Firm)

By: _____
(Authorized Signature)

Title: _____

Sworn to before me this _____ day of _____, 2026.

_____
Notary Public

NOTARY SEAL:

Brenham City Hall RTU-5 HVAC Replacement

Bid Forms

Bid No: **26-013**
Bid Opening: **2:00 P.M. (CST), Tuesday, June 23, 2026**

Submit to: Office of Purchasing Services
Attention: Kyle Branham
City of Brenham
200 W. Vulcan St., Suite 203
Brenham, TX 77833

PO Box 1059
Brenham, Texas 77834-1059

Bid Documents: Sealed bids must be submitted on this form only. **Bidders are required to submit one (1) original and one (1) copy.** All bids submitted must be itemized with prices extended when practical. **Bidder must return the entire original bid document with bid or offer.**

Bid **MUST** be signed by an authorized representative of the bidder. Original signature required.

****

To: Honorable Mayor and City Council
City of Brenham, Texas

BID FORM A
City Hall RTU-5 HVAC Replacement
200 W. Vulcan St.
Brenham, Texas 77833

City of Brenham RFP No. 26-013

From:_____ (Contractor Print Name Here)

I have received a construction narrative, details, and specifications for the project listed above as prepared by Talex, Inc. Engineers. I have also received Addenda Nos. _____ and have included their provisions in my bid. I have examined the documents, existing conditions, and the site, and submit the following bid. In submitting the bid, I agree:

1. To hold my bid open for ninety (90) calendar days after the Bid receiving date.
2. To enter into and execute a contract, if awarded on the basis of this bid.
3. To execute the contract, if awarded, within ten (10) calendar days after notification of award, and to commence work not later than ten (10) calendar days from the date of "Notice to Proceed."
4. To accomplish the work in accord with the Contract Documents.
5. **The Bidder shall propose the number of calendar days to complete the work from the Notice to Proceed**. If work is not completed by such time, I agree to pay the City, as liquidated damages, the sum of five hundred dollars ($500.00) for each calendar day after such time that the work remains incomplete, calculated in accordance with the provisions of the Contract Documents. Final completion will be reached on or before fourteen (14) calendar days after the Certificate of Substantial Completion is issued. If work is not completed by such time, I agree to pay the City additional liquidated damages of five hundred dollars ($500.00) per calendar day after such time until Final Completion is reached.

I will perform all work of this project for the lump sum price of:

BASE BID:_____

_____ Dollars ($_____) AND

_____ (_____) DAYS.

I will include the following alternative items of work as specified for changes to the Base Bid sum as follows:

ALTERNATIVE NO. 1: ALL WORK ASSOCIATED WITH THE PROVISION AND INSTALLATION OF A TEMPORARY HVAC SYSTEM TO SERVE THE AFFECTED SPACE AS DESCRIBED IN THE DOCUMENTS. ADD the sum

of: _____Dollars ($_____)

AND _____ (_____) DAYS.

To: Honorable Mayor and City Council
City of Brenham, Texas

BID FORM A
City Hall RTU-5 HVAC Replacement
200 W. Vulcan St.
Brenham, Texas 77833

City of Brenham RFP No. 26-013

ALTERNATE NO. 2: ALL WORK ASSOCIATED WITH THE REMOVAL AND DISPOSAL OF THE EXISTING ABOVE-CEILING FAN-COIL AS DESCRIBE IN THE DOCUMENTS, ADD the sum

of: _____Dollars ($_____)

AND _____ (_____) DAYS.

Executed on _____, 2026.

_____
Company Name

[If participant is a corporation]

[complete the following]

ATTEST:

_____

(Corporate Seal)

Signature: _____

Print Name: _____
Sole Owner, or Partner, or President of Corporation
(Delete titles inapplicable to signer)

Whose address is:

_____

_____

Telephone: _____

Fax: _____

Email: _____

To: Honorable Mayor and City Council
City of Brenham, Texas

BID FORM B
City Hall RTU-5 HVAC Replacement
200 W. Vulcan St.
Brenham, Texas 77833

City of Brenham RFP No. 26-013

From:_____(Bidding company name here)

I will add for any additional work above and beyond the scope of this contract, at the cost of all jobsite labor and materials furnished, plus percent (_____%) for overhead and profit. Overhead and profit includes office personnel and expenses.

I will add for any additional work performed by a subcontractor above and beyond the scope of this contract, at the subcontractor's cost, plus_____percent (_____%) for overhead and profit.

I will use the following subcontractors on this work:

Trade	Subcontractor's Name	Location
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Executed on _____,2026.

_____
Company Name

[If participant is a corporation]

Signature: _____

[complete the following]

Print Name: _____

ATTEST: Sole Owner, or Partner, or President of Corporation
(Delete titles inapplicable to signer)

_____ Whose address is:

(Corporate Seal)

_____

_____

Telephone: _____

Fax: _____

Email: _____

Exhibit "A"

TERMS AND CONDITIONS FOR PROPOSALS

Definitions:

In order to simplify the language throughout this request for proposals, the following definitions shall apply:

CITY – OWNER - Same as City of Brenham.

CONTRACT - An agreement between the City and a Vendor to furnish goods or services over a designated period of time during which repeated purchases may be made of the goods or services specified.

VENDOR – The successful Proposer(s) of this proposal request.

Instructions:

The following instructions apply to all proposals and become a part of terms and conditions of any bid submitted to the City of Brenham Purchasing Department, unless otherwise specified elsewhere in this bid request.

Form:

Proposals must be submitted on this form only. **Proposers are required to submit one (1) original and one (1) copy**. All proposals submitted must be itemized with prices extended when practical. **PROPOSER MUST RETURN THE ENTIRE ORIGINAL BID DOCUMENT WITH BID OR PROPOSAL.**

Bid Return:

Bid must be sealed, and to ensure proper recognition upon its arrival, list the Bid Number, Bid Description and the Bid Opening Date on the outside of your envelope.

Late Proposal:

Proposals must be received by the Purchasing Department prior to the time indicated on this form. Late proposals will not be opened and will be returned to the proposer only upon written request.

Acceptance:

The City of Brenham reserves the right to accept or reject any or all proposals, to waive any informalities and technicalities, to accept the offer considered most advantageous **in order to obtain the best value for the City.** Causes for rejection of a bid may include but are not limited to the proposer's current violation of any City ordinance, the proposer's current inability to satisfactorily perform the work or service, or the proposer's previous failure to timely perform its obligation under a contract with the City.

Proposers may be disqualified and rejection of proposals may be recommended for any of (but not limited to) the following causes:

1. Failure to use the proposal form furnished by the Owner;
2. Lack of signature by an authorized representative on the proposal form;
3. Failure to properly complete the proposal;
4. Evidence of collusion among proposers;
5. Omission of uncertified personal or company check as a proposal guarantee **(if Bid Bond required)**; or
6. Unauthorized alteration of bid form.

Owner reserves the right to waive any informality or irregularity.

All proposers are hereby notified that the City of Brenham shall consider all factors it believes to be relevant in selecting the offer that provides the best value for the City including, but not limited to the purchase price, the proximity of the proposer as it relates to proposer's ability to perform the contract for the City, the delivery date, the reputation of the proposer and the proposer's goods or services, the quality of the proposer's goods or services, the extent to which the goods or services meet the City's needs, the impact on the ability of the City to comply with laws and rules relating to contracting with historically underutilized business and non-profit organizations employing persons with disabilities, the total long-term cost of the City to acquire the proposer's goods or services, the proposer's past performance under contracts with

the City, the proposer's compliance with City ordinances, and any relevant criteria specifically listed in this request for bid.

The City is committed to obtaining its goods, products and services at the lowest price possible which benefits all citizens of Brenham. Therefore, in order to accomplish this objective/goal, it is not the intention of the City to exclude particular vendors or manufacturers nor to create restrictive situations in its request for bids and proposals. Any manufacturer's name, trade names, brand names, catalog numbers, technical data, etc. used in the specifications are there for the sole purpose of establishing and describing general performance, quality levels, type and dimensions and such references are not intended to be restrictive. Alternate proposals on similar or comparable products and/or services of any manufacturer or vendor equal to the products and/or services described in the specifications are invited and will be given careful consideration provided the alternate will accomplish the same task. The City shall be the sole judge on whether the alternate product and/or service is similar to, equal to and in compliance with that specified. The decision of the City shall be final.

Award of Contract:

The contract may be awarded to the proposer who provides goods or services at the best value for the City. The bid award may be based on, but not necessarily limited to, the following factors:

a. the purchase price, including payment discount terms;
b. the reputation of the proposer and of the proposer's goods or services;
c. the quality of the proposer's goods or services;
d. the extent to which the goods or services meet the City's needs;
e. the proposer's past relationship with the City;
f. the impact on the ability of the City to comply with laws and rules relating to contracting with historically underutilized businesses and nonprofit organizations employing persons with disabilities;
g. the total long-term cost of the City to acquire the proposer's goods or services; and
h. any relevant criteria specifically listed in this request for bid.

The City prefers to award the entire contract to a single proposer; although, the City reserves the right to award a primary contract and a secondary contract in an effort to secure a back-up contractor to be used in emergency situations in the event the primary contractor is unable to respond as needed.

Term of Contract:

This Contract shall become effective from date of acceptance and approval by the City of Brenham. It shall remain in force and effect with firm fixed bid prices for a period of one (1) year, beginning on the date of award of contract.

Extension of Contract:

Upon completion of the term of the original contract and mutual agreement of both parties, the contract may be extended for up to two (2) additional one (1) year terms (three (3) years total). The renewal will be under the same terms and conditions as the original contract. In the event a new contract cannot be executed at the anniversary date of the original term or any renewal term, the contract may be renewed month-to-month until a new contract is executed.

Assignment of Contract:

This contract cannot be transferred or assigned to another party without written consent of the City and may be subject to cancellation by the City if such consent is requested.

Contract Termination:

The City may terminate this Contract at any time upon thirty (30) calendar day's written notice. Upon the Vendor's receipt of such notice, the Vendor shall cease work immediately. The Vendor shall be compensated for the services satisfactorily performed prior to the termination date.

If, through any cause, the Vendor fails to fulfill its obligations under this contract, or if the Vendor violates any of the agreements of this Contract, the City has the right to terminate this Contract by giving the Vendor five (5) calendar days written notice. The Vendor will be compensated for the services satisfactorily performed before termination date. Termination of the contract for cause shall be deemed as sufficient evidence and cause to remove the Vendor's name from the proposer's list for receiving future proposals.

No term or provision of this Contract shall be construed to relieve the Vendor of liability to the City for damages sustained by the City because of any breach of contract by the Vendor. The City may withhold payments to the Vendor for the purpose of setoff until the exact amount of damages due the City from the Vendor is determined and paid.

Reimbursements:

There is no expressed or implied obligation for the City to reimburse responding firms for any expenses incurred in preparing proposals in response to this Request for Proposals and the City will not reimburse responding firms for these expenses, nor will the City of Brenham pay any subsequent costs associated with the provision of any additional information or presentation, or to procure a contract for these services.

Minority Owned Businesses:

Minority business enterprises will be afforded full opportunity to submit proposals in response to this invitation and will not be discriminated against on the grounds of race, color, creed, sex, or national origin in consideration for an award.

Error-Quantity:

Proposals must be submitted on units of quantity specified. In the event of errors in extended process, the unit price shall govern. Any suggested quantity to secure better prices is welcomed. When discrepancies occur between words and figures, the words shall govern.

Quantities:

Quantities indicated in the Bid are estimated based upon the best available information. The City reserves the right to increase or decrease the quantities by any amount deemed necessary to meet its needs without any adjustments in the unit bid prices.

Variations/Conflicts:

Any variation (deviation) from these specifications must be indicated on a separate form and be made part of the bid.

In the case of any conflict between these Terms and Conditions and the Contract between the City and the successful Proposer, the provisions of the Contract shall control.

F.O.B. – Damage

Proposals will not be considered unless proposals include F.O.B. delivered to Brenham, Texas. If shipping costs are not included in the unit bid price, proposer must give exact delivery cost, which is to be prepaid or added to the invoice. The City assumes no liability of goods delivered in a damaged or unacceptable condition.

Firm Prices:

Proposers must hold bid prices firm for 90 days after the bid opening date to allow the City sufficient time to award a contract. Once a Contract is awarded, the successful proposer must hold proposal prices firm for the duration of the Contract. Sealed competitive proposals may be negotiated, amended or changed after the proposal opening date.

Cooperative Agreements:

Successful proposer agrees to extend prices and terms to all governmental entities that have entered into, or will enter into, joint purchasing interlocal cooperation agreements with the City.

Authorized Signature:

Proposals must show full firm name and mailing address of proposer and be manually signed by an authorized representative of the proposer. Firm name and authorized signature should appear on

each page of bid where spaces are provided. Submission of a signed bid will be interpreted to mean that proposer has hereby agreed to all terms and conditions set forth in all of the sheets which make up this invitation.

Withdrawal-Alteration Of Proposals:

Proposals cannot be altered after receiving time or opening time. No bid may be withdrawn after opening time without acceptable reason in writing and with the approval of the City Council.

Lump Sum Proposals:

Lump sum proposals will be considered only if unit prices are quoted also. However, the totals of such quoted unit prices and the lump sum proposals will not be considered if the price quoted also involves prices of commodities requested on an entirely separate bid request.

All-Or-None Proposals:

All-or-none proposals will be considered only if proposer quoted prices on all items requested. If a proposer desires the City to consider an all-or-none bid, it must be stated in the bid document. All-or-none proposals will not be considered if prices quoted involved prices of items and services requested on an entirely separate bid request.

Payment Of Invoices:

Invoices must be submitted by the successful proposer to the City of Brenham, Finance Department, P.O. Box 1059, Brenham, Texas 77835-1059. All invoices to be paid in full within thirty (30) days after satisfactory delivery and billing, whichever is the latter. The City will not be liable for payment of invoices received more than sixty (60) days after delivery of order, or completion of service.

Cash Discounts:

Proposers may quote additional cash discount terms. If no discount is shown, prices are to be assumed net. Discount period to be started from the date of completion of entire order or date of receipt of invoice, whichever occurs last regardless of date of invoice.

Taxes:

The City of Brenham is exempt from Federal Excise, State Sales and Transportation Taxes. TAX MUST NOT BE INCLUDED IN BID. The City upon request will execute Tax Exemption Certificates. The City of Brenham is statutorily exempt from State and Local Sales tax and a permit number is not required.

Delivery:

Proposals must show the number of consecutive calendar days required to deliver the materials, services or equipment under normal conditions. Failure to specify delivery time will be considered reason enough to cause the bid to be disregarded. Delivery time quoted will be given consideration in awarding proposals. If delivery is not made within ten (10) days after number of days specified on bid, entire order may be canceled and proposer's name removed from mailing list.

All deliveries are to be made to the Central Warehouse located at 315 West Second Street, unless otherwise specified in the Bid Request or Purchase Order. Deliveries will be accepted only during normal working hours on normal working days. Unless otherwise indicated, items received must be new and in first-class condition. Types of materials normally packaged for protection and convenience in storage shall be in the proper containers.

Liability:

Vendor shall be liable for all damages incurred while in performance of the work to be performed hereunder. Vendor assumes full responsibility for the work to be performed hereunder, and hereby releases, relinquishes, and discharges the City, its officers, agents, and employees, from all claims, demands, and causes of action of every kind and character including the cost of defense thereof, for any injury to, including death of, any person whether that person be a third person, vendor, or an employee of either parties hereto, and any loss of or damage to property, whether the same be that of either of the parties hereto or of third parties, caused by or alleged to be caused by,

arising out of or in connection with the issuance of this order to Vendor, whether or not said claims, demands and causes of action in whole or in part are covered by insurance. Certificate of Insurance may be required for but not limited to Commercial General Liability, Commercial Auto Liability, Workers Compensation, and Professional Liability Insurance.

Material Safety Data Sheets (MSDS):

MSDS's must be provided prior to or with receipt of order, and when revised. Containers must be properly labeled and identified in accordance with the OSHA Hazard Communications Standard. Improperly labeled containers will result in refusal of the shipment and possible change in vendors.

Patents, Franchises, etc.:

The successful proposer agrees to protect the City from any claim involving patent right infringements, copyrights or sales franchises.

No Proposals:

If proposer is unable to quote, the bid form should be returned to the purchasing agent before opening time, and reason given for not bidding if proposer desires to bid on future purchases.

Addenda:

In the event of a needed change in the published documents, it is understood that all the foregoing terms and conditions and all performance requirements will apply to any published addendum.

All published addenda shall be signed and included with your response package as acknowledgement of the addendum. Proposers are responsible for obtaining all published addenda from the City of Brenham Purchasing office. The City assumes no responsibility for the Proposers failure to obtain and/or properly submit any addendum. Failure to acknowledge and submit any addendum may be cause for the bid to be rejected. The City's decision to accept or reject any particular bid due to a failure to acknowledge and submit addenda shall be final.

Fiscal Funding:

The City operates and is funded on a fiscal year basis; accordingly, the City reserves the right to terminate, without liability, any contract for which funding is not available. Renewal of a contract will be in accordance with Local Government Code 271.903 concerning non-appropriation of funds for multi-year contracts. The City reserves the right to rescind the contract at the end of each fiscal year if is determined that there are insufficient funds to extend the contract. The fiscal year for the City extends from October 1st of each calendar year to September 30th of the following calendar year.

H.B. 1295 Compliance:

The Vendor for the Contract shall comply with the requirements of Section 2252.908 of the Texas Government Code as adopted in 2015 as House Bill 1295. The law requires that a governmental entity may not enter in certain contracts with a business entity unless the business entity submits a Disclosure of Interested Parties to the governmental entity. The law applies only to a contract that either (1) requires an action or vote by the governing body of the entity or agency before the contract may be signed or (2) has a value of at least $1 million.

Compliance with the law requires that the Vendor utilize the Texas Ethics Commission website to enter the required information on Form 1295 and print a copy of the complete form. The form must be signed, notarized and submitted to the contracting government entity

The City, in the case of contracts formalized by Purchase Order or by other written contract, will notify the Vendor of Award by Council and request the completed Form 1295 within five (5) working days thereafter.

No Boycott of Israel:

By acceptance of this Contract, Vendor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contacts with, or provide supplies or

services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State. Vendor further certifies and verifies that neither vendor, nor any affiliate, subsidiary, or parent company of Vendor, if any, the "Vendor Companies"), boycotts Israel, and Vendor agrees that Vendor and Vendor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic hoard on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

Engaged in Business with Iran, Sudan, or Foreign Terrorist Organization:

Pursuant to Texas Government Code Chapter 2252, Subchapter F, Vendor affirms that it is not identified on a list created by the Texas Comptroller of Public Accounts as a company known to have contracts with or provide supplies or services to a foreign terrorist organization.

Conflict of Interest:

By doing business or seeking to do business with the City, Vendor acknowledges that they have been notified of the requirements of Chapter 176 of the Texas Local Government Code and that they are solely responsible for compliance.

Applicable Law and Venue

This Contract shall be governed by the laws of the State of Texas. The parties agree that performance and all matters related thereto shall be in Washington County, Texas and venue for any lawsuit, claim or dispute arising out of the contract shall be in Washington County, Texas. Further, neither party will seek to remove such litigation to the federal court system by application of conflicts of laws or any other removal process.

Insurance

1. The Vendor shall procure and maintain at its sole cost and expense for the duration of the Contract insurance coverage for injuries to persons or damages to property that may arise from or in connection with the performance of the work hereunder by the Contractor, its agents, representatives, volunteers, employees or subcontractors. The Contractor's insurance coverage shall be primary insurance with respect to the City, its officials, employees and volunteers. Any insurance or self-insurance maintained by the City, its officials, employees or volunteers shall be considered in excess of the Contractor's insurance and shall not contribute to it. Further, the Contractor shall include the City as an additional insured under its policy. All coverage for subcontractors shall be subject to all of the requirements stated herein. Certificates of Insurance and endorsements shall be furnished to the City and approved by the City before work commences.

2. Standard Insurance Policies Required:
   a) Commercial General Liability Policy
   b) Automobile Liability Policy
   c) Workers' Compensation Policy

3. General Requirements Applicable to All Policies:
   a) General Liability and Automobile Liability insurance shall be written by a carrier with an A: VIII or better rating in accordance with the current Best Key Rating Guide.
   b) Only Insurance Carriers licensed and admitted to do business in the State of Texas will be accepted.
   c) Deductibles shall be listed on the Certificate of Insurance and are acceptable only on a per occurrence basis for property damage only.
   d) "Claims Made" policies will not be accepted.
   e) The City of Brenham, its officials, employees and volunteers, are to be added as "Additional Insured" to the General Liability policy. The coverage shall contain no special

limitations on the scope of protection afforded to the City, its officials, employees or volunteers.

f) A Waiver of Subrogation in favor of the City with respect to Workers’ Compensation Insurance must be included.

g) Each insurance policy shall be endorsed to state that coverage shall not be suspended, voided, canceled, reduced in coverage or in limits except after thirty (30) days prior written notice has been given to the City.

h) Upon request, certified copies of all insurance policies shall be furnished to the City.

4. Commercial General Liability
   a) Minimum Combined Single Limit of $1,000,000.00 per occurrence for bodily injury and property damage.
   b) No coverage shall be deleted from the standard policy without notification of individual exclusions being attached for review and acceptance.

5. Automobile Liability
   a) Minimum Combined Single limit of $500,000.00 per occurrence for bodily injury and property damage.

6. Worker’s Compensation
   a) Statutory

7. Certificates of Insurance shall be prepared and executed by the insurance company or its authorized agent. And shall contain the following provisions and warranties:
   a) The company is licensed and admitted to do business in the State of Texas.
   b) The insurance policies provided by the insurance company are underwritten on forms that have been provided by the Texas Board of Insurance.
   c) All endorsements and insurance coverage according to requirements and instructions contained herein.
   d) The form of the notice of cancellation, termination, or change in coverage provisions to the City of Brenham.
   e) Original endorsements affecting coverage required by this section shall be furnished with the certificates of insurance.

Workers' Compensation Provisions
(State law requires the following language in contracts on public works projects).

DEFINITIONS:

Certificate of Coverage (certificate) – A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Workers' Compensation Commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

Duration of the Project – includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the City.

Persons providing services on the project ("subcontractor" in 406.096) – includes all persons or entities performing all or part of the services the Contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the Contractor and regardless of whether that person has employees. This includes, without limitations, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnished persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, that meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

The Contractor must provide a certificate of coverage to the City **prior** to being awarded the contract.

If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the City showing that coverage has been extended.

The Contractor shall obtain from each person providing services on a project, and provide to the City:

a. a certificate of coverage, prior to that person beginning work on the project, so the City will have on file certificates showing coverage for all persons providing services on the project; and
b. no later than seven calendar days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

The Contractor shall retain all required certificates of coverage for the duration of the project and for one (1) year thereafter.

The Contractor shall notify the City in writing by certified mail or personal delivery, within ten (10) calendar days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation commission, informing all persons providing services on the project that they are required to be covered and stating how a person may verify coverage and report lack of coverage.

The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

(a) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, that meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;
(b) provide to the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on a project, for the duration of the project;
(c) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;
(d) obtain from each person with whom it contracts, and provide to the Contractor:
    1. a certificate of coverage, prior to the person beginning work on the project; and
    2. a new certificate of coverage showing the extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.
(e) retain all required certificates of coverage on file for the duration of the project and for one (1) year thereafter;
(f) notify the City in writing by certified mail or personal delivery, within ten (10) calendar days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and
(g) contractually require each person with whom it contracts, to perform as required by paragraphs (a) – (g), with the certificates of coverage to be provided to the person for whom they are providing services.

By signing the contract, or providing, or causing to be provided a certificate of coverage, the Contractor is representing to the City that all employees of the Contractor who will provide services on the project will be covered by workers’ compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the Commission’s Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

The Contractor’s failure to comply with any of these provisions is a breach of contract by the Contractor that entitles the City to declare the contract void if the contractor does not remedy the breach within ten (10) calendar days after receipt of notice of breach from the City.

CONSTRUCTION NARRATIVE:

Brenham City Hall RTU-5 Replacement Project:

Overall Goal: The intent of this project is to remove, replace, and reconfigure the existing RTU and associated systems to achieve a complete and fully functional HVAC system.

General Description of the Work of the Project: Remove and replace an existing 30-ton (nominal) packaged multizone roof-mounted electric cooling and gas heating unit (RTU) with 6 interior control zones on the second-level roof of the existing Brenham City Hall Building. The replacement unit shall be a 27.5-ton (nominal) cool-only variable air volume (VAV) packaged DX RTU (as scheduled). Power for the new unit shall be from the existing unit's power, reconfigured to connect to the new unit's power entrance. The new unit shall be connected to 6 fan-powered, pressure-independent VAV air terminal units with electric resistance heaters (FPVAV, as scheduled), connected to the new RTU supply air plenum and the existing interior zone supply ducts. Power for the new air terminal boxes shall be from the existing 277/480V/3ph/4w service entrance switchgear. The return air is from the plenum above the ceiling. The temperature controls shall be an expansion of the existing JCI FX90-based Building Management System (BAS). The completed system shall be commissioned, tested, and air-balanced for each supply air device.

Existing Drawing: A Mechanical Floor Plan Drawing dated 1982 is included with these documents for informational purposes only. The accuracy of this drawing has not been field verified. The drawing depicts work that existed at the time the document was produced. The wall layout has been modified somewhat since the drawing was produced.

Existing System:

- **Existing RTU:** The existing RTU is a TEAMAIR Model CAH12000DX30T (12,000CFM, 30-Ton nominal), Job No. 101807-297, S/N 101807-297-RTI-1, 208v/3ph with 3#250kcmil CU conductors, fed from a fused switch in the ground-floor east electrical room. The unit has a Carrier condensing unit mounted on the subframe with the air handler. The condensing unit is a Model 38APD0305DA28120, S/N 0211Q41321. The condensing unit is electrically connected to the package unit. The unit is sitting on a low roof curb. The unit is located on the east end of the second-level roof, approximately 6’-0” from the roof edge.
- **Gas Connection:** The unit has a 1¼” Schedule 40 steel gas piping connection from above the roof surface.
- **Condensate Drainage:** Condensate drainage is via a 1” Schedule 40 PVC pipe above the roof surface to a roof drain.
- **Electrical Connection:** The unit is served by 3#250kcmil, #3G copper conductors from under the roof, rising through the curb into the electrical connection cabinet. The conductors are connected to a fusible switch in the east electrical room on the ground floor.
- **Controls Connection:** The low-voltage analog controls connect wall-mounted room thermostats to the RTU’s zone-control damper actuators. All other operating controls are unit-mounted. The existing RTU’s controls are not connected to the building’s central building control system (BMS).
- **Equipment Mounting:** The existing RTU is mounted on a low (approximately 4” high) roof curb that is approximately 22’-0” by 7’-6”.
- **Supply Air Duct System:** The existing supply air system consists of the sheet metal zone head that extends from the supply air zone dampers in the

RTU down through the roof curb and into the space above the ceiling. The flexible duct connectors between the unit's zone damper outlets and the sheet metal zone head below the roof have been determined to consist of asbestos-containing materials (ACM). The City-retained contractor will be responsible for removing the ACM. The RTU removal shall be coordinated with the City's ACM removal contractor. Beyond the RTU zone connections, the supply air distribution duct consists of 1" thick shop-fabricated fiberglass ductboard that appears original to the building. The fiberglass duct appears in good condition and will be reused in its existing configuration.

- **Return Air:** The return air to the existing RTU is via an above-ceiling plenum. The RA inlet to the RTU is connected to a 1" thick fiberglass ductboard elbow (sound attenuator) below the unit.

SUMMARY OF WORK: Approximate list of major tasks, but not inclusive of all work:

- **Occupancy:**
  - The office space will remain occupied during the work of this project. The Contractor shall schedule and coordinate his work with the City to minimize disruption to the occupants.
  - It is understood that occasional disruption of occupancy and building services such as power, lighting, HVAC, etc., may occur for the demolition and installation of the work. The Contractor shall provide at least 48 hours' notice of any service disruption or relocation request.

- **Temporary HVAC - (Bid Alternate No. 1):**
  - Provide temporary HVAC equipment and temporary ductwork during the time the permanent systems are shut down for the work on the project.
  - Access to the occupied space and placement for temporary equipment, duct, and electrical shall be coordinated with the Owner's representative.

- **Mechanical – Demolition:**
  - Disconnect and properly terminate electrical, controls, and gas service to the existing RTU.
  - Disconnect supply air duct connections from the existing RTU. Coordinate disconnection procedures and timing with the City's ACM abatement contractor. The City will retain and pay the abatement contractor.
  - Disconnect the fiberglass ductboard return air attenuator.
  - Remove the existing package RTU and remove it from the site.
  - Provide temporary weatherproof covering for the roof opening until the new unit is installed.
  - Carefully remove and preserve existing ceiling tile and ceiling suspension components for reinstallation.
  - Disconnect fiberglass ductboard supply air ducts from the existing sheet metal zone head. Provide support for the ducts as necessary to prevent damage.
  - Remove and discard the existing sheet metal zone head duct assembly.
  - Remove and discard the existing ductboard return air attenuator plenum.

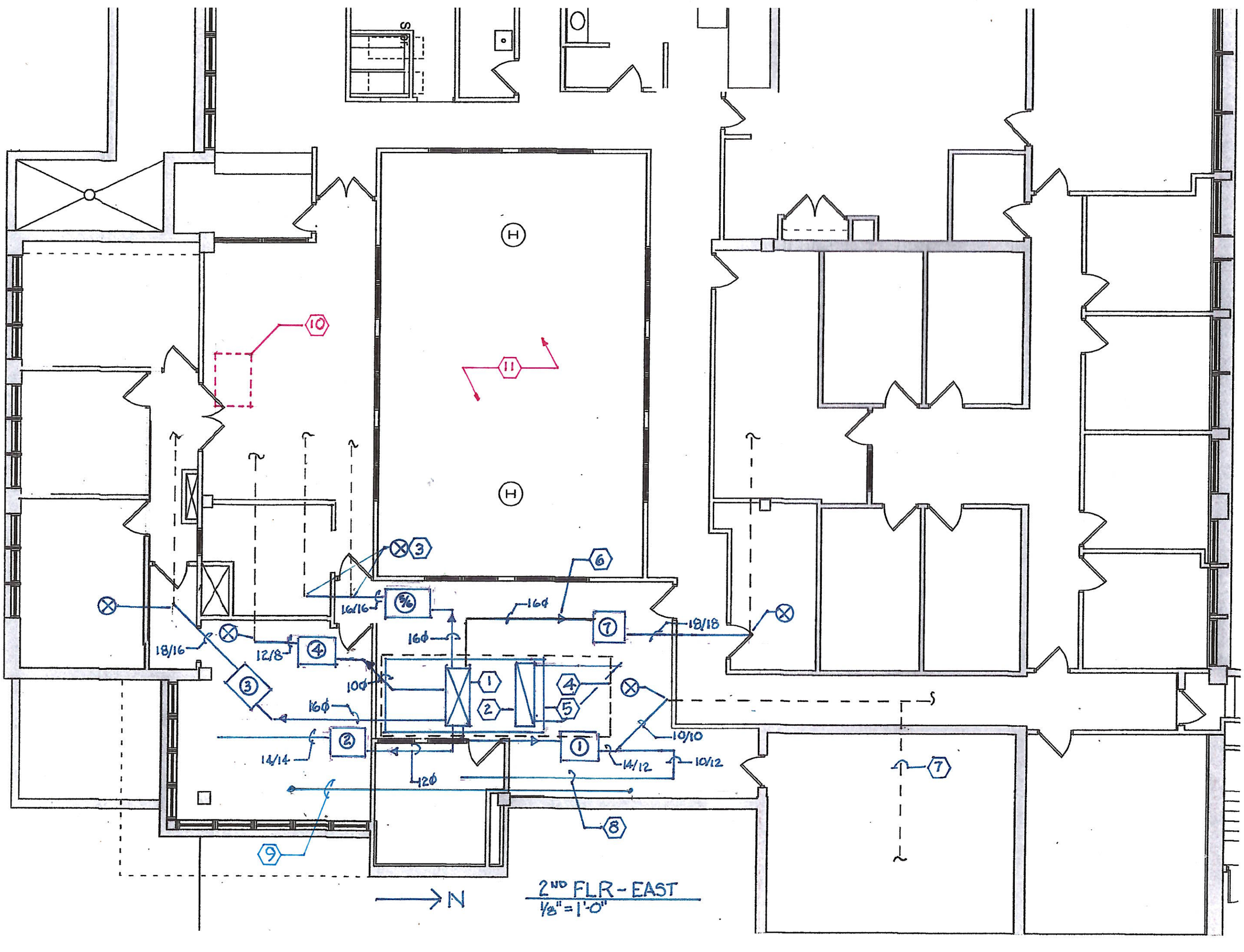
- **Mechanical – RTU Equipment Installation:**
  - Install curb adaptor on existing roof curb with gasket and sealant
  - Fabricate and install new sheet metal supply air plenum insulated with 1½” R6 acoustical duct liner (JM Linacoustic RC).
  - Fabricate and install a new return air plenum elbow insulated with 1½” R6 acoustical duct liner.
  - Install new RTU on curb adaptor and connect to plenums.
  - Connect condensate drainage, electrical, and controls to the new unit.
  - Provide a 1-1/4” copper tubing vented condensate trap for the new RTU. Run a new 1-1/4” hard-drawn copper tubing condensate drain line to the existing roof drain. Support new drain line on polycarbonate pillow blocks – Miro 1.5 or similar.

- **Mechanical – Supply Air Modifications and Equipment Installation:**
  - From the existing above-ceiling configuration, determine the appropriate locations for the new FPVAV boxes to allow for adequate maintenance space per the manufacturer’s recommendations and applicable code, approximately as shown on the Mechanical Floor Plan Drawing. Relocate existing services as required for the installations.
  - Install Fan-Powered VAV (FPVAV) boxes (as scheduled) above the ceiling and connect to the existing fiberglass ductboard zone ducts with an insulated sheet metal transition duct.
  - Connect new FPVAV boxes to the new supply air plenum with insulated round sheet metal ducts.

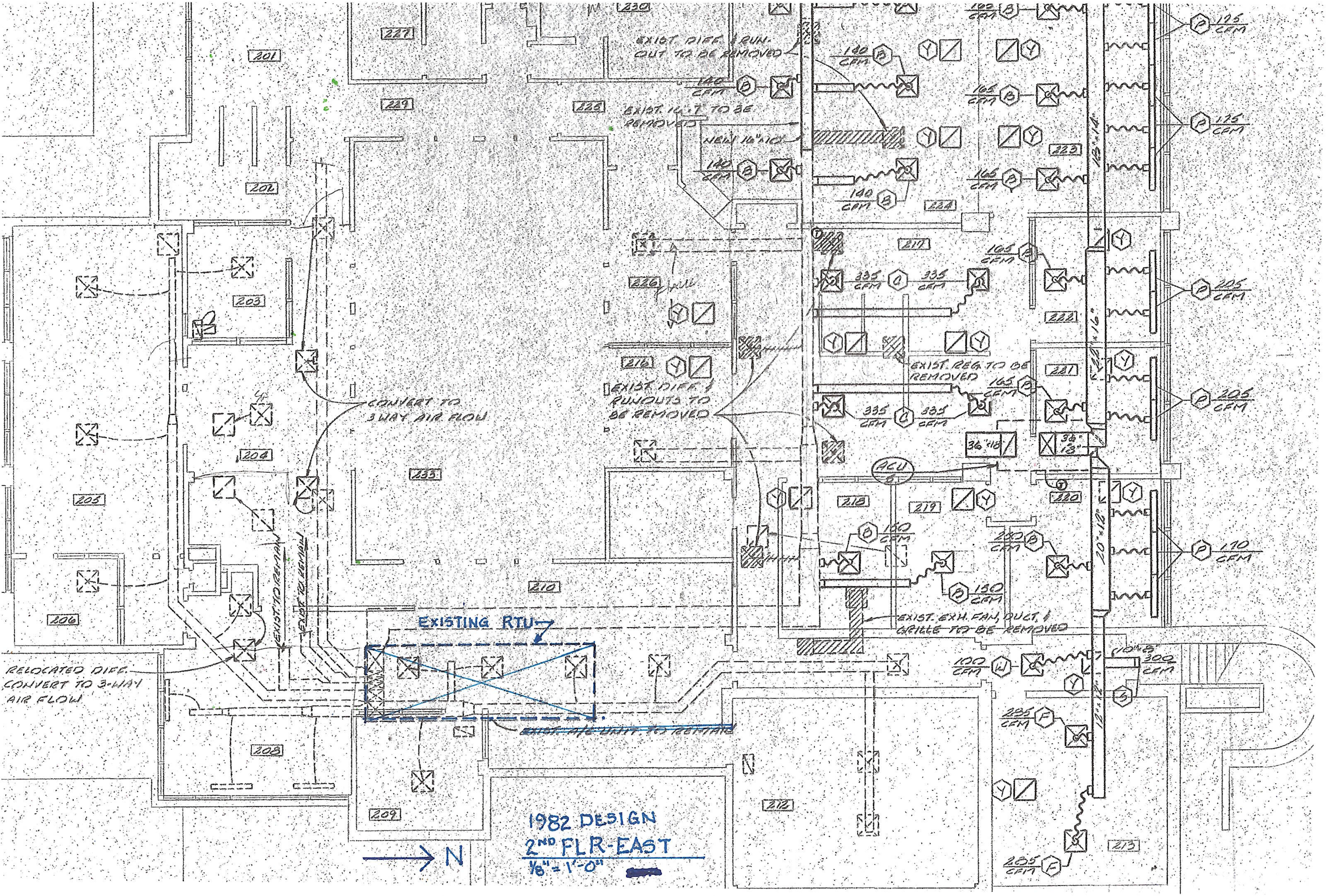
- **Controls:**
  - Provide, install, and connect JCI FX90-based controls to each FPVAV, new RTU, and existing Building Management System (BMS).
  - Provide any necessary software upgrades, program the controls, and upgrade the graphics in the existing BMS to include new components.
  - Integrate new input and output (I/O) points into the existing BMS.

- **Electrical:**
  - Reconfigure the existing feeder to the existing RTU (3#250kcmil, #3G, 3”C – field verify) to connect to the new RTU. Provide necessary junction boxes, conduit conductors, and other materials necessary to connect the existing feeder(s) to the new RTU.
  - Replace the existing fuses in the 400A/3P/208V switchboard fused switch located in the first floor, east, electrical room. Size fuses per the new RTU MOCP requirements.
  - Provide fused disconnects (heavy-duty fused safety switch as shown on the one-line diagram) and connect to each of the 6 new FPVAV with electric heater air terminal boxes.
  - Route 2 new 60A/3Ph/277/480V/4wire circuits with 4#6, #10G, 1”C, from the existing spare 60A/3P fused switches in the existing Main Service Panel located in the first-floor south electrical service room to the new FPVAV box disconnect switches as shown on the FPVAV one-line diagram.
  - Provide and install new 60A fuses in the 2 existing switchboard disconnects.

- **Startup:**
  - Provide a factory rep for the startup and commissioning of the RTU.
  - Provide startup and commissioning of each FPVAV terminal.
  - Verify BMS controls graphics are compatible, complete, functioning, and seamless with the existing controls.
  - Provide commissioning of the control system to verify each I/O point is present, calibrated, and operating. Produce a commissioning report listing each point and verification of proper operation.
  - Test, Adjust, and Balance (TAB) airflow and temperatures for the new RTU, each FPVAV box, and proportional balance of each supply outlet. Produce a TAB report.
  - Remove temporary HVAC systems and restore all temporary openings to their original condition.
  - Restore the ceiling suspension system and ceiling tiles. The City will provide attic stock for any damaged ceiling tile.
  - Clean the site and remove all construction components and debris.



2ND FLR - EAST
1/8" = 1'-0"



1982 DESIGN
2ND FLR-EAST
1/8" = 1'-0"
N
EXISTING RTU
EXIST. A/C UNIT TO REMAIN
RELOCATED DIFF. CONVERT TO 3-WAY AIR FLOW
CONVERT TO 3 WAY AIR FLOW
EXIST. TO REMAIN
EXIST. DIFF. & RUN-OUT TO BE REMOVED
EXIST. 16"x7 TO BE REMOVED
NEW 16"x10"
EXIST. DIFF. & RUNOUTS TO BE REMOVED
EXIST. REG. TO BE REMOVED
EXIST. EXH. FAN, DUCT, & GRILLE TO BE REMOVED
ACU 6
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230
233
140 CFM
165 CFM
175 CFM
205 CFM
335 CFM
150 CFM
130 CFM
280 CFM
110 CFM
100 CFM
300 CFM
285 CFM
36"x18"
36"x13"
18"x14"
20"x18"
10"x8"

GENERAL NOTES:

A. LOCATION OF ZONE FPVAV BOXES AND DUCTS ARE APPROXIMATE AND ARE BASED ON EXISTING ORIGINAL DESIGN DRAWINGS.

B. RELOCATE CONDUIT AND OTHER SERVICES TO ALLOW SPACE FOR NEW BOXES AND MAINTENANCE ACCESS AS REQUIRED BY THE EQUIPMENT MANUFACTURER AND CODES.

C. *MOUNT ELECTRICAL DISCONNECT SWITCHES TO BUILDING STRUCTURE ADJACENT TO EQUIPMENT.* LABEL DISCONNECTS WITH THE EQUIPMENT ID.

D. DUCT SIZES SHOWN ARE INTERNAL DIMENSIONS.

KEYED NOTES:

1. SHEET METAL SUPPLY PLENUM. OUTSIDE DIMENSIONS 1" SMALLER THAN RTU OUTLET, FLANGED, AND GASKETED TO RTU CURB. LINE WITH 1-1/2" THICK ACOUSTICAL DUCT LINER INSULATION. WRAP EXTERIOR OF PLENUM WITH DUCTWRAP INSULATION AS SPECIFIED. PROVIDE DUCT FLEX CONNECTOR BELOW UNIT.
2. SHEET METAL RETURN PLENUM WITH ELBOW SOUND ATTENUATOR. OUTSIDE DIMENSIONS 1" SMALLER THAN RTU INLET, FLANGED, AND GASKETED TO RTU CURB. LINE WITH 1-1/2" THICK ACOUSTICAL DUCT LINER INSULATION. PROVIDE DUCT FLEX CONNECTOR BELOW UNIT.
3. COMBINE EXISTING DUCTS SERVING ZONES 5 AND 6 INTO A SINGLE ZONE 5/6.
4. DASHED LINE IS OUTLINE OF EXISTING RTU CURB ON ROOF.
5. SOLID LINE IS THE OUTLINE OF THE NEW RTU.
6. PROVIDE A DUCT REDUCER UPSTREAM OF BOX CONNECTION WITH AT LEAST 24" OF STRAIGHT PIPE OF CONNECTION SIZE. TYPICAL FOR ALL BOXES.
7. DASHED LINE IS APPROXIMATE LOCATION OF 1" THICK FIBERGLASS DUCTBOARD EXISTING DUCT (TYPICAL).
8. SOLID LINE IS NEW SHEET METAL DUCT WITH EXTERNAL INSULATION.
9. PROVIDE ROOF EDGE GUARD WITHIN 10'-0" OF NEW RTU. GUARD SHALL BE A MODULAR, MANUFACTURED, FREE-STANDING, NON-PENETRATING, AND OSHA COMPLIANT. SIMILAR AND EQUIVALENT TO KEE GUARD.
10. APPROXIMATE LOCATION OF ABANDONED FAN-COIL UNIT. REF. ALTERNATE NO. 2
11. CLERESTORY ABOVE ROOF LINE. OPEN TO BELOW.

Sequence of Operation: PACKAGED RTU-5

Building Automation System Interface:
The Building Automation System (BAS) shall send the controller Occupied Bypass, Pre-Cool, Occupied/Unoccupied, and Heat/Cool modes. The BAS shall also send the discharge air temperature setpoint and the duct static pressure setpoint. If a BAS is not present, or communication is lost with the BAS, the controller shall operate using default modes and *setpoints*.

Occupied:
During occupied periods, the supply fan and return fan shall run continuously, and the mixed air dampers shall open to maintain minimum ventilation requirements. The unit controller shall control the supply fan speed to maintain the current supply duct static pressure setpoint (adj.). The unit controller shall control the return fan speed to maintain the current return duct static pressure setpoint (adj.). Upon a call for DX cooling, the unit controller shall enable the first fixed speed compressor. If the fixed speed compressor cannot satisfy the load conditions, the unit controller shall start the next fixed speed compressor in sequence to add to the total unit cooling load percentage. This process shall repeat until all of the fixed speed compressors have been started or until the active discharge air temperature setpoint is satisfied. If economizing is enabled, the outdoor air or mixed air dampers shall modulate to maintain the discharge air temperature setpoint. If the discharge air temperature sensor fails, the DX cooling shall be disabled and an alarm shall annunciate at the BAS.

Unoccupied:
During the unoccupied periods, the supply fan shall be disabled, the return fan shall be disabled, the outside air damper shall close, and the mechanical cooling shall be disabled to conserve energy.
When the space temperature is above the unoccupied cooling setpoint of 85.0 deg. F (adj.) the supply fan and return fan shall be commanded on, the outside air damper shall open if economizing is enabled and remain closed if economizing is disabled, and the mechanical cooling shall be enabled. When the space temperature falls below the unoccupied cooling setpoint of 85.0 deg. F (adj.) minus the unoccupied differential of 4.0 deg. F (adj.) the supply fan, the outside air damper shall close, and the mechanical cooling shall be disabled.

Optimal Start:
The BAS shall monitor the scheduled occupied time, occupied space setpoints, and space temperature to calculate when the optimal start occurs.

Optimal Stop:
The BAS shall monitor the scheduled unoccupied time, occupied setpoints and space temperature to calculate when the optimal stop occurs. When the optimal stop mode is active the unit controller shall maintain the space temperature to the space temperature offset setpoint. Outside air damper shall remain enabled to provide minimum ventilation.

Pre-Cool Mode:
During optimal start, if the average space temperature is above the occupied cooling setpoint, pre-cool mode shall be activated. When pre-cool is initiated, the unit shall enable the fan and either the cooling or the economizer. The outside air damper shall remain closed, unless economizing. When the space temperature reaches the occupied cooling setpoint (adj.), the unit shall transition to the occupied mode.

unit shall shut down, and a manual reset diagnostic is displayed at the remote panel and/or the BAS system.

Relief Air and Building Pressure Control:
A differential pressure transducer shall actively monitor the pressure difference between the building (indoors) and outdoors. If the building pressure exceeds the desired setpoint, the associated controller shall modulate the relief air damper to maintain building pressure at the setpoint. If the building pressure decreases below the desired setpoint, the associated controller shall close the relief air damper.

Filter Status:
A differential pressure switch shall monitor the differential pressure across the filter(s) when the fan is running. If the switch closes during normal operation, a dirty filter alarm shall annunciate at the BAS.

Condensate Overflow Shutdown:
The unit shall shut down in response to a signal from the condensate overflow sensor. The sensor shall be interlocked with the unit cooling controller to enable immediate shutdown of cooling.

Refrigerant Mitigation Mode:
The unit controller shall monitor the leak detection system. When a leak is detected, an alarm shall promptly alert the BAS via BACnet Change-of-Value (COV), and mitigation shall be activated.
In occupied mode, the supply fan shall remain operational, and the compressor(s), electric heating, fuel-fired heating, electrostatic devices, and any other ignition device starters shall be disabled, and activate mechanical ventilation (if it's required by Section 7.6.4 of the ASHRAE standard). for the duration of the mitigation process, plus an additional 5 minutes.
In unoccupied mode, the supply fan shall remain operational, and the compressor(s), electric heating, fuel-fired heating, electrostatic devices, and any other ignition device starters shall be disabled, and activate mechanical ventilation (if it's required by Section 7.6.4 of the ASHRAE standard). for the duration of the mitigation process, plus an additional 5 minutes.

SEQUENCE OF OPERATION: AIR TERMINAL UNITS: FAN POWERED VAV WITH ELECTRIC HEATING:

START/STOP: The units shall be interlocked with the RTU via the BMS. With the RTU off, the VAV dampers shall fully close, and the internal fan and heaters shall be de-energized.

COOLING: The pressure-independent VAV damper shall modulate between minimum (set point -1 deg f - adj) and maximum (SP+1°F - adj) air flows as scheduled to maintain the set point of the thermostat.

HEATING: Upon a fall in room temperature of 3°F (adj 2 to 6°F) below the set point of the room thermostat, the VAV damper shall remain at minimum air low and the internal fan shall start. With a further 2°F (adj 2 to 6°F) fall in room temperature, the first stage of heat shall be energized. Upon a further fall in room temperature of 2°F (adj), the second stage of heat shall be energized.

Occupied Bypass:
The BAS shall monitor the status of the ON and CANCEL buttons of the space temperature sensors. When an occupied bypass request is received from a space sensor, the unit shall transition from its current occupancy mode to occupied bypass mode and maintain the space temperature at the occupied setpoints (adj.).

Cool Mode:
COOLING: The unit controller shall use the discharge air temperature sensor and the discharge air temperature cooling setpoint to determine when to initiate cooling requests. The discharge air setpoint shall be maintained by controlling cooling as required.

Discharge Air Temperature Reset Control:
The discharge air temperature setpoint shall be reset to the optimal setpoint communicated by the BAS. The BAS shall reset the discharge air temperature setpoint based on the current outside air temperature, but shall override this reset function and return the discharge air temperature setpoint to 55.0 deg. F (adj.) if more than two (adj.) zones begin to overheat. Also, the BAS shall override this reset function whenever the outdoor dew point exceeds 60.0 deg. F (adj.) or indoor humidity is higher than 60% RH (adj.). If the discharge air temperature falls below the minimum limit, a low-temperature alarm shall annunciate, and the unit shall shut down. If the discharge air temperature rises above the maximum limit, a high temperature alarm shall annunciate.

Economizer:
ENABLE (Comparative Enthalpy): Outside air (OA) enthalpy shall be compared with the return air (RA) enthalpy point. The economizer shall enable when OA enthalpy is less than RA enthalpy - 2.0 BTU/LB. The economizer shall disable when OA enthalpy is greater than RA enthalpy. OPERATION: The supply air sensor shall measure the dry bulb temperature of the air leaving the evaporator coil while economizing. When economizing is enabled, and the unit is operating in the cooling mode, the economizer damper shall be modulated between its minimum position and 100% to maintain the discharge air temperature setpoint. The economizer damper shall modulate toward the minimum position if the discharge air temperature falls below the discharge low-limit temperature setpoint. Compressors shall be delayed from operating until the economizer has opened to 100%.

Ventilation Control:
When in occupied mode, the flow-measuring outdoor air and damper shall modulate to maintain the current ventilation airflow setpoint. The ventilation airflow setpoint shall be reset to the optimal ventilation setpoint communicated by the BAS. The BAS shall reset the ventilation setpoint based on the current ventilation needs of the VAV terminals.

Supply & Return Fan Operation:
The supply and return fans shall be enabled in occupied mode and cycled on in unoccupied mode. The unit controller shall vary the supply fan speed to meet current cooling and heating loads. The return fan speed shall be modulated to maintain the return air static pressure setpoint.

Static Pressure High Limit:
If, for any reason, the supply air pressure or return plenum exceeds their respective static pressure high limit, the fans shall shut down. The unit shall be allowed to restart three times after a 15-minute off period. If the over-pressurization condition occurs on the fourth restart, the

	INPUTS												OUTPUTS										SOFTWARE FEATURES																					
	ANALOG						DIGITAL						DIGITAL					ANALOG					CALCULATED						ALARMS					PROGRAMS										
VAV RTU-5	TEMPERATURE	PRESSURE	RELATIVE HUMIDITY	SETPOINT ADJUST	FLOW	FEEDBACK	DP SWITCH	SWITCH	CURRENT SWITCH	SMOKE DETECTOR	AUX. CONTACT	SAFETY DEVICE	ON-OFF (H.O.A.)	START/STOP P.B.	OFF-HIGH-LOW	OPEN/CLOSE	ENABLE/DISABLE	0-10 Vdc or P.C.	4-20 ma	3-15 PSI	FLOATING POINT	OVERRIDE	KWHr/DEMAND	ENTHALPY	POSITION AS % OPN	SETPOINT	TOTALIZATION	RUNTIME	HIGH ANALOG	LOW ANALOG	BINARY	PROOF	MAINTENANCE ALM	TIME OF DAY	START/STOP OPT.	ENTHALPY OPT.	DEMAND LIMITING	DDC/PID CONTROL	EVENT PROGRAM	ALARM MESSAGES	TREND REPORT	DYN. COLOR GRAPHIC	DYN. TREND GRAPH	COMMENTS
ROOF TOP UNIT									X				X									X						X				X	X	X	X				X	X		X		
SUPPLYFAN & RELIEF AIR FAN									X				X															X				X	X							X		X		
SUPPLY FAN VFD						X												X															X							X		X		
SUPPLY FAN STATIC CUTOUT		X										X																					X							X		X		HARDWIRE INTERLOCK
SUPPLY STATIC PRESSURE		X																								X			X	X												X		
MIXED AIR STATIC PRESSURE		X		X																						X			X	X												X		
OUTSIDE AIR DAMPER				X														X								X																X		
CONDENSATE PAN HI WATER												X																			X											X		
MIXED AIR TEMPERATURE	X																	X											X	X			X							X		X		
COIL LEAVING AIR TEMPERATURE	X			X														X											X	X			X							X		X	X	
SUPPLY AIR TEMPERATURE	X																	X											X	X			X							X		X	X	
RETURN AIR TEMPERATURE	X																	X											X	X			X							X		X	X	
OA TEMPERATURE	X																	X															X							X		X		
FILTER SWITCH							X																			X							X									X		
SMOKE DETECTOR											X																				X		X									X		HARDWIRE INTERLOCK
RA ENTHALPY	X		X															X						X																				
OA ENTHALPY	X		X															X						X																				
OA MONITOR				X	X													X								X																X		

	INPUTS												OUTPUTS										SOFTWARE FEATURES																					
	ANALOG						DIGITAL						DIGITAL					ANALOG					CALCULATED						ALARMS					PROGRAMS										
AIR TERMINAL UNITS (FPVAV)	TEMPERATURE	PRESSURE	RELATIVE HUMIDITY	OCCUPANCY SENSOR	SETPOINT	CARBON DIOXIDE	DP SWITCH	TEMP. SWITCH	CURRENT SWITCH	SMOKE DETECTOR	AUX. CONTACT	PULSE CONTACT	ON-OFF (H.O.A.)	START/STOP P.B.	OFF-HIGH-LOW	OPEN/CLOSE		0-10 Vdc	4-20 ma	3-15 PSI	FLOATING POINT	OVERRIDE	KWHr/DEMAND	BTU'S	POSITION AS % OPN	SETPOINT	TOTALIZATION	RUNTIME	HIGH ANALOG	LOW ANALOG	BINARY	PROOF	MAINTENANCE ALM	P1 PROTOCOL BOARD	START/STOP OPT.	ENTHALPY OPT.	DEMAND LIMITING	DDC/PID CONTROL	EVENT PROGRAM	ALARM MESSAGES	TREND REPORT	DYN. COLOR GRAPHIC	DYN. TREND GRAPH	COMMENTS
AIR TERMINAL UNITS																																												
SPACE TEMPERATURE	X																									X			X	X												X		
VAV AIR DAMPER																		X							X													X				X		
SUPPLY AIR VOLUME					X																								X	X												X		
SUPPLY AIR TEMPERATURE	X																												X	X												X		
FAN									X																								X							X		X		
ELEC HEATER															X																											X		

VARIABLE AIR VOLUME DX ROOFTOP UNIT WITH OUTSIDE AIR ECONOMIZER

MARK	AREA SERVED	SUPPLY AIR FAN						RELIEF AIR FAN				DX COOLING COIL					
		SUPPY AIR CFM	OA CFM	ESP (IN. WG)	TYPE	MIN. H.P.	STARTER TYPE	RETURN AIR CFM	ESP (IN.)	MIN. H.P.	MOTOR TYPE	EAT (DB/WB)	LAT (DB/WB)	TOTAL CAP. (MBH)	SENS (MBH)	MIN. ROWS	REFRIG
RTU-5	SECOND FLOOR EAST	8,000	750	2.0	FC	10	VFD	6,750	1.0	6.0	ECM	80/67	56.6/54.6	307	205.5	4	454B

MARK	MANUFACTURER	ELECTRICAL			EFFICIENCY		FILTERS		OPERATING
	TRANEMODEL NO.	VOLT / PH.	MCA	UNIT MOCP	EER	IEER	MERV	THICKNESS INCHES	WEIGHT (LBS)
RTU-5	TCD330DE0	208/3	167.0	200	12.0	17.2	14	4	4,972

ACCESSORIES TO BE INCLUDED

1. LOW AMBIENT CONTROL TO 0°F DEGREES
2. FACTORY FABRICATED ROOF CURB ADAPTOR TO FIT EXISTING CURB
3. UNIT SHALL BE HIGH EFFICIENCY WITH MINIMUM 5 STAGES OF COMPRESSOR UNLOADING
4. SUPPLY FAN VARIABLE FREQUENCY DRIVE WITH BY-PASS. FACTORY MOUNTED IN UNIT
5. VFD DRIVEN MOTORS ARE TO BE PREMIUM EFF. MOTOR IN ACCORDANCE WITH NEMA MG1 PART 30 & 31.
6. PROVIDE MOTOR WITH SHAFT GROUNDING RING SIMILAR AND EQUIVALENT TO AEGIS "SGR"
7. UNIT SHALL BE FURNISHED WITH FACTORY INSTALLED CONDENSER COIL HAIL & VANDAL GUARDS
8. UNIT SHALL BE FURNISHED WITH HINGED SERVICE ACCESS PANELS
9. FURNISH UNIT WITH 120 VOLT SERVICE OUTLET FACTORY POWERED FROM LINE SIDE OF DISCONNECT
10. NON FUSED DISCONNECT-LOCKABLE TYPE.
11. GENERIC BAS INTERFACE FOR CONTROL SYSTEM BACNET NATIVE
12. OUTSIDE AIR FLOW MONITOR STATION EQUAL TO TRANE TRAQ SYSTEM
13. STAINLESS STEEL POSITIVELY SLOPING INSULATED COIL DRAIN PAN
14. HIGH CONDENSATE SWITCH TO DISCONNECT COMPRESSOR AND SIGNAL ALARM
15. CABINET CONSTRUCTION SHALL INCLUDE 1/2" THICK CLEANABLE IAQ FOIL FACED FIBERGLASS INSULATION ON ALL EXTERIOR SURFACES EXPOSED TO AIRSTREAM
16. UNIT SHALL BE FURNISHED WITH RELIEF FAN(S) AND DAMPER(S) FOR INTEGRAL STATITRAC BUILDING PRESSURIZATION CONTROL
17. FURNISH UNIT WITH AMCA CLASS 1A LOW LEAK COMPARATIVE ENTHALPY ECONOMIZER WITH FAULT DETECTION DIAGNOSTICS
18. UNIT SHALL BE LISTED FOR USE WITH R-454B AND INCLUDE A FACTORY INSTALLED LEAK DETECTION SYSTEM AND INCLUDE INPUT, MITIGATION AND CONCENTRATION BACNET POINTS PER UL 60335-2-40
19. UNIT SHALL BE FURNISHED WITH FACTORY INSTALLED PHASE MONITOR, FROSTAT, AND TEMPERATURE DISCHARGE LIMIT SENSORS AND SAFETY DEVICES
20. PROVIDE UNIT CONTROLLER THAT INCLUDES A 2 X 16 LCD SCREEN WITH TACTILE BUTTONS AND SHALL BE CONFIGURABLE VIA BLUETOOTH CONNECTION TO MOBILE DEVICE
21. UNIT SHALL BE FURNISHED WITH MANUFACTURERS 1ST YEAR PARTS, LABOR AND REFRIGERANT WARRANTY. COMPRESSOR(S) MANUFACTURER WARRANTY COVERAGE SHALL BE 5 YEARS.

GENERAL NOTES

A. FILTER PRESSURE DROP TO BE IN UNIT CALCULATED PRESSURE DROP.
B. EXTERNAL STATIC PRESSURE (ESP) SHOWN IN SCHEDULE IS FOR FILTER LOADING AND DUCTWORK ONLY
C. ALL COOLING MBH CAPACITIES SHOWN ARE MINIMUM REQUIRED CAPACITIES.
D. FILL ROOF CURB VOIDS WITH BATT INSULATION.
E. INSTALL NEW HARD DRAWN COPPER CONDENSATE DRAIN TO EXISTING ROOF DRAIN
F. PROVIDE VENTED TRAP AND CONNECT ALL CONDENSATE DRAIN OUTLETS ON UNIT.

PARALLEL FAN POWERED VAV TERMINAL UNIT SCHEDULE

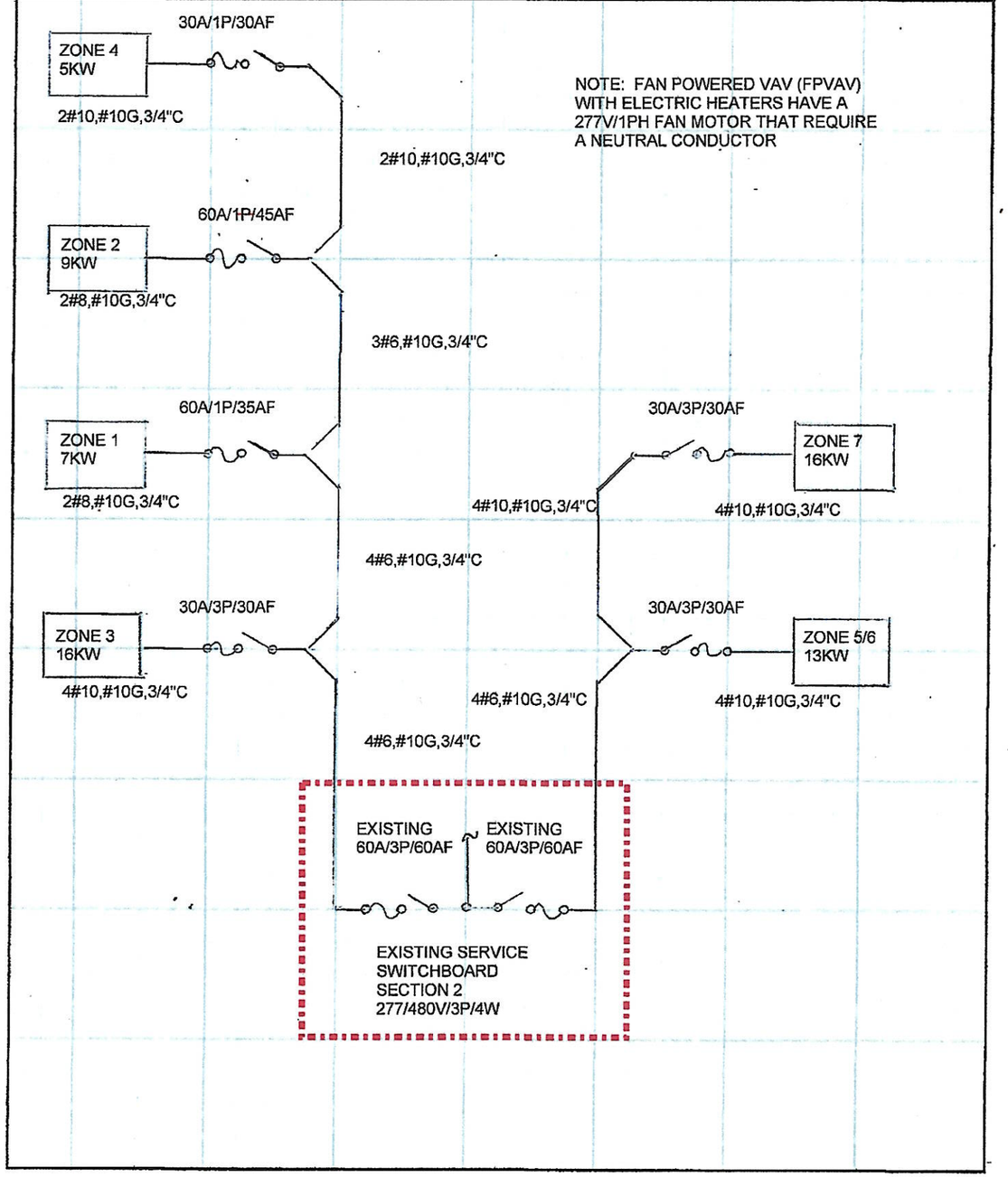
		AIR VALVE					TOTAL HTG	FAN						HEATING	
Unit Tag FPVAV	Area Served	Primary Inlet	Design cooling airflow (CFM)	Min cooling airflow (CFM)	Air Valve Heating Airflow (CFM)	Downstream SP (in H2O)	Unit heating airflow (CFM)	Fan airflow (CFM)	Fan Size	Motor Voltage	Fan power (hp)	Fan TSP (in H2O)	% of fan range (%)	Electric Heater Kilowatt	Electric Heater Voltage
Z-1	E. OFC, VAULT	8"	850	160	160	0.35	640	480	Small	277/60/1	0.333	0.7	76.25	7	277/60/1
Z-2	CORNER OFC	10"	1070	200	200	0.35	800	600	Small	277/60/1	0.333	0.7	77.93	9	277/60/1
Z=3	S. OFCs	12"	1920	360	360	0.35	1440	1080	Medium	277/60/1	0.75	0.6	69.99	16	480/60/3
Z-4	CONFR	8"	530	105	105	0.35	405	300	Small	277/60/1	0.333	0.7	71.01	5	277/60/1
Z-5/6	RECEPT, TLT	16"	1490	420	420	0.35	1260	840	Large	277/60/1	1	0.6	48.92	13	480/60/3
Z-7	BRK, N.OFCs	14"	2140	400	400	0.35	1600	1200	Medium	277/60/1	0.75	0.6	70.89	16	480/60/3

	ELECTRICAL			PERFORMANCE							WEIGHT	MAKE/MODEL
Unit Tag	Full load amps (A)	Min circuit ampacity	Max overcurrent protection (MOCP)	Primary EDB (F)	Plenum EAT (F)	Room heating setpoint (F)	Unit LAT (F)	Coil heating capacity (MBh)	Coil EAT (F)	Coil LAT (F)	Operating weight (lb)	Trane Model Number
Z-1	27.57	34.46	35	55	66.3	68	97.9	23.91	63.48	97.9	116	VPEG08**1A0****DE21*018WWD07021W**0000000
Z-2	34.79	43.49	45	55	66.3	68	98.88	30.74	63.48	98.88	118	VPEG10**1A0****DE21*018WWD09021W**0000000
Z=3	23.35	29.18	30	55	66.3	68	98.45	54.64	63.48	98.45	160	VPEG12**2A0****DE21*018WWF16021W**0000000
Z-4	20.35	25.44	30	55	66.3	68	102.23	17.08	63.37	102.23	116	VPEG08**1A0****DE21*018WWD05021W**0000000
Z-5/6	20.84	26.05	30	55	66.3	68	95.01	44.4	62.53	95.01	177	VPEG16**3A0****DE21*018WWF13021W**0000000
Z-7	23.35	29.18	30	55	66.3	68	94.95	54.64	63.48	94.95	162	VPEG14**2A0****DE21*018WWF16021W**0000000

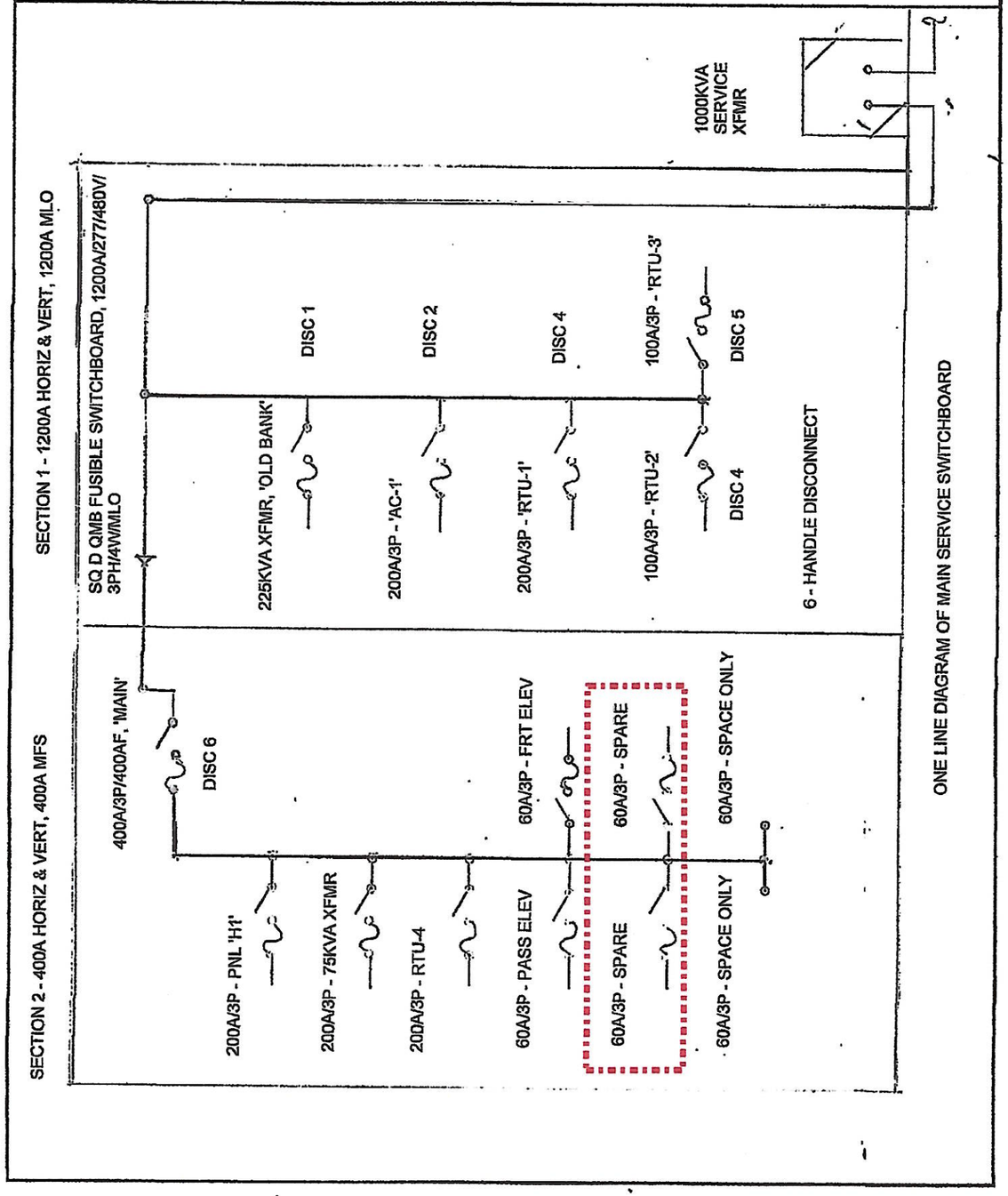
FPVAV SCHEDULE NOTES:

1. PARALLEL FAN POWERED WITH ELECTRIC HEAT
2. FLANGED OUTLET CONNECTION
3. 1" FOIL FACED INSULATION
4. STANDARD TOP AND BOTTOM ACCESS
5. STANDARD AIR LEAKAGE
6. FUSED DISC. SWITCH BY E.C.
7. 1" MERV 8 FILTER
8. JCI PCV16xx CONTROLLER W/ACTUATOR
9. 2 EQUAL ELEC HEAT STAGES W/ 24VAC MAG CONTACTOR
10. 50VA, 277V x 24V CONTROLS XFMR
11. ELEC HTR AIR FLOW SWITCH
12. ECM MOTOR - CONSTANT VOLUME
13. VIBRATION TYPE HANGERS

inc, engineers	DATE 4/28/2026	BY TA	SHEET OF	FILE
	PROJECT BRENHAM CITY HALL - RTU-5 REPLACEMENT			
	DESCRIPTION ONE LINE DIAGRAM FOR FPVAV BOXES			



inc, engineers	DATE 4/28/2026	BY TA	SHEET OF	FILE
	PROJECT BRENHAM CITY HALL - RTU-5 REPLACEMENT			
	DESCRIPTION ONE LINE DIAGRAM OF MAIN SERVICE SWITCHBOARD			



SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Construction Narratives, and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to all Sections of these Specifications.

1.2 SUMMARY OF WORK

A. All Drawings, Construction Narratives, and general provisions of the Contract, including General and Supplementary Conditions, other Division 1 Specification Sections, and all Government conditions and rules, apply to all Sections of these Specifications.

B. The purpose of this project is to:

1. Replace the existing roof-mounted packaged multizone air conditioning unit (RTU-5) with new RTU equipment as described herein.
2. Remove the existing equipment and associated components from the work premises and dispose of them in accordance with required procedures and applicable codes.
3. Close, seal, and insulate all unused roof openings.
4. Provide and install new Fan-Powered Variable Air Volume (FPVAV) air terminal units and connect to the new RTU and the existing zone ducts.
5. Connect the new equipment to the existing zoned ductwork with transitions and other appurtenances necessary for the connections.
6. Modify the existing electrical system to accommodate the equipment components
7. Connect the new equipment to the existing.
8. Provide temperature and other operating controls that are compatible with the existing Johnson Controls Systems FX90 Building Management System (BMS).
9. Provide software modifications so that the new equipment and systems are seamlessly compatible with the existing operation and graphics of the existing BMS.

C. Indications on the Drawings or mention in the construction documents of articles, materials, operations, or methods require that the Contractor or his Subcontractors provide each item indicated or mentioned of the quality or subject to the qualifications noted.

D. Perform, according to conditions stated, each operation described; and provide, therefore, all necessary labor, equipment, services, and incidentals required for the execution of the Work.

1.3 WORK SEQUENCE

A. The existing facility will remain open and functioning during construction. All work shall be phased to minimize interference with operations in the existing building.

B. The Contractor shall submit a sequence of work plan and schedule to the Owner for acceptance prior to commencement of work.

C. As an ADD ALTERNATE: The Contractor shall provide temporary cooling and heating as necessary to keep the building air conditioned during the work of the project.

D. Provide signage, barricades, and other measures to direct occupants around work areas. Confine work areas to as few, as small, and as least disruptive as possible. Open work areas and remove control measures as soon as possible after completing the immediate activities there.

E. Any interruption of utilities, including HVAC, shall be coordinated with the Owner at least 48 hours prior to the needed interruption.

1.4 CONTRACTOR USE OF PREMISES

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy and use by the building occupants.

1. Confine operations to areas within the Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
2. Keep driveways and entrances serving the premises clear and available to the occupants at all times. Do not use these areas for parking or storage of materials. Schedule

deliveries to minimize the space and time required for storing materials and equipment on site.

B. Use of the Existing Building: Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.

1.5 OCCUPANCY OF BUILDING

A. The existing facility will be occupied at all times during this project's construction.

B. Throughout the construction period, occupants shall be protected, and the building shall be protected from damage.

C. Required shutdowns of any utilities shall be scheduled and coordinated with the Owner to minimize disruption.

D. Required fire exits from the existing building shall be maintained, kept accessible, and kept clear at all times while the building is occupied.

1.6 RECORD DOCUMENTS

A. Record Drawings: Maintain a clean, undamaged set of black line white prints of Contract Drawings and Specifications. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Where Shop Drawings are used for changes, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record later. Keep the set updated weekly, and review it with the Engineer's representative at each site visit.

1.7 LAYING OUT WORK, MEASUREMENTS, LEVELS, AND SURVEYS

A. The Contractor shall establish and maintain all lines and levels and shall be responsible for the accuracy thereof.

B. All measurements at the site or at the building shall be verified, and no extra compensation will be allowed on account of the difference between actual dimensions, quantities, and dimensions on the Construction Documents.

C. Before ordering any materials or performing any work, each Contractor shall verify all measurements at the building and shall be responsible for their correctness. No extra charge or compensation will be allowed for differences between actual dimensions and the measurements indicated on the Drawings. Any differences found shall be submitted to the Engineer for consideration before proceeding with the work.

1.8 HAZARDOUS MATERIALS

A. Non-use of Hazardous Materials: The Contractor shall not use asbestos or products containing toxic or hazardous materials, including but not limited to asbestos, PCBs, or lead, on this Project

PART 2 - PRODUCTS
Not Applicable

PART 3 - EXECUTION
Not Applicable

END OF SECTION

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Alternate submission descriptions.

1.2 RELATED SECTIONS

A. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the Work.

B. Sections of Specifications identified in each Alternate.

1.3 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each alternate

1.4 SCHEDULE OF ALTERNATES

A. **ALTERNATE NO. 1** - **Temporary HVAC During Construction:**

1. Provide temporary air conditioning and heating during the construction of the project from the time the subject unit is turned off for demolition until the replacement unit is adequately complete to service the space.

2. The performance requirements are to maintain indoor conditions between 68°F (heating) and 78°F at 60% RH (cooling).

3. The means and methods for providing and installing the equipment and distribution are at the contractor's option.

4. Electrical power will be available at the site from the City. Connection to the power source(s) shall be included in the cost. If connected to the building's power, the power will be provided at no cost to the Contractor.

5. The price of the Alternate shall include all costs associated with provision, erection, temporary building openings and closures, connections to energy sources, removal of components, and other items necessary for a functioning system.

B. **ALTERNATE No. 2: Removal of Existing Above-Ceiling Fan-Coil Unit:**

1. Remove and dispose of the existing above-ceiling Fan-Coil Unit, associated ductwork, and supporting hardware of an abandoned DX Fan-Coil Unit that is above the conference area of the subject workspace.

2. The unit has been disconnected from its associated condensing unit, and the refrigerant has been removed.

3. The work will require removal and replacement of the lay-in ceiling beneath the unit.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. This 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.
2. Submittals Schedule.

1.2 COORDINATION

A. Coordinate preparation and processing of schedules and reports with the performance of construction activities and with the scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by the 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 the orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of the Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend the schedule from the date established for the Notice to Proceed to the 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 separate area as a separate numbered activity for each principal 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 the Engineer.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in the schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    a. Major lead items: Equipment such as:
        1) A/C equipment
        2) Ductwork fabrication
        3) Controls components
        4) Electrical equipment

3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in the schedule. Coordinate submittal review times in the Contractor's Construction Schedule with the Submittals Schedule.
4. Startup and Testing Time: Include not less than seven days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update the schedule to reflect actual construction progress and activities. Issue the schedule one week before each regularly scheduled progress meeting.
   1. Revise the 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 an 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 Actual Completion percentage for each activity.

END OF SECTION

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing the procedures at least 10 days before cutting and patching are carried out, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.

2. Changes to In-Place Construction: Describe anticipated results. This includes changes to structural elements and operating components, as well as changes in the building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.

4. Dates: Indicate when cutting and patching will be performed.

5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.

7. Engineer's Approval: Obtain approval of the cutting and patching proposal before cutting and patching. Approval does not waive the right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in the Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at the Project site with the parties involved in cutting and patching, including the mechanical and electrical trades. Review areas

of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually fully match in-place adjacent surfaces, if possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched, and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support for the Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with the use of adjoining areas or the interruption of free passage to adjoining areas.

D. 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 and prevent interruption to occupied areas.

3.3 PERFORMANCE

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 the installation of other components or the performance of other construction and subsequently patch as required to restore surfaces to their original condition.

B. 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.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to the required size, and with minimal disturbance to 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. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of the pipe or conduit to prevent the entrance of moisture or other foreign matter after cutting.

5. Proceed with patching after construction operations requiring cutting are complete.

C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate the integrity of the 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. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance. Provide new ceiling tile and suspension components matching the existing where damaged during the Work of this Project.

4. Exterior Building Enclosure: Patch components in a manner that restores the enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection procedures.
   2. Warranties.
   3. Final cleaning.

1.2 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting an inspection for determining the date of Substantial Completion, complete the following. List items below that are incomplete in the request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   5. Prepare and submit Project Record Documents, operation and maintenance manuals, as-built submittal and drawings, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
   6. Deliver tools, spare parts, extra materials, and similar items to the location designated by the Owner. Label with manufacturer's name and model number where applicable.
   7. Terminate and remove temporary facilities from the Project site, along with mockups, construction tools, and similar elements.
   8. Complete final cleaning requirements, including touch-up painting.
   9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of the request, the Engineer will either proceed with the inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare the Certificate of Substantial Completion after inspection or will notify the Contractor of items, either on the Contractor's list or additional items identified by the Engineer, that must be completed or corrected before the certificate is issued.
   1. Reinspection: 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.

1.3 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining the date of Final Completion, complete the following:
   1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
   2. Submit a certified copy of the Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by the Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
   3. Submit evidence of final, continuing insurance coverage complying with insurance

requirements.

4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of the request, the Engineer will either proceed with the inspection or notify the Contractor of unfulfilled requirements. The Engineer will prepare a final Certificate for Payment after inspection or will notify the Contractor that the work must be completed or corrected before the certificate is issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of the 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 the Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize a list of spaces in sequential order, starting with exterior areas first and proceeding from the lowest floor to the highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

A. Submittal Time: Submit written warranties on request of the Engineer for designated portions of the Work where commencement of warranties other than the date of Substantial Completion is indicated.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-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 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 the installer.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by the 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

3.1 FINAL CLEANING

A. General: Provide 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 the condition expected in an average commercial building cleaning and maintenance program. Comply with the manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or for a portion of the 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 neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from the Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored, or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign substances.
n. Replace parts subject to unusual operating conditions.
o. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Project site and dispose of lawfully.

END OF SECTION

SECTION 02 05 00 – DEMOLITION

PART 1 PART 1 GENERAL

1.1 SECTION INCLUDES

A. Demolition of designated portions of existing construction; disconnecting and capping utilities as required.

B. Removing designated building equipment and fixtures; removing designated building components.

C. Patching and repairing existing construction damaged or altered during construction of the Work.

1.2 REGULATORY REQUIREMENTS

A. Conform to all applicable codes for demolition of structure, safety of adjacent structures, dust control, service utilities, discovered hazards, and disposal.

1.3 DEMOLITION REQUIREMENTS

A. Perform demolition in a manner that eliminates hazards to persons and property.

B. Conduct demolition to minimize interference with adjacent structures and building areas.

C. Conduct operations with minimum interference to public or private accesses.

D. Maintain protected egress and access at all times. Do not close or obstruct roadways and sidewalks without permission from the Owner.

E. Cease operations immediately if adjacent structures appear to be in danger. Notify Engineer.

F. Erect and maintain temporary partitions to prevent spread of dust, odors and noise and to permit continued Owner occupancy and public access of upper floors and communications rooms located within the construction area.

G. Wet down site and areas of demolition as required to prevent dust from rising.

H. Ensure that permanent utility services to existing building are maintained.

PART 2 PART 2 NOT USED

PART 3 PART 3 EXECUTION

3.1 PREPARATION

A. Provide, erect, and maintain temporary barriers and security devices.

B. Protect existing building components, landscaping materials, structures, and paving surfaces that are not to be demolished.

C. Protect existing items which are not indicated to be removed.

3.2 DEMOLITION, PATCHING, AND REPAIRING

A. Demolition shall be carried out as quietly as possible with all deliberate speed once the demolition operation has begun.

B. Demolish components indicated in an orderly and careful manner.

C. All cutting through existing concrete and masonry shall be done with a cutting machine, saw, or core drill to ensure minimum disturbance to adjacent construction.

D. Existing work shall be cut, altered, removed, temporarily removed and replaced, or relocated as required for the performance of the work indicated by the Contract Documents. Responsibility for the cost of restoring work to remain, when damaged by operations included in this section, shall be considered a requirement of this section.

E. All materials required for remodeling and patching on or in the existing building shall be of the same type, quality, and workmanship, or as noted on drawings, or as specified. Each trade shall be responsible for matching existing conditions.

F. Patch walls and ceilings in renovated areas as required to match existing finishes. Floors shall be patched as required. Provide patches of the same type, finish, and texture as the surrounding areas.

3.3 CLEAN UP

A. Remove demolished materials from the site as work progresses.

B. Leave areas of work in a clean condition.

END OF SECTION

SECTION 23 01 00 - GENERAL REQUIREMENTS FOR MECHANICAL WORK

PART 1 - GENERAL

1.1 SCOPE

A. This project involves construction of the project as titled above, with associated site work as shown on the plans and described herein.

1.2 DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements. Contractor shall determine the exact locations from field measurements. Also refer to all architectural, structural, and related drawings. The lack of specific details for all offsets, transitions, etc., shall not relieve the Contractor of responsibility to provide the necessary elements to coordinate his work with building construction and other trades.

1.3 SUBSTITUTION

A. All bids shall be based only on the equipment and materials as scheduled on the drawings and/or as specified, or on equivalent equipment and materials from a pre-approved alternative manufacturer. No bids may be based on a substitute or other alternative without specific written prior approval from the Engineer. Any Bidder who assumes equivalence of products and who bases his/her bid on that assumption does so at their own risk.

B. A listing of approved alternative manufacturers does not mean that all products of a particular alternative manufacturer are acceptable alternatives to the scheduled items; it merely means that, for bidding, prior approval is not required. All fixtures and devices must still be submitted in accordance with the prescribed procedures.

1.4 INTENT

A. All equipment, materials, and labor that may be necessary to complete work in accordance with the intent of these plans and specifications shall be furnished by the Contractor without additional cost.

B. All systems represented in the documents shall, unless specifically noted to the contrary, be provided and installed completely with all necessary components to form a complete and fully functioning system. Submission of bids will be considered confirmation that complete and functional systems have been included in the bids.

C. If any discrepancies or confusion is perceived in the documents, the Contractor shall call such to the attention of the Architect for clarification of the documents prior to bidding or construction. If any inconsistencies or contradictions within the construction documents are discovered after the construction contracts are awarded, the Architect shall determine the intent and correct interpretation of the construction documents.

D. Contractor shall supervise and direct the work competently and efficiently, and in accordance with the drawings and specifications. Contractor shall be responsible for using construction means, methods, techniques, sequences, and procedures as are

compatible with the project's requirements and will result in a project completed in accordance with the requirements of the drawings and specifications.

1.5 CODES AND PERMITS

A. Contractor shall comply with all local, state, and national codes.

1.6 VIBRATION AND NOISE

A. Each of the various pieces of equipment shall operate without objectionable vibration or noise. All rotating equipment shall be statically and dynamically balanced and mounted, supported, and fastened so that vibration does not exceed the specified levels for the equipment item. The specific type of vibration isolation to be installed shall be submitted to the Engineer for his approval.

B. If, in the opinion of the Engineer, objectionable vibration or noise or transmission thereof to the building occurs, the Contractor shall execute remedial measures as may be necessary to eliminate such unsatisfactory operating conditions, and the work and material thereby required shall be furnished and performed at the Contractor's expense.

1.7 GUARANTEE

A. Each Contractor shall guarantee all labor and materials furnished by him for a period of one year unless otherwise noted. Guarantee period shall extend from the time of final written acceptance of the installation or from the time of use, as directed in writing by the Owner, whichever occurs first. The guarantee shall cover the repair or replacement, at no additional cost to the Owner, of any defective materials or faulty workmanship.

1.8 SERVICE

A. All necessary services of each system, such as adjustment of controls, air distribution, and water balancing valves, mechanical repair of equipment, and other work requiring specialized training, shall be furnished by the Contractor, at no cost to the Owner, for a period of one year, concurrent with the warranty period specified above.

1.9 SAFETY

A. General
   1. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

B. Hazardous Chemicals
   1. According to OSHA, a hazardous chemical is any chemical that is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a contractor produces, uses, or stores hazardous chemicals at the workplace, then the Contractor shall develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. In projects with multiple tenants in which the building is partially occupied during the project, the Contractor shall, in accordance with OSHA guidelines, inform the building manager or owner of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified. The

Contractor shall employ the required methods for training, information, handling, ventilation, labeling, storage, disposal, and removal of hazardous chemicals.

1.10 COORDINATION

A. Each Contractor's bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Failure by the Contractor to coordinate with all other trades, resulting in interference, shall be sufficient reason to require the Contractor to replace or rebuild the affected work at no extra charge.

1.11 STORAGE OF MATERIALS

A. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rain-proof and lockable as required. Materials or equipment stored on site but not in a lockable, rain-proof storage facility shall be stored above ground or above slab. The Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. Provide submittal to the A/E within 45 days of commencement of the Contractor's agreement with the Owner.

B. In addition, submit specific information on equipment, products, and principal materials specified. Indicate and provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Include all items mentioned by model number and/or manufacturer's name in the specifications or on the drawings, including but not limited to the following:
   1. HVAC - All equipment, air devices, insulation, piping, valves, controls, and other principal materials.

C. Requirements for submittal
   1. Each submittal shall:
      a. bear a stamp or specific written indication that Contractor has reviewed and approved all submittals prior to submission to Engineer,
      b. have all information deleted by Contractor that pertains to the means and methods of construction or to the fabrication, assembly, installation, or erection process (approval by Engineer shall not extend to these areas unless specifically noted by Engineer),
      c. be clearly marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
      d. be clearly marked as to which available options are being submitted that are associated with a piece of equipment, and
      e. be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable the Engineer to review the proposed equipment.

2. Omission by Contractor of any of the above requirements for submittals will subject the submittal to automatic rejection without review.
3. Any submittals received by the Engineer that were not requested shall be returned without review of any kind.

D. Substitutions
1. In addition, no substitution is allowable without the Engineer's written approval ten days prior to bid due date (unless otherwise allowed by the Engineer) unless the manufacturer is listed on the Drawings or in the specifications as being a pre-approved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.
2. Contractor's responsibility shall be to verify that the submitted substitute equipment will fit in the space available. The Contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but completely.
3. The Contractor shall be responsible for the cost of any such modifications due to the substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect on any and all other trades.
4. The Engineer may request shop drawings of systems of the substituted equipment.

E. Installation Instructions
1. For certain products or systems as identified in subsequent specification sections, the Contractor shall, as required, provide copies of the manufacturer's installation instructions with the submittal. When required, the installation instructions are considered part of the submittal, and their omission may result in automatic rejection. Where more than one identical device is scheduled, only one set of installation instructions needs to be submitted, e.g., if seven five-ton split-system air conditioners are scheduled, only one set of five-ton unit installation instructions needs to be submitted. Similarly, if one set of installation instructions is identified by the manufacturer and is applicable to more than one type or size of device, e.g., if one set of air conditioner instructions is good for three-, four-, and five-ton units, then only one instruction set is required for those devices.

2.2 MATERIALS

A. All materials shall be new and of the quality specified. Materials shall be free from defects. Where manufacturers' names are mentioned in these specifications or on the plans, this is to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his materials to and on the job and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each workday, each Contractor is responsible for covering or protecting his work or materials that may be susceptible to damage, even if such damage is the result of unforeseen causes, e.g., an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced at Contractor's expense.

C. Contractor shall verify that all pieces of equipment will fit through available openings in the building and that all equipment can be installed without modification of the building structure.

2.3 LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Such independent testing authorities shall include, but not be limited to, the following:

A.D.C.	Air Diffusion Council
A.G.A.	American Gas Association
A.M.C.A.	Air Movement and Control Association
A.N.S.I.	American National Standards Institute
A.R.I.	Air-Conditioning and Refrigeration Institute
A.S.H.R.A.E.	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.P.E.	American Society of Plumbing Engineers
A.S.S.E.	American Society of Sanitary Engineers
A.S.T.M.	American Society for Testing and Materials
A.W.W.A.	American Water Works Association
F.M.	Factory Mutual
I.C.C.	International Code Council
N.B.S.	National Bureau of Standards
N.E.B.B.	National Environmental Balancing Bureau
N.E.C.	National Electric Code
N.E.M.A.	National Electrical Manufacturers Association
N.F.P.A.	National Fire Protection Association
N.R.C.A.	National Roofing Contractors Association
N.S.F.	National Sanitation Foundation
P.D.I.	Plumbing and Drainage Institute
S.M.A.C.N.A.	Sheet Metal and Air Conditioning Contractors' National Association
T.A.B.B.	Testing, Adjusting, and Balancing Bureau
T.I.M.A.	Thermal Insulation Manufacturers Association
U.L.	Underwriters Laboratory

2.4 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide four copies of operating and maintenance manuals. Contractor shall deliver these four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain at least the following:
   1. Certificates of acceptance from inspecting authorities,
   2. Waiver of all liens,
   3. For each piece of equipment:
      a. operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the particular equipment and information that does not.),
      b. nameplate data and design parameters for equipment,
      c. name, phone number, and address of vendor, manufacturer's representative, and warranty provider,
      d. start-up and commissioning reports.
   4. Copies of all shop drawings and as-built drawings,
   5. Copies of all approved submittals,
   6. Warranties with start dates and end dates for each piece of equipment and/or for each system. Warranties shall begin on the date of substantial completion of acceptance by Owner in writing.

7. Names, phone numbers, and addresses of all subcontractors, vendors, manufacturer's representatives, and warranty providers,
8. Certification letter from each Contractor that each system furnished and installed by that Contractor and/or Subcontractors is started up, completely commissioned, tested, adjusted, balanced, and checked for proper operation in accordance with the intent of the contract documents, and
9. Acceptance letter from each Contractor with blanks for date of acceptance and date of expiration of warranties and guarantees.

2.5 TAGGING

A. Equipment to be Tagged: Each major piece of equipment discussed in the specifications or scheduled on the drawings shall have affixed a tag showing the name or function of that piece. The list of equipment to receive tags shall include, but not be limited to, the following:
   1. air moving or air conditioning equipment,
      a. rtu,
      b. FPVAV Units,
      c. Items that have no unique name, such as air devices, plumbing fixtures, lights, etc., need not have tags.

B. Tags
   1. Material - Tags shall be engraved plastic, brass, or anodized aluminum. Surface-mounted tags shall have pressure-sensitive adhesive backing. Tags for outdoor use shall be mounted with brass screws.
   2. Lettering - Characters shall be a minimum of ¼" in height and shall be of a contrasting color to the tag.

C. Alternatives
   1. For larger equipment such as large air handlers, switchgear, etc., the use of manufactured stencils (2-inch characters) and spray paint (in a contrasting color to the equipment) is an acceptable alternative.
   2. Individual adhesive letters are not acceptable.
   3. Other alternatives are acceptable only by submitting samples or the manufacturer's literature to the Engineer and receiving written permission.

2.6 MOTORS AND MOTOR STARTERS

A. Motors
   1. Unless scheduled otherwise, each electric motor shall be a high-efficiency type.
   2. Each single-phase motor larger than 1/10 (one-tenth) horsepower and each single-phase motor that drives a pump or compressor shall be a permanent split capacitor type. Each polyphase squirrel-cage induction motor shall be an energy-efficient type as defined in NEMA document No. MG1-2016. Motors controlled by variable frequency drives (VFD) shall be provided with motor shaft grounding rings similar and equivalent to AEGIS SGR.

B. Motor Connections
   1. Motor starters, unless scheduled otherwise or packaged with the equipment, shall be provided and installed by the Electrical Contractor. The Mechanical Contractor shall provide to the Electrical Contractor a complete list of motors requiring starters or other connections, including power and control, and shall include the following information for each such motor:
      a. a tag reference to the piece of equipment for which the motor is needed,
      b. the voltage and number of phases,

c. the motor requirements in terms of horsepower, running load amps, full load amps, etc.,
d. any other pertinent information required or requested by the Electrical Contractor.

2. The Electrical Contractor shall receive and review the above information and advise the Mechanical Contractor and Architect of any discrepancies or required modifications. The Electrical Contractor shall provide and install the correct starter, conductors, and other devices in accordance with the electrical drawings, specifications, and the National Electrical Code.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting, and conduit shall be concealed unless otherwise noted, and installed square to the building lines. Any work that does not meet this requirement shall be replaced or rebuilt at no extra expense to the Owner.

3.2 INTERIM CLEANING

A. The Contractor shall maintain the work area in a clean condition during the course of the work. All debris, scrap, and surplus material shall be removed from the work area on a periodic basis with a minimum of at least once per day.

B. All stored material shall be supported above floor level and be protected from becoming damaged or dirty.

C. All installed materials shall have open ends closed and protected from entrance of foreign material during construction.

D. Prior to enclosing an area such as a ceiling or chase wall, the installed material and surrounding area shall be thoroughly cleaned. After removing loose material, the area shall be vacuum cleaned or blown out with a portable blower to remove dust from surfaces.

3.3 CUTTING, PATCHING, AND PENETRATIONS

A. Section 01 73 29 Cutting and Patching.

B. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

C. Where cutting any non-structural element(s) of walls, floors or ceilings is necessary to permit the installation of any work under this contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut, to adjacent elements, or to the work of other trades.

D. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the

approval of the Architect. In the absence of specific finish instructions, provide a finish to match adjacent surfaces.

E. Where a penetration or cutting of a ceiling, wall, or other building membrane is required or made, each such penetration or cut shall be made neatly with a cutting tool such as a saw, sharp knife, etc., and not with an impact tool such as a hammer, screwdriver, wrench, crowbar, etc. Each such penetration or cut shall be no larger than reasonably necessary, and penetrations in occupied or publicly accessible spaces shall have a chrome-plated escutcheon installed large enough to cover the entire opening.

3.4 EQUIPMENT AND PIPING SUPPORTS

A. All supporting systems for piping, equipment, and materials supported by the building structure shall be submitted to the Engineer for approval prior to purchase and installation.

3.5 ACCESSIBILITY

A. Access Panels
   1. Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, whether or not shown on drawings, and shall be brought to the attention of Architect for his approval of type, color, etc. Where access is provided in rated members, the access panels shall be of a type that maintains the integrity of the member penetrated.

B. Access to Equipment
   1. All ducts, pipes, tubing, conduit, wiring, etc., shall be installed in such a way so as not to prevent and/or not to make unreasonably difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways, observation ports, measurement or balancing devices, junction boxes, etc. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Architect or Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Architect and Engineer are satisfied that access for the above purposes is achieved.

3.6 FIELD REPORTS

A. The Contractor shall be required to respond to all deficiency items noted in Field, Site Visit, Punch List, and other such reports provided by the Engineer. The response shall address each deficiency item in the same order as the report, with annotations as to what was done to remedy the deficiency, who performed the work, and when it was done.

3.7 OPERATING TESTS

A. General
   1. After all mechanical and electrical systems have been completed and put into operation. Contractor shall subject each system to an operating test under design conditions to ensure proper sequence and operation throughout its operating range.

All associated costs of such tests, including labor, fuel, apparatus, piping, etc., shall be borne by the Contractor.

2. Contractor shall make adjustments as required to ensure proper functioning of all systems. Special tests for individual systems are specified in the corresponding sections. The Contractor shall return to the project during the first year, in the opposite season from that in which the system was initially operated, and shall verify the proper operation of the mechanical and electrical systems. Contractor shall perform any adjustments or corrective procedures required for the proper operation of all systems.

B. Notification
   1. Contractor shall give the Architect seven days prior notification of any test so that the Architect and/or Engineer will have time to be present if he so desires.

C. Reports
   1. After each test is performed, the Contractor who performed the test shall prepare and issue a report to include the following information:

      a. Project name and location, date of the report,
      b. Contractor's name, address, and telephone number; if the Contractor performing the test is a Subcontractor, indicate also for whom the test is being performed, their name, address, telephone number, and a contact person's name,
      c. the date, or range of dates, of the test,
      d. the name of the Contractor's employee who was responsible for performing or for overseeing the performance of the test,
      e. a brief description of the system being tested,
      f. a brief description of the testing procedure,
      g. a summary of the test result(s),
      h. a brief assertion that the system was tested as stated and that the system complied with the requirements of the contract documents or those of the Authority Having Jurisdiction, whichever is the most stringent, and
      i. a hand-written date and signature of someone who has authority or responsibility from the company that performed test(s), and a hand-written brief note stating that the above information is true and accurate.
   2. If the tested system is tested in parts, then one report may be made after the last part is tested.
   3. The report shall be issued to the Architect within five working days after the test is completed.
   4. Such reports shall be required of all mechanical or electrical systems that require tests for pressure, water tightness, flow, resistance, or conductivity.

D. Services of a Manufacturer's Representative
   1. Reports: For all major systems or equipment required by subsequent specifications sections to have tests or inspections by a manufacturer's representative, the manufacturer's representative shall prepare a written report to be sent to the Architect for subsequent distribution to the Engineer, Owner, General Contractor, and to whomever else the Architect deems necessary. The report shall include at least the following:
      a. date of the visit, name and title of the representative, name and location of the project,
      b. name and title of any observers,
      c. a brief description of the equipment being inspected and/or tested,

d. a brief discussion of the quality of the installation, including any important items (in the manufacturer's experience) that were done correctly, as well as any items that were done incorrectly or not to the recommendations,
e. a list of tests and/or inspections performed and the results of the same, and
f. a brief statement of whether the installation conforms to the manufacturer's recommendations and/or requirements, and if not, what is required to bring the installation into conformance.

2. Deficiencies and Defects
   a. Contractor shall be responsible for providing all labor and materials, at no cost to anyone except Contractor, to correct any deficiencies or defects reported by the manufacturer's representative.
   b. If, in the opinion of the manufacturer's representative, the deficiencies and defects are sufficiently serious, then Contractor shall arrange for, and bear all costs of, another inspection by the manufacturer's representative after corrective measures have been taken.
3. The above process shall continue until the manufacturer's representative approves the installation.

3.8 INSTRUCTIONS FOR OWNER

A. Contractor shall instruct the Owner's operating personnel in the operation and maintenance of all mechanical, control, and electrical equipment. Contractor shall furnish any special servicing tools required for maintenance.

3.9 DEMONSTRATION

A. Contractor shall conduct a demonstration of the installation upon completion of the work. Prior to this, all work shall have been completed, tested, balanced, commissioned, and placed in operation. Qualified personnel must be present at the demonstration to operate all systems and verify the equipment's performance. The schedule for this demonstration shall be coordinated with the Engineer.

3.10 CLEANUP

A. Section 00 77 00 Closeout Procedures: Final Cleaning

B. At substantial completion of the project, thoroughly clean all equipment and systems of all dirt, debris, and foreign material.

C. This shall include cleaning coils and fans inside of air handlers, cleaning the interior of duct systems, and wiping down the interior of all electrical equipment.

D. Remove all unused temporary wiring or construction lighting and power, and all unused material from above the ceilings and from hidden recesses.

END OF SECTION

SECTION 23 05 94 - HVAC TEST, ADJUST, AND BALANCE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall select and employ an impartial, independent technical Balancing Contractor to provide balancing, testing, and adjusting services for the heating, ventilating, and air conditioning systems of this project.

B. The Balancing Contractor shall be responsible for the satisfactory execution of the balancing, testing, and adjusting of the HVAC systems.

C. The Contractor and the suppliers of the equipment installed shall provide all supervision, personnel, equipment, and materials, and perform all work necessary to assist the Balancing (HVAC) Contractor in providing the balancing, testing, and adjusting services for the heating, ventilating, and air conditioning (HVAC) systems of this project.

1.2 STANDARDS

A. The Balancing Contractor shall be certified by and perform the services in accordance with the Associated Air Balance Council's (A.A.B.C.), National Environmental Balancing Bureau (N.E.B.B.), or Testing, Adjusting and Balancing Bureau (T.A.B.B.) standards and procedures, including revisions to the date of the contract.

1.3 SUBMITTALS

A. Reports

1. Deficiency Report: Following examination of the installed system, prior to balancing, submit a report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.

2. TAB Report: Submit a PDF file of the complete testing, adjusting, and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.

3. Reports shall be on TABB/SMACNA, NEBB, or AABC forms that indicate information addressing each of the testing methods, readings, and adjustments.

1.4 INSTRUMENTATION

A. Balancing Contractor shall provide all necessary instruments to complete balancing and testing work.

1.5 SPECIAL WARRANTY

A. Provide a warranty for a period of 90 days following submission of the completed report, during which time, the Owner may request a recheck of repaired equipment and up to 10% of the total number of terminals, or resetting of any outlet, coil, or device listed in the test report.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 RESPONSIBILITY OF BALANCING (HVAC) CONTRACTOR

A. The services of balancing, testing, and adjusting the heating, ventilating, and air conditioning systems will be performed by an independent technical firm or balancing company with a minimum of five years of specialized experience in the field of air and hydronic system balancing, and possessing calibrated instruments, qualified Engineers, and skilled technicians to perform all required tests.

B. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems as cited in the Summary of Work. Such tests shall be done as are deemed necessary by the Engineer. Contractor shall then make available to the Engineer such instruments and technicians as are required for spot checks of the system.

C. The Balancing Contractor will not instruct or direct the Contractor in any of the work. Any proposed changes or revisions in the work shall be submitted to the Owner's representative in writing.

3.2 PREPARATION AND EXAMINATION

A. The Balancing Contractor shall inspect the installation of HVAC ductwork, temperature controls, and other component parts of the heating, air conditioning, and ventilating systems. The inspection of the work will cover that part relating to proper arrangement and adequate provisions for the testing and balancing.

B. Prior to commencing the testing, adjusting, and balancing of environmental system(s), verify the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed, complete, and operable.
3. Automatic and manual dampers are operable and fully open.
4. Clean filters are clean and properly installed. The Owner will provide filters.
5. Duct and fan systems are clean.
6. Fans are rotating correctly.
7. Air coil fins are cleaned and combed.
8. Access doors are closed.
9. Air outlets indicated on the drawings are installed and connected.

C. If deficiencies are evident, submit Deficiency Report to the Owner's representative. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied or as directed by the Owner's representative.

D. The Balancing Contractor shall be responsible for inspecting, testing, adjusting, balancing, and logging the data on the performance of fans, each damper in the duct systems, and each air distribution and exhaust device.

E. General Procedure:

1. The Balancing Contractor shall perform a complete balance and test of heating, ventilating, and air conditioning systems, including air moving equipment, and air distribution exhaust systems as herein specified. Each instrument used shall be accurately calibrated and maintained in good working order.

2. Balancing and testing shall not begin until the system is in full working order with all identified deficiencies addressed.

3. Upon completion of the air conditioning system, Balancing Contractor shall perform the following tests, compile the test data, and submit the completed test data to the Owner's representative.

3.3 BALANCING SERVICES

A. Air Balancing Procedure:

1. The Balancing Contractor shall perform the following tests and balance the system in accordance with the following requirements:
   a) Test and adjust blower speed and rotation to design requirements.
   b) Test and record motor full load amperes.
   c) Make pitot tubes traverse of the main supply and obtain design cfm at the fans.
   d) Test and record system static pressures, suction, and discharge across each AHU component.
   e) Test and adjust the system for the design cfm of recirculated air.
   f) Test and adjust the system for the design cfm outside air.
   g) Test and record entering air temperatures (db for heating and db/wb for cooling).
   h) Test and record leaving air temperatures (db for heating and db/wb for cooling).
   i) Adjust each zone to proper design, cfm, supply, and return.
   j) Set adjustments of automatically operated dampers to operate as specified, indicated, and/or noted.

B. Adjustments

1. All equipment shall be adjusted so that it will perform as specified and shown.

2. Readjustment, where necessary to accomplish the specified results, shall be made during the guarantee period at no additional cost to the Owner.

END OF SECTION

SECTION 23 07 00 - HVAC INSULATION

PART 1 – GENERAL

1.1 SCOPE

A. Furnish all labor and materials necessary for the complete installation of thermal insulation on all hot and cold surfaces that require insulation for heat or cold conservation, comfort and safety of occupants, efficiency or ease of operation, or to prevent condensation or dripping. The insulation shall be complete and effective throughout the building.

B. Section Includes:
   1. Ductwork insulation.
   2. Insulation accessories, including vapor retarders and accessories.

C. All work shall be performed in a neat and professional manner by a Contractor or Subcontractor regularly engaged in the insulation field. The Mechanical Contractor shall be responsible for the bidding and execution of this work.

D. Any equipment or devices mentioned specifically in this section or any equipment or devices installed by the Mechanical Contractor that can have or cause temperatures low enough to cause condensation shall be adequately insulated and vapor sealed. If equipment, devices, or required insulation products are not specifically mentioned in this section or shown on drawings, the Contractor is required to request and obtain written instructions from the Engineer. If condensation should occur due to inadequate or missing insulation and/or vapor sealing, such damage, including damage to other affected property or building elements, shall be repaired by the Contractor at no cost to the Owner.

1.2 GENERAL REQUIREMENTS

A. All insulation inside the building shall have a composite (insulation, jacket or facing, and adhesive or cement used to adhere the jacket to the insulation) flame-spread rating of 25 or less and smoke-developed rating of 50 or less as tested under procedure ASTM E-84 and NFPA 255.
   1. Insulation with a less stringent flame and smoke rating may be used only with the written permission of the Architect.
   2. Insulation products that meet the 25/50 rating requirement but that melt and drip flammable products, such as closed-cell polyethylene products, are not acceptable.

B. Accessories such as adhesive, mastics, cements, and cloth for fittings shall be permanently fire and smoke resistant. Chemicals used for treating paper in jacket laminates shall be unaffected by water or humidity.

C. All adhesives, sealers, vapor barrier coatings, etc., shall be compatible with materials to which they are applied and shall not corrode, soften, or attack such materials in either the wet or dry state. Unless otherwise approved, all adhesives, sealers, coatings, mastics, etc., shall be water-based.

D. Any insulation product found to be damaged or has become wet, whether installed or stored, shall be immediately removed and replaced with a new product.

E. Thermal insulation shall be applied where needed, including but not limited to the

following systems, as described herein:

1. Ductwork,
2. Equipment.

PART 2 - PRODUCTS

2.1 DUCT WORK INSULATION

A. Air Conditioning Duct

1. Indoors: Insulation shall be foil-faced duct wrap, R-6, and a foil-scrim-kraft composite vapor barrier. Insulation shall be CertainTeed Standard Duct Insulation, Knauf Duct Wrap, Owens-Corning Fiberglas, Manville R-Series Microlite, or approved equivalent.

2. Duct Liner: Interior supply and return air plenums shall be lined with R6.3 acoustical duct liner. Insulation shall be JM Linacoustic RC, 1-1/2" thickness or approved equivalent.

2.2 EQUIPMENT

A. All equipment shall be factory insulated where specified. All equipment installed in a duct downstream of a cooling coil shall be insulated to the same level as the external duct insulation to prevent condensation. Alternatively, a closed-cell elastomeric insulation in sheet form, such as ARMAFLEX, may be used in strict conformance with the manufacturer's written instructions and these specifications.

PART 3 - EXECUTION

3.1 DUCTWORK EXTERNAL INSULATION

A. Applications :

1. Insulate and vapor seal the following ductwork:
   a) Metal air conditioning supply air ductwork,

2. The following ductwork does not require insulation :
   a) Return air ductwork unless noted.

B. Air Conditioning Duct

1. Before applying duct wrap, sheetmetal duct shall be clean, dry, and tightly sealed at all joints and seams.

2. Prepare overlap by removing approximately 2 inches of insulation from the facing. Wrap insulation around the duct, with the facing to the outside, so the 2-inch flap completely overlaps the facing and insulation at the other end of the duct. Insulation shall be snugly butted.

3. Seams shall be stapled approximately 6 inches on center with outward clinching staples, then sealed with 4-inch wide pressure-sensitive tape matching the facing and designed for use with duct insulation. Tape shall be Hardcast Foil-Grip 1402 or approved equivalent.

4. Adjacent sections of duct wrap insulation shall be snugly butted with the circumferential 2-inch tape flap overlapping and secured as recommended for

longitudinal seam. In lieu of pressure-sensitive tape, two coats of vapor-retarder mastic reinforced with one layer of 4-inch-wide open-weave glass fabric may be used.

5. The insulation on the underside of ductwork 24 inches or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18 inches on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed and then sealed with the same tape as specified above.

6. Wherever an externally insulated duct rests on a trapeze hanger, remove a strip of the external flexible wrap and install a high-density rigid insulating board such as calcium silicate, foamglass, or approved equivalent between the duct and the hanger. Rigid insulation shall be at least twice the width of the hanger and shall be the full width of the duct. Repair the insulation facing to provide a continuous vapor barrier.

7. Insulate the duct all the way through equipment connection points, including duct exposed inside of equipment curbs.

8. Vapor barrier shall be complete and unbroken.

3.2 PLENUM INTERIOR INSULATION (DUCT LINER)

A. Applications:

1. Install in supply air and return air plenums.

2. Install with adhesive and welded pin with washer system as described by the insulation manufacturer’s instructions.

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes all labor, material, equipment, and appurtenances indicated on the Drawings and herein specified for the installation of air distribution systems, including supply, exhaust, return, and outside air.

1.2 SUBMITTALS

A. Duct schedule: Provide a duct schedule or table indicating the following information, according to appropriate pressure class:
   1. each duct size group (as defined in SMACNA "HVAC Duct Construction Standards")
   2. duct sheetmetal gauge,
   3. duct joint and reinforcement spacing,
   4. transverse joint construction,
   5. intermediate reinforcement construction, and
   6. hanger type and spacing.

B. Duct insulation: Provide insulation and weather protection as described in Section 270700.

1.3 AS-BUILT DRAWINGS

A. Maintain field changes on a drawing set at the construction site. These drawings shall be available to the Engineer at the construction site upon request.

B. Upon completion of the project, update the shop drawing CAD files to reflect the field changes.

1.4 COORDINATION OF WORK

A. Prior to producing shop drawings and installation of work, coordinate work with other trades, including structural, plumbing, fire protection, and electrical.

B. Verify all ceiling heights and construction details.

C. Lack of coordination of work will not be considered grounds for additional cost or time requests.

PART 2 - PRODUCTS

2.1 SHEETMETAL DUCTWORK

A. General
   1. Ductwork shall be made of single-wall galvanized steel sheets. Ductwork shall be round or rectangular as shown on the Drawings. Straight pieces of round concealed ductwork shall be spiral lockseam or longitudinal snap-lock.
   2. Ducts shall be constructed in accordance with the recommended construction for the appropriate pressure class insofar as gauges of metal to be used,

bracing of joints and joint construction, fittings and fittings construction, etc., as established in HVAC DUCT CONSTRUCTION STANDARDS, Latest Edition, published by the Sheet Metal and Air Conditioning Contractors National Association, Inc., (SMACNA).

a. Ductwork shall be constructed to the following minimum pressure classes:

(1) Air Handlers and Fan-Coils

(a) supply +2"

(b) return -1"

3. Sealing

a. Snap-lock duct and rectangular duct: seal all ducts to SMACNA Class 'A' rating, that is, "All transverse joints, longitudinal seams, and duct wall penetrations" shall be sealed.

b. Spiral lockseam: same sealing as snap-lock except sealing of longitudinal seams is not required.

c. A gasketed mechanical joint system, such as Ductmate, does not require sealing.

d. Sealant shall be a water-based product; solvent-based products are expressly prohibited. Products shall be recommended by the manufacturer for HVAC duct applications and shall cure into a flexible film with a strong adhesive bond to common duct materials. Product shall be rated by the manufacturer for operating temperatures from 0°F to 200°F. Product shall have been tested per ASTM E84 procedures and shall have a maximum flame spread rating of 25, a maximum fuel contributed rating of 5, and a maximum smoke developed rating of 20. Product shall be Hardcast "Iron Grip" IG-601 or "Flex-Grip" FG-550, Rectorseal "Air-Lock", Foster 32-50, United McGill Duct Sealer, or approved equivalent.

PART 3 - EXECUTION

3.1 GENERAL

A. During construction, all air-moving equipment and ducts shall be protected from the entrance of water, dust, trash, vermin, etc., per Section 23 01 00. Fans of all types not yet connected to ductwork shall have their inlets and outlets covered with a plastic sheet, temporarily secured with tape, wire, etc. Such covers shall be maintained throughout the construction phase until the ductwork is connected.

B. Ducts shall be routed in conjunction with pipes, electrical, conduits, lights, ceiling hangers, etc., to avoid interference insofar as possible.

3.2 CLEANING

A. Ducts, plenums, and casings shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction. New filters shall be installed after all construction dirt has been removed. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to produce tension. All control valves and other miscellaneous equipment requiring adjustment shall be adjusted to settings indicated or as directed.

Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

3.3 DUCTWORK, GENERAL

A. Support
   1. Support each fitting that effects a change in direction, either vertical or horizontal, at the fitting.
   2. Support each fitting that has a branch intersection at the fitting.
   3. Support ductwork at or near connections to equipment.
   4. Support each duct independently. Do not support one duct from another except as allowed by SMACNA.
   5. Do not use wire as a hanger, even to support another hanging device such as a trapeze, regardless of acceptability by other authorities. Only straps, threaded rods, and channels may be used as hangers.

B. Install ductwork without twisting.

C. Install ductwork shown on the Drawings to be horizontal as straight and level as possible.

D. Install exterior ductwork so that water will completely drain from the top surface with no ponding.

E. Install ductwork shown on the Drawings to be as vertical as possible in both directions. Vertical ductwork extending more than one floor in height shall be supported at every floor or every 12 feet, whichever is less.

F. Install ductwork so that no duct or hanger touches other duct or building elements such as framing, structure (except for supports), piping, conduit, etc.

3.4 SHEETMETAL DUCTWORK

A. In supporting sheetmetal ductwork, SMACNA, in HVAC Duct Construction Standards, Table 4-1 lists several combinations of hanger types and hanger spacing that are equivalent for various duct sizes. Contractor shall conform to one of the listed combinations (except for prohibited wire hangers).

B. Duct sealing material shall not be used to fill gaps caused either by careless or unprofessional work during fabrication or erection, or by damage after erection. Surfaces on which sealant is to be applied shall be cleaned and dry before application. If any oil or grease is present, the surface shall additionally be treated with a degreaser.

END OF SECTION

SECTION 23 81 11 - PACKAGED VARIABLE AIR VOLUME ROOFTOP AIR CONDITIONING UNITS

PART 1 - GENERAL

1.1 REFERENCES

A. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

B. ARI 360 - Unitary Air-Conditioning Equipment.

C. ANSI/ASHRAE 90A - Energy Conservation in New Building Design

D. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.

1.2 SUBMITTALS

A. Submit drawings indicating components, dimensions, weights, and loadings, required clearances, and location and size of field connections.

B. Submit product data indicating rated capacities, weights, accessories, service clearances, and electrical requirements.

C. Submit manufacturer's installation instructions.

1.3 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, start-up and operating instructions, installation instructions, and maintenance procedures.

1.4 HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Leave factory shipping covers in place until installation.

1.5 WARRANTY

A. Provide a full parts warranty for one year from Substantial Completion.

B. Provide a five-year extended warranty for compressors.

1.6 MAINTENANCE SERVICE

A. Furnish complete service and maintenance of packaged rooftop units for one year from the Date of Substantial Completion by Contractor. Include annual inspection and coil cleaning.

1.7 REGULATORY REQUIREMENTS

A. Unit shall conform to UL 60335-2-40 for construction of packaged air conditioner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Trane

B. Carrier

C. JCI/York

D. Daikin

2.2 GENERAL UNIT DESCRIPTION

A. Units furnished and installed shall be cooling-only packaged rooftops as specified on the contract documents and within these specifications. Cooling capacity ratings shall be based upon ARI Standard 360. Units shall consist of an insulated, weathertight casing with compressors, air-cooled condenser coil, condenser fans, evaporator coil, filters, supply and/or exhaust fan motors and drives, and unit controls.

B. Units shall be single-piece construction as manufactured at the factory. Site-assembled sub-assemblies will not be allowed. Package units shall be constructed for installation on a roof curb adaptor providing full perimeter support under entire unit.

C. Units shall be factory-run tested to include the operation of all fans, compressors, heat exchangers, and control sequences.

D. Units shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

2.3 UNIT CASING

A. Cabinet: Double-walled galvanized steel, phosphatized, and finished with paint coating durable enough to withstand 1000 consecutive-hour salt spray application in accordance with standard ASTM B 117. Structural members shall be 14-gauge with access doors and removable panels of minimum 18-gauge steel. Roof panels shall be sloped to provide positive drainage of rainwater away from the cabinet.

B. Access Doors: Fully gasketed hinged doors with fluted knob fasteners and chained "tiebacks" to provide access to filters, heating section, return/exhaust air fan section, supply air fan section, and both sides of the evaporator coil section.

C. Control Panel: The unit control panel section shall be compartmented to separate high and low voltage components. The control panels shall also be fully gasketed, hinged, and provided with quick-release latches for easy access.

D. Insulation: Provide double-wall panels with foam R-8 Insulation sandwiched between panels.

2.4 AIR FILTERS

A. Air Filters: Filters shall be mounted integrally within the unit casing and be accessible via hinged access panels.

1. Pre-Filters shall be four-inch pleated media MERV 8 as tested by ASHRAE 52.2.

2. All filters shall be housed within the unit itself and not the curb.

B. Provide at least 3 complete sets of filters and change filters before the air balance. Turn over a new set of filters to the owner at the completion of the project.

C. Provide Differential Pressure gauges with adjustable switches to indicate filter loading for each filter bank. Dwyer Photohelic with 4" face, suitable for outdoor installation. Provide a filter gauge tubing set. Pipe with hard-drawn copper tubing.

2.5 FANS

A. Provide supply and relief fans with direct drive assemblies. Dynamically balance all fans and the unit's running fan assembly (fan mounted on actual shaft, bearings, and in scroll housing) to assure smooth operation of the fan and its associated assembly. Balancing of the fan only shall not be acceptable.

B. Mount fan motors and fan on a common base assembly and isolate from the unit with double deflection rubber-in-shear isolators. Provide thrust-restraint isolation on the fan housing/fan board to ensure a smooth fan startup transition and operation.

C. Fan shaft shall be mounted on grease-lubricated ball bearings.

D. Motor shall be open drip-proof. Motor shall have an E+ T-frame and a minimum service factor of 1.15.

E. Motors shall be completely compatible with the VFD's with shaft grounding rings, such as Aegis.

F. All drive components shall be accessible without the use of scaffolds or ladders, to facilitate periodic maintenance checks and for operator safety.

2.6 VARIABLE FREQUENCY DRIVE (VFD)

A. Include factory-engineered, tested, mounted, and wired Variable Frequency Drives for the Supply and Return/Exhaust Fans.

B. Units shall transform 60 Hz input power into frequency and voltage-controlled three-phase outputs suitable to provide positive speed control to standard induction motors. Speed control shall be stepless throughout the speed range under variable-torque loads, on a continuous basis. Control shall incorporate a non-switching input section with a minimum inverter efficiency of 95% at all speeds above 25% of full speed. Drive logic shall be microprocessor-based, and PWM voltage output shall be sine wave coded, resulting in a quasi-sinusoidal output current waveform to minimize harmonics.

C. Drives shall allow for low-noise operation using IGBT's (Insulated Gate Bipolar Transistors - a Bipolar type MOS-FET). An output filter shall be available to reduce motor noise due to PWM waveform. The carrier frequency for the sine wave PWM control shall be capable of changing to prevent resonance in the mechanical system.
   1. All discrete electronic components shall be assembled on modular printed circuit boards that can be replaced without soldering connections. Motor speed controllers shall have capability to interface with a Direct Digital Control (DDC) Energy Management System (EMS).
   2. Self-protection Features:
      a. Current limiter shall be capable of limiting output current to 110% of the inverter rating. The current limiter shall be designed to automatically prevent overcurrent tripping due to momentary overload conditions, allowing the inverter to continue operating.
      b. Instantaneous overcurrent trip shall safely limit output current to 150% of rated current within under 50 microseconds due to phase short circuit or severe overload conditions.

c. Undervoltage trip shall protect the inverter due to non-momentary power or phase loss. Undervoltage trip shall activate automatically when line voltage drops 10-15% below rated input voltage.
d. Overvoltage trip shall protect the inverter due to voltage levels in excess of 10-15% of nominal line voltage.
e. Over temperature trip shall protect inverter from elevated temperatures in excess of component rating. Over temperature trip indicator shall illuminate continuously if a unit is tripped on over temperature.
f. Inverter logic shall allow trip condition resulting from overcurrent, undercurrent, over temperature, or overvoltage to automatically reset, and inverter shall automatically restart upon correction of trip condition. Number of restart attempts shall be limited to five (5). If after five attempts, restart is not successful, inverter shall shut down safely and require a manual restart. If successful restart occurs, restart circuit counter shall reset to zero (0) counts after approximately ten (10) minutes of uninterrupted operation.
g. In the event of power loss, control shall be designed to shut down safely without component failure. Upon return of power, system shall be designed to automatically return to normal operation and restart into a rotating motor, or shut down and then restart without component damage.
h. In the event of a phase-to-phase short circuit, control shall be designed to shut down safely without component damage.

3. No damage to units shall result in the event that an input or output power contactor, disconnect switch, or circuit breaker is opened or closed while control is activated.
4. To facilitate start-up and service, controllers shall be designed to operate without motor or auxiliary equipment connected to inverter output.
5. Operational Features:
   a. Nominal 0-5 volt DC signal shall be provided for Owner's use. Signal shall vary in direct proportion to controller speed.
   b. Controllers shall be suitable for operation in a 104 degrees F/95% RH (non-condensing) environment. Units shall not be installed in direct sunlight or mounted on any surface exceeding 104 degrees F.
   c. Hand/Off/Auto switch and manual speed potentiometer shall be provided on front of enclosure. When switch is in "hand" position, a unit shall be enabled and potentiometer shall control speed. When switch is in "auto" position, a controller shall be controlled by an input control signal provided an external "enabling" contact is closed.
   d. Acceleration time from zero to full speed shall be adjustable from thirty (30) to three hundred (300) seconds. Deceleration time shall be independently adjustable for same range. Maximum frequency (speed) potentiometer adjustment shall be available to limit drive output to less than 60 Hz. frequency selectable.
   e. Provide output of VFD speed in terms of percentage or Hertz to connect to the control system.
   f. Frequency, voltage, and ampere meters shall be located on front panel.
6. Provide built-in input line and load reactors.

2.7 EVAPORATOR COIL SECTION

A. Provide heavy duty aluminum fins mechanically bonded to seamless copper tubes. Evaporator coil shall be inter-circuited to maintain the active coil face area under part-load conditions. Coil shall also utilize internally enhanced tubing for maximum efficiency.

B. Provide a thermostatic expansion valve (TXV) for each refrigerant circuit. Factory pressure and leak test coil at 450 psi.

C. Provide pitched stainless-steel drain pan to assure positive drainage of condensate from the unit casing.

2.8 CONDENSER SECTION

A. Provide heavy duty aluminum fins mechanically bonded to seamless copper tubes. Factory leak test coil under 750 psia pressure.

B. Provide subcooling circuits integral with condenser coils to maximize efficiency and prevent premature flashing of liquid refrigerant, to a gaseous state, ahead of the expansion valve.

C. Provide vertical discharge, direct drive fans with steel blades, and three phase motors. Fans shall be statically and dynamically balanced. Motors shall be permanently lubricated, with built-in current and thermal overload protection and a weathertight slinger over motor bearings.

D. Furnish unit with factory-installed electronic low ambient option to allow for operation down to 20 degrees F.

E. Provide factory-installed louvered steel coil hail guards around perimeter of condensing section to protect the condenser coils, refrigerant piping and control components. Louvered panels shall be fabricated from minimum 20 ga. galvanized steel and be rigid enough to provide permanent protection for shipping and pre-/post- installation. Course wire mesh is not an acceptable material for coil guards.

F. Condenser coils shall be V-banked for cleaning ease. The coils shall not exceed 14 fins per inch density to permit routine cleaning and prevent excessive air pressure drop across the condenser coil.

2.9 REFRIGERATION SYSTEM

A. Compressors shall be industrial grade, energy efficient direct drive 3600 RPM maximum speed scroll . The motor shall of a suction gas cooled hermetic design. Compressor shall have centrifugal oil pump with dirt separator, oil sight glass, and oil charging valve.

B. Provide with thermostatic motor winding temperature control to protect against excessive motor temperatures resulting from over-/under-voltage or loss of charge. Provide high and low-pressure cutouts and reset relay.

C. Provide factory-installed compressor lockout thermostat to prevent compressor operation at low ambient conditions.

D. Provide coil frost protection compressor unloading based on refrigerant circuit suction temperature to prevent coil frosting with minimum energy usage. Provide factory-installed hot gas bypass shall be required on all VAV units to prevent coil frosting.

E. Refrigerant shall be R453B or R32.

2.10 OUTDOOR AIR SECTION

A. Provide outside air dampers with actuators.

B. Provide adjustable minimum position control through the standard rooftop Human Interface.

C. Provide spring-return motor for outside air damper closure during unit shutdown or power interruption.

2.11 DAMPERS

A. Provide low-leak dampers with a leakage rate not to exceed 2.5% of nominal airflow at one-inch W.C. static pressure.

B. Leakage rate shall be determined in accordance with AMCA Standard 575.

2.12 DDC MICROPROCESSOR CONTROLS

A. General - Each unit shall be provided with a factory-installed, programmed and run-tested, stand-alone, microprocessor control system suitable for VAV control as required. This system shall consist of temperature and pressure sensors (thermistor and transducer), printed circuit boards, and a unit-mounted Human Interface Panel. The microprocessor shall be equipped with on-board diagnostics to indicate that all hardware, software, and all interconnected wiring and sensors are in proper operating condition. The microprocessor's memory shall be non-volatile EEPROM type, thus requiring no battery or capacitive backup to maintain all data during a power loss.

B. The unit manufacturer shall make the points available to the controls contractor for use in the Building Automation System (BAS). The equipment manufacturer shall cooperate fully with the controls contractor to deliver a complete, working BAS system.

C. The Human Interface Panel shall be readily accessible for service diagnosis and programming without having to open the main control panel on the rooftop unit. Alphanumeric coded displays shall not be acceptable.

1. Human Interface (HI) Panel - shall be a 16 key touch-sensitive membrane key switch panel, password protected to prevent use by unauthorized personnel. The Human Interface Panel display shall consist of a 2-line, 40-character-per-line clear English display. The display shall be a Liquid Crystal Display (LCD) with blue characters, a 5 x 7 dot matrix with a cursor, on a gray-green background for high visibility and ease of reading.

D. Anti-recycle Protection - shall be provided to prevent excessive cycling and premature wear of the compressors, contactors, and related components.

E. Include factory-supplied static pressure sensor to continuously monitor supply air duct pressure.

F. The control system shall be completely compatible with the VAV box controllers, with each box controller addressable and controllable through the Package Unit controller.

G. DDC Controller:
1. Direct digital controllers shall be microprocessor-based with all hardware, software, and operator/programmer terminals. Systems shall be capable of stand-alone operation, multiple-controller operation with common operator terminals, and/or integration into larger systems.
2. System to include DDC controllers, and operator's/programmer's terminal. The controllers shall be mounted and wired in a factory enclosure complete with all relays, digital to analog converters, power supplies and terminal strips when located outside the unit enclosure. The controller to operate within the following limits:
   a. Temperature: 0 to 130° F
   b. Humidity: 0 to 95% RH (non-condensing)

3. All DDC algorithms and parameters shall be RAM-based for ready access for modification and adjustment. Memory provided shall be configured and non-volatile.
4. The Controller Software shall include a complete operating system, standard energy management application packages, standard control algorithm application packages, and an owner/used custom control and calculation application package and graphic function blocks.

H. The operating system software shall operate independently of any central computer. The operating system shall control communications between the operator's terminal and the controllers and I/O modules, provide alarm monitoring and reporting, provide control application packages, interface a variety of sensor and actuator types, and contain built-in diagnostic routines. The controller shall have memory error checking. Upon detecting a memory error, the CPU shall correct it or halt to prevent erroneous operation. All "halts" shall be reported as alarms at the control operator's terminal and remote.
   1. After a power failure, and upon a power restoration, the system shall provide automatic sequential restart of equipment based on current program time and program requirements.
   2. All modules shall communicate with equal authority on a peer-to-peer network. Each module is stand-alone.

I. The software shall consist of discrete programs that can be implemented in any combination, in coordination with the proper control sequences, by providing the necessary input sensors and programming the required sequence and executing proper commands to the output devices.
   1. Application Software: Application software shall establish sequences for individual control systems. Software shall be written locally by the supplier, incorporating all energy management software and all necessary subroutines to provide the required sequences. The custom software shall allow the operator to read the stored data and to program custom control sequences directly into microcomputer memory, such as; change "start/stop" times, add or delete loads, change control strategy, etc.

J. Unitary Controller:
   1. Unit controllers shall support, but not be limited to, the following types of systems to address specific applications described in the "Execution" portion of this Specification, and for future expansion:
      a. Air Handling Unit
      b. Refrigeration Control
      c. VAV control
   2. Controller shall support the following types of point inputs and outputs:
      a. Outdoor Air Switch over Inputs:
         (1) Dry bulb
         (2) Outdoor Air Enthalpy
         (3) Differential Temperature
         (4) Binary Input from a separate controller
      b. Outdoor Air Outputs:
         (1) Integrated analog with minimum position
         (2) Binary output to enable self-contained economizer actuator
      c. Heating and Cooling Outputs:
         (1) to 6 stages
      d. Fan Output:
         (1) On/off logic control

3. Controllers shall support the following library of control strategies to address the requirements of the sequences described in the "Execution" portion of this Specification, and for future expansion:
    a. Daily Schedules
    b. Comfort/Occupancy Mode
    c. Economy Mode:
        (1) Standby Mode
        (2) Unoccupied
        (3) Shutdown
    d. Temporary Override Mode:
        (1) Temporary Comfort Mode (Occupancy-based control)
4. Temporary Override Modes:
    a. Temporary Occupancy Mode: The controller interface to the zone temperature sensor shall allow for an optional momentary switch to change the mode of the controller from economy to comfort.
5. Alarm Management: Each unitary controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

K. Points:
1. All points shall be adjustable from unitary controller terminal, portable operator terminal, laptop or main computer.

L. Temperature sensors shall be thermistor or RTD based.
1. Space Temperature Sensors shall both be installed in a wall-mounted decorative enclosure. The sensor shall be provided with the manufacturer's standard locking cover, with a "warmer-cooler" slider adjustment on the cover to change the temperature setpoint. Provide a zone bus jack for zone terminal connection and a built-in override switch.
2. Provide insulated base behind all sensors located on any exterior walls.
3. Outside air wall-mounted sensors shall be provided with a sun shield.

M. Differential Pressure Switches shall be used for filter alarm indication on the heat recovery units and major air handling units only. Switches shall be UL listed adjustable set point and differential pressure type. Switches shall be piped to respond to pressure differential between inlet and outlet sides of the filters.

N. Current sensing relays shall be used for indication of on/off status of electrical devices such as fans, compressors, valves and VFD's. Provide fixed response relays that are selected to respond to the applicable current or provide adjustable relays that can be adjusted to the appropriate current.

O. Static pressure sensor shall be large diameter diaphragm type mounted in the air handler control panel with 3/8” tubing extended to the remote sensing location described in the Sequence of Operation.

P. Provide air flow monitoring stations as scheduled on the drawings.

2.13 ROOF CURB

A. Provide an insulated roof curb as scheduled, galvanized steel with supply and return air gasketing.

B. Curb shall be manufactured in accordance with the National Roofing Contractors Association guidelines for rooftop equipment support and shall be capable of being re-roofed without disturbing the unit.

C. Insulation shall be 2” thick, 3 lb. Density, rigid fiberglass board.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that the roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on the factory-built roof mounting frame, providing a watertight enclosure to protect the ductwork. Install roof mounting curb level.

3.3 MANUFACTURER'S FIELD SERVICES

A. Manufacturer shall furnish a factory-trained service technician without additional charge to assist the installing contractor with start-up of the units.

B. Include at least 4 hrs per unit for start-up, check-out, and logging. Furnish a log of operating pressures and temperatures to the installing contractor for the owner’s manuals.

C. Provide two - hour sessions of training for Owner-operator personnel. Training shall include all phases of normal operations, routine maintenance, troubleshooting, and minor repair items.

D. Package rooftop unitary manufacturer shall maintain service capabilities no more than 100 miles from the jobsite.

E. The manufacturer shall furnish complete submittal wiring diagrams of the package unit as applicable for field maintenance and service.

END OF SECTION

SECTION 26 01 00 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.1 SCOPE

A. This project involves the construction of the project as titled above, as described herein.

1.2 DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements. Contractor shall determine the exact locations from field measurements. The lack of specific details for all offsets, transitions, etc., shall not relieve the Contractor of responsibility to provide the necessary elements to coordinate his work with building construction and other trades.

1.3 SUBSTITUTION

A. All bids shall be based only on the equipment and materials as scheduled on the drawings and/or as specified, or on equivalent equipment and materials from a pre-approved alternative manufacturer. No bids may be based on a substitute or other alternative without specific written prior approval from the Engineer. Any Bidder who assumes equivalence of products and who bases his/her bid on that assumption does so at their own risk.

B. A listing of approved alternative manufacturers does not mean that all products of a specific alternative manufacturer are acceptable alternatives to the scheduled items; it merely means that, for bidding, prior approval is not required. All fixtures and devices must still be submitted in accordance with the prescribed procedures. In addition, some items that have an important visual effect, e.g., electric water coolers, may also be required to receive the Engineer's or Owner's approval.

1.4 INTENT

A. All equipment, materials, and labor that may be necessary to complete work in accordance with the intent of these plans and specifications shall be furnished by the Contractor without additional cost.

B. All systems represented in the documents shall, unless specifically noted to the contrary, be provided and installed completely with all necessary components to form a complete and functioning system. Submission of bids will be considered confirmation that complete and functional systems have been included in the bids.

C. If any discrepancies or confusion is perceived in the documents, the Contractor shall call such to the attention of the Engineer for clarification of the documents prior to bidding or construction. If any inconsistencies or contradictions within the construction documents are discovered after the construction contracts are awarded, the Engineer shall determine the intent and correct interpretation of the construction documents.

D. Contractor shall supervise and direct the work competently and efficiently, and in accordance with the drawings and specifications. The Contractor shall be responsible for using construction means, methods, techniques, sequences, and procedures that are compatible with the project's requirements and will result in a project completed in accordance with the drawings and specifications.

1.5 CODES AND PERMITS

A. Contractor shall comply with all local, state, and national codes.

1.6 VIBRATION AND NOISE

A. Each of the various pieces of equipment shall operate without objectionable vibration or noise. All rotating equipment shall be statically and dynamically balanced and mounted, supported, and fastened so that vibration does not exceed the specified levels for the equipment item. The specific type of vibration isolation to be installed shall be submitted to the Engineer for his approval.

B. If, in the opinion of the Engineer, objectionable vibration or noise or transmission thereof to the building occurs, the Contractor shall execute remedial measures as may be necessary to eliminate such unsatisfactory operating conditions, and the work and material required shall be furnished and performed at the Contractor's expense.

1.7 GUARANTEE

A. Each Contractor shall guarantee all labor and materials furnished by him for a period of one year unless otherwise noted. Guarantee period shall extend from the time of final written acceptance of the installation or from the time of use, as directed in writing by the Owner, whichever occurs first. The guarantee shall cover the repair or replacement, without additional cost to the Owner, of any defective material or faulty workmanship.

1.8 SERVICE

A. All necessary service of each system, such as adjustment of controls, air distribution, and water balancing valves, mechanical repair of equipment, and other work requiring specialized training, shall be furnished by the Contractor, at no cost to the Owner, for a period of one year, concurrent with the warranty period specified above.

1.9 SAFETY

A. General
   1. Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work, and Contractor shall comply with all laws governing safety, specifically the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", state and federal.

B. Hazardous Chemicals
   1. According to OSHA, a hazardous chemical is any chemical that is a physical hazard or a health hazard. This may include items such as paints, solvents, adhesives, sealants, cleaners, etc. If a contractor produces, uses, or stores hazardous chemicals at the workplace, then the contractor shall develop, implement, and maintain a hazard communication program in compliance with the latest OSHA requirements. In projects with multiple tenants in which the building is partially occupied during the project, the contractor shall, in accordance with OSHA guidelines, inform the building manager or owner of any hazardous chemicals being produced, stored, or used in the building so that other tenants may be notified. The Contractor shall employ the required methods for training, information, handling, ventilation, labeling, storage, disposal, and removal of hazardous chemicals.

1.10 COORDINATION

A. Each Contractor's bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Failure by the Contractor to coordinate with all other trades, resulting in interference, shall be sufficient reason to require the Contractor to replace or rebuild the affected work at no extra charge.

1.11 STORAGE OF MATERIALS

A. Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be rain-proof and lockable as required. Materials or equipment stored on-site but not in a lockable, rainproof storage facility shall be stored above ground or above the slab. Contractor shall take necessary precautions to prevent entry of and/or damage from dirt, trash, water, or vermin. Equipment not properly stored and protected shall be, at the discretion of the Engineer, replaced at no cost to Owner. Roofs are not acceptable storage areas unless specifically allowed in writing by the Engineer.

PART 2 - PRODUCTS

2.1 SUBMITTALS

A. Provide submittal to the Engineer within 45 days of commencement of the Contractor's agreement with the Owner or as defined by the Engineer.

B. The format of the submittal shall be as defined by the Engineer. If not defined, provide electronically in PDF format.

C. In addition, submit specific information on equipment, products, and principal materials specified. Indicate and provide names of manufacturers, catalog and model numbers, cut sheets, and such other supplementary information as necessary for evaluation. Include all items mentioned by model number and/or manufacturer's name in the specifications or on the drawings, including but not limited to the following:
   1. Electrical - Fixtures, panelboards, switchgear, protective devices, wiring devices, switches, motor starters, transformers, conduit, and any other equipment or principal materials.

D. Requirements for submittal
   1. Each submittal shall:
      a. bear a stamp or specific written indication that Contractor has reviewed and approved all submittals prior to submission to Engineer,
      b. have all information deleted by Contractor that pertains to the means and methods of construction or to the fabrication, assembly, installation, or erection process (approval by Engineer shall not extend to these areas unless specifically noted by Engineer),
      c. be clearly marked as to which specific piece of equipment is being submitted, by use of a permanent marker, stamp, etc., so as to distinguish it from other pieces of equipment that may occur on the same page,
      d. be clearly marked as to which available options are being submitted that are associated with a piece of equipment, and
      e. be complete with respect to quantities, dimensions, specific performance, materials, and similar data to enable the Engineer to review the proposed equipment.
   2. Omission by Contractor of any of the above requirements for submittals will subject the submittal to automatic rejection without review.
   3. Any submittals received by the Engineer that were not requested shall be returned without review of any kind.

E. Substitutions
   1. In addition, no substitution is allowable without the Engineer's written approval ten days prior to the bid due date (unless otherwise allowed by the Engineer) unless the manufacturer is listed on the Drawings or in the specifications as being a pre-approved alternative manufacturer. Any submittal received without such written approval or prior approval is subject to unqualified rejection.
   2. Contractor's responsibility shall be to verify that the submitted substitute equipment will fit in the space available. The Contractor's submittal for acceptance of the substitute shall include a written statement of whether or not such acceptance would require any subsequent or associated changes to the drawings or specifications. Any such changes shall be described in writing, briefly but completely.
   3. The Contractor shall be responsible for the cost of any such modifications due to the substitution of materials or equipment for that which was specified or scheduled. The cost shall be complete, that is, it shall include the cost effect on any and all other trades.
   4. The Engineer may request shop drawings of mechanical rooms or systems of the substituted equipment.

F. Installation Instructions
   1. For certain products or systems as identified in subsequent specification sections, the Contractor shall, as required, provide copies of the manufacturer's installation instructions with the submittal. When required, the installation instructions are considered part of the submittal, and their omission may result in automatic rejection. Where more than one identical device is scheduled, only one set of installation instructions needs to be submitted, e.g., if seven five-ton split-system air conditioners are scheduled, only one set of five-ton unit installation instructions needs to be submitted. Similarly, if the manufacturer identifies a single set of installation instructions that applies to more than one type or size of device, e.g., a single set of air conditioner instructions that applies to three-, four-, and five-ton units, then only one instruction set is required for those devices.

2.2 MATERIALS

A. All materials shall be new and of the quality specified. Materials shall be free from defects. Where manufacturers' names are mentioned in these specifications or on the plans, this is to establish a standard of quality and construction.

B. Contractor will be responsible for transportation of his materials to and on the job and will be responsible for the storage and protection of his materials and work until the final acceptance of the job. At the end of each workday, each Contractor is responsible for covering or protecting his work or materials that may be susceptible to damage, even if such damage is the result of unforeseen causes, e.g., an overnight thunderstorm. Failure to do so will be sufficient cause for rejection of any item in question, and any such item shall be replaced at Contractor's expense.

C. Contractor shall verify that all pieces of equipment will fit through available openings in the building and that all equipment can be installed without modification of the building structure.

2.3 LABELING

A. Each device for which an independent testing authority has established a standard shall have affixed a label indicating its compliance and listing. Such independent testing authorities shall include, but not be limited to, the following:

A.N.S.I.	American National Standards Institute

A.R.I.	Air-Conditioning and Refrigeration Institute
A.S.H.R.A.E.	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M.	American Society for Testing and Materials
F.M.	Factory Mutual
ICC	International Code Council
N.B.S.	National Bureau of Standards
N.E.C.	National Electric Code
N.E.M.A.	National Electrical Manufacturers Association
N.F.P.A.	National Fire Protection Association
N.R.C.A.	National Roofing Contractors Association
U.L.	Underwriters Laboratory

2.4 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Contractor shall prepare and provide four copies of operating and maintenance manuals. Contractor shall deliver these four bound sets to the Engineer for approval. Each manual shall be in a ring binder and shall be indexed with dividers for each section. Delivery of required documents is a condition of final acceptance.

B. Each manual shall contain at least the following:
   1. Certificates of acceptance from inspecting authorities,
   2. Waiver of all liens,
   3. For each piece of equipment:
      a. operating and safety instructions, service manuals, and parts lists applicable to each item of equipment furnished (Contractor shall clearly distinguish in the manual between information that pertains to the specific equipment and information that does not.),
      b. nameplate data and design parameters for equipment,
      c. name, phone number, and address of vendor, manufacturer's representative, and warranty provider,
      d. start-up report, if applicable,
   4. copies of all shop drawings and as-built drawings (as-built drawings shall be on a reproducible vellum as produced by a Xerox or photographic process),
   5. copies of all approved submittals,
   6. warranties with start dates and end dates for each piece of equipment and/or for each system (warranties shall begin on the date of substantial completion and acceptance by Owner),
   7. names, phone numbers, and addresses of all subcontractors, vendors, manufacturer's representatives, and warranty providers,
   8. certification letter from each Contractor that each system furnished and installed by that Contractor and/or Subcontractors is started up, commissioned, balanced, adjusted, and checked for proper operation in accordance with the intent of the contract documents, and
   9. acceptance letter from each Contractor with blanks for date of acceptance and date of expiration of warranties and guarantees.

2.5 TAGGING

A. Equipment to be Tagged: Each major piece of equipment discussed in the specifications or scheduled on the drawings shall have a tag affixed showing the name or function of that piece. The list of equipment to receive tags shall include, but not be limited to, the following:

1. panelboards, switchgear, transformers, starters, safety switches, contactors, etc., with designation from drawing and indicating function or device served (e.g., Rm 101 lighting contactor, CHP-1, etc.),
2. motor starters and contactors, indicating which devices are being controlled,
3. any other major piece of equipment.
4. Items that have no unique name, such as light fixtures, need not have tags.

B. Tags
1. Material - Tags shall be engraved plastic, brass, or anodized aluminum. Surface-mounted tags shall have pressure-sensitive adhesive backing. Tags for outdoor use shall be mounted with brass screws.
2. Lettering - Characters shall be a minimum of 1/4" in height and shall be of a contrasting color to the tag.
3. Installation - Surface-mounted tags with adhesive backs shall be applied only to clean, dry surfaces. Adhesive tags shall not be applied to surfaces that are subject to condensation or excessive heat.

C. Alternatives
1. For larger equipment such as large switchgear, etc., the use of manufactured stencils (2-inch characters) and spray paint (in a contrasting color to the equipment) is an acceptable alternative.
2. Individual adhesive letters are not acceptable.
3. Other alternatives are acceptable only by submitting samples or the manufacturer's literature to the Engineer and receiving written permission.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. The workmanship shall, in all respects, be of the highest grade, and all construction shall be done according to the best practices of the trade. Piping, ducting, and conduit shall be concealed unless otherwise noted and installed square to the building lines. Any work that does not meet this requirement shall be replaced or rebuilt at no extra expense to the Owner.

3.2 INTERIM CLEANING

A. The Contractor shall maintain the work area in a clean condition during the course of the work. All debris, scrap, and surplus material shall be removed from the work area on a periodic basis with a minimum of at least once per day.

B. All stored material shall be supported above floor level and be protected from becoming damaged or dirty.

C. All installed material shall have open ends closed and protected from the entrance of foreign material during construction.

D. Prior to enclosing an area such as a ceiling or chase wall, the installed material and the surrounding area shall be thoroughly cleaned. After removing loose material, the area shall be vacuum cleaned or blown out with a portable blower to remove dust from surfaces.

3.3 CUTTING, PATCHING, AND PENETRATIONS

A. No joists, beams, girders, columns, slabs, or other structural elements shall be cut, drilled, or altered in any way by the Contractor without first obtaining written permission and instructions from the Engineer.

B. Where cutting any non-structural element(s) of walls, floors or ceilings is necessary to permit the installation of any work under this contract, or to repair any defects that may appear up to the expiration of the guarantee, such cutting shall be done by Contractor with as little damage as reasonably possible to the element being cut, to adjacent elements, or to the work of other trades.

C. After the necessary work has been completed, the damage shall be repaired by the Contractor, who shall pay all costs of such cutting and patching. All patching or sealing of cuts, penetrations, etc., including final appearance of same, shall be done to the approval of the Engineer. In the absence of specific finish instructions, provide a finish to match adjacent surfaces.

D. Where a penetration or cutting of a ceiling, wall, or other building membrane is required or made, each such penetration or cut shall be made neatly with a cutting tool such as a saw, sharp knife, etc., and not with an impact tool such as a hammer, screwdriver, wrench, crowbar, etc. Each such penetration or cut shall be no larger than reasonably necessary, and penetrations in occupied or publicly accessible spaces shall have a chrome-plated escutcheon installed large enough to cover the entire opening.

E. Where a penetration is made in a fire-rated building assembly (wall, floor, ceiling, floor-ceiling, roof-ceiling, etc.) or in a membrane of a fire-rated assembly, and no specific firestopping assembly is shown on Drawings, Contractor shall provide and install a firestopping assembly or product as listed in the latest edition of U.L. Fire Resistance Directory. Firestopping assembly or product shall be appropriate for the size and material of the penetrating element, for the penetrated building element, for the presence or lack of insulation, for the size of the annulus around the penetrating element, etc. The Contractor shall include the firestopping assembly or product in submittals. Contractor shall review and verify fire ratings of building assemblies as shown on the plans. Lack of knowledge of the fire rating of a building assembly shall not relieve the Contractor of the requirement to install firestopping.

3.4 EQUIPMENT AND PIPING SUPPORTS

A. All supporting systems for piping, equipment, and materials supported by the building structure shall be submitted to the Engineer for approval prior to purchase and installation.

3.5 ACCESSIBILITY

A. Access Panels
   1. Access panels shall be provided wherever necessary for possible future replacement, adjustment, or maintenance of operating devices such as machinery, valves, dampers, switches, relays, etc., or to other critical non-operating devices such as pull boxes, inspection parts, gauges, etc. Such access panels shall be provided and installed by Contractor, whether or not shown on drawings, and shall be brought to the attention of Engineer for his approval of type, color, etc. Where access is provided in rated members, the access panels shall be of the type that maintains the integrity of the member penetrated.

B. Access to Equipment
   1. All pipes, tubing, conduit, etc., including, but not limited to, chilled water and heating water piping, domestic cold water and hot water piping, fire sprinkler piping, waste and vent piping, drain piping of any type, electrical conduit, wiring not in conduit, and

pneumatic control tubing shall be installed in such a way so as not to prevent and/or not to make unreasonably difficult the removal, operation, use, or maintenance of equipment, access panels or doors, pathways (especially in attics or crawl spaces), observation ports, measurement or balancing devices, junction boxes, etc.. If access for these purposes is prevented or made unreasonably difficult in the opinion of the Engineer, then the Contractor shall make modifications or repairs at no cost to anyone except the Contractor. Such modifications or repairs shall be considered neither complete nor adequate until the Engineer is satisfied that access for the above purposes is achieved.

3.6 FIELD REPORTS

A. The Contractor shall be required to respond to all deficiency items noted in Field, Site Visit, Punch List, and other such reports provided by the A/E. The response shall address each deficiency item in the same order as the report, with annotations as to what was done to remedy the deficiency, who performed the work, and when it was done.

3.7 OPERATING TESTS

A. General
   1. After all mechanical and electrical systems have been completed and put into operation, Contractor shall subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation. All associated costs of such tests, including labor, fuel, apparatuses, piping, etc., shall be borne by the Contractor.
   2. Contractor shall make adjustments as required to ensure proper functioning of all systems. Special tests for individual systems are specified in the corresponding sections.

B. Notification
   1. Contractor shall give the Engineer seven days' prior notification of any test so that the Engineer will have time to be present if he so desires.

C. Reports
   1. After each test is performed, the Contractor who performed the test shall prepare and issue a report to include the following information:

      a. Project name and location, date of the report,
      b. Contractor's name, address, and telephone number; if the Contractor performing the test is a Subcontractor, indicate also for whom the test is being performed, their name, address, telephone number, and a contact person's name,
      c. the date, or range of dates, of the test,
      d. the name of the Contractor's employee who was responsible for performing or for overseeing the performing of the test,
      e. a brief description of the system being tested,
      f. a brief description of the testing procedure,
      g. a summary of the test result(s),
      h. a brief assertion that the system was tested as stated and that the system complied with the requirements of the contract documents or those of the Authority Having Jurisdiction, whichever is the most stringent, and
      i. a hand-written date and signature of someone who has authority or responsibility from the company that performed test(s), and a hand-written brief note stating that the above information is true and accurate.
   2. If the tested system is tested in parts, then one report may be made after the last part is tested.

3. The report shall be issued to the Engineer within five working days after the test is completed.
4. Such reports shall be required of all mechanical or electrical systems that require tests for pressure, water tightness, flow, resistance, or conductivity.

D. Services of a Manufacturer's Representative
1. Reports: For all major systems or equipment required by subsequent specifications sections to have tests or inspections by a manufacturer's representative, the manufacturer's representative shall prepare a written report to be sent to the Engineer for subsequent distribution to the Engineer, Owner, General Contractor, and to whomever else the Engineer deems necessary. The report shall include at least the following:
   a. date of the visit, name and title of the representative, name and location of the project,
   b. name and title of any observers,
   c. a brief description of the equipment being inspected and/or tested,
   d. a brief discussion of the quality of the installation, including any important items (in the manufacturer's experience) that were done correctly, as well as any items that were done incorrectly or not to the recommendations,
   e. a list of tests and/or inspections performed and the results of the same, and
   f. a brief statement of whether the installation conforms to the manufacturer's recommendations and/or requirements, and if not, what is required to bring the installation into conformance.
2. Deficiencies and Defects
   a. Contractor shall be responsible for providing all labor and materials, at no cost to anyone except Contractor, to correct any deficiencies or defects reported by the manufacturer's representative.
   b. If, in the opinion of the manufacturer's representative, the deficiencies and defects are sufficiently serious, then Contractor shall arrange for, and bear all costs of, another inspection by the manufacturer's representative after corrective measures have been taken.
3. The above process shall continue until the manufacturer's representative approves the installation.

3.8 INSTRUCTIONS FOR OWNER

A. Contractor shall instruct the Owner's operating personnel in the operation and maintenance of all mechanical equipment. Contractor shall furnish any special servicing tools required for maintenance.

3.9 DEMONSTRATION

A. Contractor shall conduct a demonstration of the installation upon completion of the work. Prior to this, all work shall have been completed, tested, balanced, and placed in operation. Qualified personnel must be present at the demonstration to operate all systems and verify the equipment's performance. The schedule for this demonstration shall be coordinated with the Engineer.

3.10 CLEANUP

A. At substantial completion of the project, thoroughly clean all equipment and systems of all dirt, debris, and foreign material.

B. This shall include cleaning coils and fans inside of air handlers, cleaning the interior of duct systems, and wiping down the interior of all electrical equipment.

C. Remove all unused temporary wiring or construction lighting and power, and all unused material from above the ceilings and from hidden recesses.

END OF SECTION

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes building wire and cable; nonmetallic-sheathed cable; direct burial cable; service entrance cable; armored cable; metal clad cable; and wiring connectors and connections.

1.2 REFERENCES

A. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SYSTEM DESCRIPTION

A. Product Requirements: Provide products as follows:
   1. Solid copper conductor for feeders and branch circuits 12 AWG and smaller.
   2. Stranded copper conductors for control circuits.
   3. Stranded copper conductors larger than 12 AWG.
   4. Conductor not smaller than 12 AWG for power and lighting circuits.
   5. Conductor not smaller than 16 AWG for control circuits.
   6. 10 AWG conductors for 20 amperes, 120-volt branch circuits longer than 75 feet.
   7. 10 AWG conductors for 20 amperes, 277-volt branch circuits longer than 200 feet.

B. Wiring Methods: Provide the following wiring methods:
   1. Concealed Dry Interior Locations: Use only building wire THHN/THWN insulation in raceway.
   2. Concealed Dry Interior Locations: For lighting whips and drops to single outlet or switch and within wall cavities, THHN/THWN insulation with grounding strip for exterior of metal clad cable and green insulated ground wire may be used at the contractor's option.
   3. Above Accessible Ceilings: Use only building wire THHN/THWN insulation, in raceway. For lighting whips and drops to a single outlet or switch, THHN/THWN-insulated metal-clad cable with a green insulated ground wire and a redundant grounding strip for the metal cladding may be used at the contractor's option.
   4. Wet or Damp Interior Locations: Use only building wire THHN/THWN insulation in raceway.
   5. Exterior Locations: Use only building wire THHN/THWN insulation in raceway.

1.4 SUBMITTALS

A. Section 26 01 00 - Submittal Procedures: Requirements for submittals.

1.5 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and circuits.

1.6 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.7 COORDINATION

A. Where wire and cable destinations are indicated, and routing is not shown, determine the routing and lengths required.

B. Wire and cable routing indicated are approximate unless dimensioned. Include wire and cable lengths within 10 feet of the length shown in both horizontal and vertical dimensions.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Product Description: Single-conductor insulated wire.

B. Conductor: Copper.

C. Insulation: 600-volt rating; thermoplastic material rated 90 degrees C.

2.2 METAL CLAD CABLE

A. Conductor: Copper.

B. Insulation Voltage Rating: 600 volts.

C. Insulation Temperature Rating: 90 degrees C.

D. Insulation Material: Thermoplastic.

E. Insulated green grounding conductor.

F. Armor Material: Steel or Aluminum suitable for jacket exterior grounding

G. Armor Design: Interlocked metal tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify the interior of the building has been protected from the weather.

B. Verify that the mechanical work likely to damage the wire and cable has been completed.

C. Verify raceway installation is complete and supported.

3.2 PREPARATION

A. Completely and thoroughly swab the raceway before installing the wire.

3.3 INSTALLATION

A. Route wire and cable to meet Project conditions.

B. Neatly train and lace wiring inside boxes, equipment, and panelboards.

C. Identify and color code wire and cable under provisions of Section 26 05 53. Identify each conductor with its circuit number or other designation indicated.

D. Special Techniques--Building Wire in Raceway:
   1. Pull conductors into the raceway at the same time.
   2. Install building wire 4 AWG and larger with pulling equipment.

E. Special Techniques - Cable:
   1. Protect exposed cable from damage.
   2. Support cables above the accessible ceiling, using spring metal clips to support cables from the structure or the ceiling suspension system. Do not rest the cable on the ceiling panels.
   3. Use suitable cable fittings and connectors.

F. Special Techniques - Wiring Connections:
   1. Clean conductor surfaces before installing lugs and connectors.
   2. Make splices, taps, and terminations to carry the full ampacity of conductors with no perceptible temperature rise.
   3. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation rating of the conductor.
   4. Install split bolt connectors for copper conductor splices and taps, 6 AWG and larger.
   5. Install solderless pressure connectors with insulating covers for copper conductor splices and taps, 8 AWG and smaller.
   6. Install insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.

G. Install solid conductor for feeders and branch circuits 12 AWG and smaller.

H. Install stranded conductors for branch circuits 10 AWG and larger. However, when stranded conductors are used in lieu of solid, install crimp-on fork terminals for device terminations. Do not place bare stranded conductors directly under screws.

3.4 WIRE COLOR

A. General
   1. For wire sizes 10 AWG and smaller, install wire colors in accordance with the following – unless governed by other local code amendments:
      a. Black and red for single-phase circuits at 120/240 volts.
      b. Black, red, and blue for circuits at 120/208 volts, single or three-phase.
   2. For wire sizes 8 AWG and larger, identify wire with colored tape at terminals, splices, and boxes. Colors are the same as above.
   3. If there is a local code stating wire color, the local code shall supersede.

B. Neutral Conductors: White 120/208 volts, neutral gray 277/480 volts. When two or more neutrals are located in one conduit, individually identify each with the proper circuit number.

C. Branch Circuit Conductors: Install three or four-wire home runs with each phase uniquely color-coded.

D. Feeder Circuit Conductors: Uniquely color-code each phase.

E. Ground Conductors:
   1. For 6 AWG and smaller: Green.
   2. For 4 AWG and larger: Identify with green tape at both ends and visible points, including junction boxes.

END OF SECTION

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Conduit support.
   2. Formed steel channel.

1.2 REFERENCES

A. ASTM International:
   1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
   3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
   4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

B. FM Global:
   1. FM - Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.

C. National Fire Protection Association:
   1. NFPA 70 - National Electrical Code.

D. Underwriters Laboratories Inc.:
   1. UL 263 - Fire Tests of Building Construction and Materials.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 1479 - Fire Tests of Through-Penetration Firestops.
   4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
   5. UL - Fire Resistance Directory.

E. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest the movement of fire, smoke, heat, and hot gases through fire-rated construction.

1.4 SUBMITTALS

A. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.

B. Product Data:

1. Hangers and Supports: Submit the manufacturer's catalog data, including load capacity.

C. Design Data: Indicate the load-carrying capacity of trapeze hangers.

D. Manufacturer's Installation Instructions:
1. Hangers and Supports: Submit special procedures and assembly of components.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Engineering Judgments: For conditions not covered by UL or WH listed designs, submit judgments by a licensed professional engineer suitable for presentation to the authority having jurisdiction for acceptance as meeting code fire protection requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with the manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and mechanical damage by storing in original packaging.

PART 2 - PRODUCTS

2.1 CONDUIT SUPPORTS

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. Electroline Manufacturing Company
3. B-Line
4. Unistrut
5. Power Strut
6. Kindorf
7. Substitutions: Section 01 60 00 - Product Requirements.

B. Hanger Rods: Threaded high tensile strength galvanized carbon steel with free-running threads. Minimum diameter 3/8 inch.

C. Beam Clamps: Malleable Iron, with tapered hole in base and back to accept either bolt or hanger rod. Set screw: hardened steel.

D. Conduit clamps for trapeze hangers: Galvanized steel, notched to fit trapeze with a single bolt to tighten.

E. Conduit clamps - general purpose: One-hole malleable iron for surface-mounted conduits.

F. Cable Ties: High-strength nylon temperature-rated to 185 degrees F. Self-locking.

G. Roof Support: UV resistant rubber type with galvanized formed channel piping support similar to B-Line DB5.

2.2 FORMED STEEL CHANNEL

A. Manufacturers:
1. Allied Tube & Conduit Corp.
2. B-Line Systems
3. Midland Ross Corporation, Electrical Products Division.
4. Unistrut Corp.
5. Powerstrut
6. Kindorf

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

C. All channels, bolts, nuts, washers, rods and other fittings used on fabrications exterior to the building shall be hot-dipped galvanized finish – ASTM A123 or A153.

PART 3 - EXECUTION

3.1 INSTALLATION - HANGERS AND SUPPORTS

A. Anchors and Fasteners:
1. Concrete Structural Elements: Provide precast inserts, expansion anchors, and preset inserts.
2. Steel Structural Elements: Provide beam clamps and spring steel clips.
3. Concrete Surfaces: Provide expansion anchors.
4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Provide toggle bolts and hollow wall fasteners.
5. Solid Masonry Walls: Provide expansion anchors and preset inserts.
6. Sheet Metal: Provide sheet metal screws.
7. Wood Elements: Provide wood screws.

B. Install conduit and raceway support and spacing in accordance with NEC.

C. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

D. Install multiple conduit runs on common hangers.

E. Supports:
1. Fabricate supports from structural steel or formed steel channel. Install hexagon-head bolts to ensure a neat appearance with adequate strength and rigidity. Install spring lock washers under nuts.
2. Install surface-mounted cabinets and panelboards with a minimum of four anchors.
3. In wet and damp locations, install steel channel supports to stand cabinets and panelboards 1 inch off the wall.
4. Support vertical conduits at every floor.
5. Cut off ends of unsupported channel beyond supporting structure unless specifically required for cantilevered support.

6. Cut off hanger rods to within 1 inch of the support. Finish exposed rods with an acorn nut.
7. Coat the cut ends of galvanized channel and hardware used exterior of the building with zinc-rich paint such as ColdGalv or similar

END OF SECTION

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):
   1. National Electrical Code (NEC) NFPA 70 latest edition or as required by local code amendments.

B. American National Standards Institute:
   1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
   2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
   3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).

C. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
   2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
   3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
   4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
   5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
   7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

A. All wiring shall be in conduit unless specifically noted otherwise.

B. All conduits shall be concealed behind walls, below floors, below roof and above ceilings unless the space is an unfinished area or utility space such as a mechanical or electrical room or unless specifically noted otherwise.

C. All conduits shall be run above slab unless specifically shown on the drawings or described otherwise.

D. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceways to complete the wiring system.

1.4 DESIGN REQUIREMENTS

A. Minimum Raceway Size: ½ inch unless otherwise specified.

1.5 SUBMITTALS

A. Product Data: Submit for the following:
   1. Flexible metal conduit.
   2. Liquidtight flexible metal conduit.
   3. Nonmetallic conduit.
   4. Flexible nonmetallic conduit.
   5. Nonmetallic tubing.
   6. Raceway fittings.
   7. Conduit bodies.
   8. Surface raceway.
   9. Wireway.
   10. Pull and junction boxes.
   11. Handholes.

B. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by the Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

A. Project Record Documents:

   1. Record actual routing of conduits larger than 2 inches.
   2. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect conduits from corrosion and the entrance of debris by storing above grade. Provide appropriate covering.

B. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.1 METAL CONDUIT

A. Rigid Steel Conduit (RMC-S): ANSI C80.1.

B. Rigid Aluminum Conduit (RMC-A): ANSI C80.5.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.2 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Product Description: (LFMC) Interlocked steel or aluminum construction with PVC jacket.

B. Fittings: NEMA FB 1.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Product Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: NEMA FB 1; steel, compression or set screw indenter type.

C. Provide connectors with insulated throat.

2.4 WIREWAY

A. Product Description: General-purpose and Raintight type wireway.

B. Knockouts: None.

C. Size: as indicated on Drawings.

D. Cover: Screw cover.

E. Connector: Slip-in.

F. Fittings: Lay-in type with removable top, bottom, and side; captive screws and drip shield.

G. Finish: Rust inhibiting primer coating with gray enamel finish.

2.5 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Minimum 4”x 4”x 2-1/8” deep
   2. Luminaire and Equipment Supporting Boxes: Rated for the weight of equipment supported; furnish 1/2-inch male fixture studs where required.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

2.6 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface-mounted junction box:
   1. Material: Galvanized cast iron or Cast aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 APPLICATION - RACEWAY

A. Dry Locations, Concealed within or suspended under building:
   1. EMT.
   2. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas.
   3. Provide hinged enclosure for large pull boxes.

B. Wet and Damp Locations, Concealed within or suspended under building:
   1. RMC-S, RMC-A or IMC.
   2. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

C. Exposed within building, such as in mechanical and electrical rooms
   1. Below 8'-0" above finished floor: RMC-S, RMC-A or IMC.
   2. Above 8'-0": EMT
   3. Provide sheet-metal boxes.
   4. Provide flush mounting outlet box in finished areas.
   5. Provide hinged enclosure for large pull boxes.

D. Exposed exterior to building:
   1. Exposed areas:
      a. RMC-S, RMC-A, or IMC.
      b. Provide cast metal or nonmetallic outlet, pull, and junction boxes.

E. Connections to equipment:
   1. Within building or suspended under building: FMC
   2. Exterior to building: LFMC
   3. Length of connector: 3'-0" maximum unless noted otherwise.

3.3 INSTALLATION

A. Ground and bond raceway and boxes.

B. Fasten raceway and box supports to the structure and finishes.

C. Identify raceway and boxes.

D. Arrange raceway and boxes to maintain headroom and present a neat appearance.

3.4 INSTALLATION - RACEWAY

A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.

B. Do not install raceway underground or under-slab unless specifically noted otherwise.

C. Arrange raceway supports to prevent misalignment during wiring installation.

D. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

E. Group related raceway; support using conduit rack. Construct a rack using steel channel.

F. Do not support raceway with wire or perforated pipe straps. Remove the wire used for temporary supports

G. Do not attach raceway to ceiling support wires or other piping systems.

H. Construct wireway supports from steel channel specified in Section 26 05 29.

I. Route exposed raceway parallel and perpendicular to walls.

J. Route raceway installed above accessible ceilings parallel and perpendicular to walls.

K. Maintain clearance between the raceway and piping for maintenance purposes.

L. Maintain 12-inch clearance between raceway and surfaces with temperatures exceeding 104 degrees F.

M. Cut conduit square using saw or pipe cutter; de-burr cut ends.

N. Bring conduit to shoulder of fittings; fasten securely.

O. Install conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

P. Install no more than the equivalent of three 90-degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Employ a hydraulic one-shot bender to fabricate bends in metal conduit larger than 2 inches.

Q. Avoid moisture traps; install a junction box with a drain fitting at low points in the conduit system.

R. Install fittings to accommodate expansion and deflection where the raceway crosses control and expansion joints.

S. Install insulated bushings or insulated throat bushings at all connections to boxes, fixtures, equipment or other devices and terminations.

T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.

U. Install suitable caps to protect the installed conduit against the entrance of dirt and moisture.

V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.

W. Close ends and unused openings in the wireway.

3.5 INTERFACE WITH OTHER PRODUCTS

A. Route conduit through roof openings for piping and ductwork or through a suitable roof jack with a pitch pocket. Coordinate location with roofing installation.

B. Align adjacent wall-mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

A. Install knockout closures in unused openings in boxes.

3.7 CLEANING

A. Clean the interior of boxes to remove dust, debris, and other material.

B. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 28 20 - ELECTRICAL EQUIPMENT

PART 1 - GENERAL

1.1 SCOPE

A. Furnish and install all labor and material necessary for complete and working systems, including:
   1. Safety and Disconnect Switches
   2. Fuses

1.2 SUBMITTAL

A. Provide submittal in accordance with Sections 26 01 00.

B. Provide submittal for all material described herein.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Square D – Schneider Electric

B. GE - ABB

C. ITE

D. Siemens

E. Eaton

2.2 SAFETY AND DISCONNECT SWITCHES

A. Provide UL-listed safety switches that meet NEMA-KSI-1975 for heavy-duty type with single interlock, quick-make, quick-break, and high-pressure fuse holders where required.

B. Switches exposed to weather shall be in NEMA 3R rain-tight enclosures with rain-tight hubs. In interior locations, they shall be in NEMA 1 general-purpose enclosures unless otherwise indicated.

C. Provide switches in types, sizes, features, ratings, and enclosures as indicated on drawings for equipment disconnects. Provide units with ratings suitable to loads, per N.E.C.

2.3 FUSES

A. Provide UL-listed and labeled fuses for overcurrent protection and to leave the system in complete working order. Feeder circuit fuses shall correspond with the ampacity of the protected feeder. Size motor circuit fuses from standard fuse tables. Determine the exact motor size and rating from the motor nameplate, and furnish properly sized fuses.

B. Fuses shall have ampere ratings as indicated on drawings, and voltage rating equal to, or greater than, the voltage at their point of application. All fuse contact surfaces shall be plated.

C. Fuses to 600 amperes shall be Bussman Low Peak Dual Element type LPN-RK (250 volts) or Gould Shawmut A2D and Bussman LSP-RK (600 volts) or Gould Shawmut A6D, unless otherwise noted. Fuses above 600 amperes shall be Bussmann KRP-C or Gould Shawmut A4BT time-delay fuses unless otherwise noted.

D. Provide spare fuses in quantities of 10% of each size and type installed, but in no case less

than three spares of each size. Deliver spare fuses to Owner, neatly enclosed in a suitable cabinet.

PART 3 - EXECUTION

3.1 TESTING

A. Take amperage and voltage readings at each switchboard and panelboard with circuits in operation and submit a typewritten tabulation of readings to the Engineer to demonstrate that the load is balanced at each board.

B. Do not test disconnect switches by operating them under load. However, demonstrate switch operation through six opening/closings. Remove and replace defective units with new units and retest to demonstrate compliance.

3.2 INSTALLATION

A. Coordinate electrical equipment installation with other building components.

B. Sequence, coordinate, and integrate installation of electrical equipment for efficient flow of work. Give particular attention to large equipment requiring installation prior to closing-in rooms.

C. Install electrical equipment to facilitate maintenance, repair, or replacement of equipment components.

D. Before energizing the system and again prior to substantial completion of the project, completely clean the inside and outside of each panel of all debris, dust and other such foreign material.

END OF SECTION