RESOLUTION ORDERING REQUEST FOR PROPOSAL FOR ASHTABULA COUNTY, OHIO- COURTHOUSE HVAC RENOVATIONS 2025 ROOFTOP HVAC EQUIPMENT INSTALLATION

WHEREAS, on August 5, 2025 proposals were ordered and on September 16, 2025 proposals were awarded to Carrier Corporation for the Ashtabula County, Ohio- Courthouse HVAC Renovations 2025 Rooftop HVAC Equipment pre-purchase; and

WHEREAS, Janet Discher, Ashtabula County Administrator, now requests that the Ashtabula County Board of Commissioners order Request for Proposals for the Ashtabula County, Ohio Courthouse HVAC Renovations 2025 Rooftop HVAC Equipment Installation portion of the project, to-wit:

Project Scope: Installation of the already purchased HVAC rooftop equipment for heating and air conditioning unit at the County Courthouse for the purchase of equipment only, not installation

Estimated Cost:	$276,700.00
Proposal Due Date:	December 29, 2025 by 3:00 p.m. EST
Estimated Completion Date:	April 30, 2026

WHEREAS, because the above request is estimated to be in excess of the competitive bidding threshold as outlined in ORC 9.17, which for 2025 is $77,250.00, it is necessary to advertise for proposals as required by Section 307.862 Ohio Revised Code in accordance with specifications now on file in this office; now

THEREFORE, BE IT RESOLVED, By the Board of Commissioners of Ashtabula County, Ohio, that a proposal opening will be held on December 29, 2025 at 3:00 p.m. EST in the offices of the Board of County Commissioners, 25 West Jefferson St., Jefferson, OH 44047 and the Clerk of the Board is hereby ordered to advertise in a newspaper of general circulation, via the internet at the Ashtabula County Website, http://ashtabulacounty.us/bids and to post notice of said proposal on the bulletin board as required by law.

ASHTABULA COUNTY COMMISSIONERS

CERTIFICATION PAGE

Resolution No. 2025-516 **November 25, 2025**

RESOLUTION ORDERING REQUEST FOR PROPOSAL FOR ASHTABULA COUNTY, OHIO- COURTHOUSE HVAC RENOVATIONS 2025 ROOFTOP HVAC EQUIPMENT INSTALLATION

Upon the motion of Casey R. Kozlowski, seconded by Kathryn L. Whittington.

VOTE:

J.P. Ducro IV	**Aye**
Casey R. Kozlowski	**Aye**
Kathryn L. Whittington	**Aye**

CERTIFICATE OF CLERK

IT IS HEREBY CERTIFIED that the foregoing is a true and correct transcript of a resolution acted upon and duly passed by the Board of County Commissioners of Ashtabula County, Ohio, on the date noted above.

Lisa Hawkins

Lisa Hawkins, Clerk of the Board
Board of County Commissioners
Ashtabula County, Ohio

Ashtabula County, Ohio

REQUEST FOR PROPOSALS

Ashtabula County, Ohio – Courthouse HVAC Renovations 2025

RFP Issue Date: November 25, 2025

RFP Response Due Date: December 29, 2025 at 3:00 p.m.

OFFICE OF THE ASHTABULA COUNTY COMMISSIONER'S

PROPOSAL PACKET

For: Ashtabula County – Courthouse HVAC Renovations 2025

Proposer's Name _____

Street Address _____

P.O. Box _____

City, State & zip _____

Email/Ph. #: _____

Project Location:	Ashtabula County Courthouse 25 West Jefferson St., Building B Jefferson OH 44047
Place of Proposal Opening:	Ashtabula County Commissioner's Conference Room 2nd Floor, Old Courthouse 25 West Jefferson St. Jefferson, OH 44047
Cost Estimate:	$276,700.00
Questions Due:	December 19, 2025 by 4:30 p.m.
Questions Answered:	December 24, 2025 by 12:00 p.m.
Proposal Due Date:	December 29, 2025 at 3:00 p.m. EST
Est. Completion Date:	April 30, 2026

LEGAL NOTICE

Ashtabula County, Ohio – Courthouse HVAC Renovations 2025

The Board of Commissioners of Ashtabula County, Ohio, is soliciting sealed proposals for the **Designated HVAC Renovations** to provide an updated Heating, Ventilating & Air Conditioning System for the Ashtabula County Courthouse located at 25 West Jefferson Street, Jefferson, Ohio (Building B).

Sealed proposals will be received until **3:00 p.m. (EST) on December 29, 2025** and must be submitted in writing to the offices of the Board of County Commissioners, Attn: Lisa Hawkins Clerk of the Board, 25 West Jefferson Street, Jefferson, Ohio 44047-1092. NO ELECTRONIC SUBMISSIONS WILL BE ACCEPTED. Proposals will be publicly opened at that time and location, for the following project:

- **Project Title:** Courthouse HVAC Renovations 2025
- **Estimated Cost:** $276,700
- **Proposal Package 1:** HVAC Renovations including install of Pre-Purchased Rooftop HVAC Unit

Contractors may access the legal notice and download the proposal packet and specifications online at www.ashtabulacounty.us/bids by clicking on the link titled **"2025 Courthouse HVAC Renovations 2025."** After selecting the appropriate link at the bottom of the notice and completing the required information, the proposal packet and specifications will be available for download.

Each bid must comply with all Instructions to Bidders and include, per **ORC 153.54**, a bid bond for 100% of the bid amount **or** a certified check, cashier's check, or irrevocable letter of credit equal to 5% of the bid. Security will be returned upon contract execution or bid rejection.

All questions must be submitted in writing via email to: Andy Udovich, P.E. at audovich@palmerc2.com by 4:30 p.m. on December 19, 2025.

This project **is a prevailing wage project** under Ohio law. The successful responder is responsible for ensuring full compliance with all applicable **Ohio prevailing wage requirements**, including reporting, documentation, and payment of prevailing wage rates to all laborers and mechanics performing work on the project.

The Board of Commissioners reserves the right to waive any and all informalities and the right to reject any and all proposals and has the sole discretion to determine the most advantageous proposal.

Note: A Pre-Proposal meeting is scheduled for 2:30 p.m. on December 9, 2025, at the Courthouse.

By order of the Board of Commissioners of Ashtabula County, Ohio: J. P. Ducro IV, Casey Kozlowski, Kathryn Whittington.

Lisa Hawkins
Ashtabula County Clerk of the Board
Publish Date: Star Beacon, November 26, 2025

INSTRUCTIONS TO PROPOSERS

SUBMISSION OF PROPOSALS:

Competitive sealed Proposals shall be submitted to the Ashtabula County Commissioners Office, on or before the advertised submission date and time for the equipment and other things necessary for the full and complete performance of the project described by the accompanying Proposal advertisement & documents.

Proposals must be submitted in a sealed envelope marked with **Ashtabula County, Ohio – Courthouse HVAC Renovations 2025** no later than 3:00 p.m. EST on Tuesday, December 29, 2025 to the Ashtabula County Commissioners, Attn: Lisa Hawkins, 25 West Jefferson St., Jefferson, Ohio, 44047. Proposals shall be opened immediately upon expiration of the Proposal submission time and publicly read in a manner that prevents the disclosure of contents of competing offers to competing offerors.

FORM OF PROPOSAL

Proposals shall be submitted using the attached blank forms, designed for such purpose. These forms must be completed intact, without removal of any part, must recite the full name of the party making the Proposal, and must be properly signed.

EXAMINATION OF PROPOSAL DOCUMENTS & SITE OF WORK

Proposers must carefully examine the published Proposal Documents before submitting a Proposal. Submission of a Proposal implies that the Proposer has investigated the Project and is satisfied as to the character, quality, quantities and conditions to be encountered in performing the Work.

ARTICLE 1 - BASIC PROCEDURES

1.1 DESCRIPTION, LOCATION OF PROPOSED WORK AND DESIGNATION OF PROJECT CONTACT:

A. Performance Specification for Equipment & Related Installation Services: **Ashtabula County, OH Courthouse (CH) HVAC Renovations 2025** – 25 West Jefferson St., Jefferson, Ohio, 44047

B. Contact Person: Ms. Janet Discher, Ashtabula County Administrator, JLDischer@ashtabulacounty.us

C. Owner's Agent/Criteria Design Contact: County FIRM dba Palmer Conservation Consulting, Mr. Andy Udovich, P.E., 330-289-6486 audovich@palmerc2.com

D. Pre-Proposal Walk-thru: 2:30 p.m. December 9, 2025 at the Courthouse. Subsequent/Special case walk-thru's may be arranged by contacting Ashtabula County/County FIRM-Palmer Conservation Consulting and arranging a date and time for a site visit.

E. Questions on the Proposals must be offered no later than 4:30 p.m. on Friday December 19, 2025 and answers/clarifications will be issued no later than 12:00 p.m. on Wednesday, December 24, 2025.

F. It is the Intent of this exercise to receive qualified Final Design, Complete Installation & Support Services Proposals utilizing the County Pre-Purchased equipment & services information provided, coordination of lead times, deliveries, physical conditions, etc. from qualified Design-Build Contractors and after subsequent proper evaluation by Ashtabula County, Ohio (AC) and its agents, fully complete the required Field-Installation. The previously selected Vendor/manufacturer of the HVAC Equipment/Services will by virtue of a prior recommendation, accept and execute all reasonable and required equipment furnishing & support services to this Installing Contractor as if the order for the Systems/Equipment/Services had been handled directly between the two parties without involvement of Ashtabula County or its designated agents. The expected Equipment Support Services required (by Equipment supplier chosen) in this solicitation includes, but is not limited to:
   1. Detailed & complete Final Submittal preparation.
   2. Engineering support for applicable Piping routing, components & sizing for the solution accepted.
   3. Engineering for Factory-recommended Sequences of Operation and Controls Interlocks coordination.

4. Site-specific field-coordination for Factory-authorized/recommended installation.
5. Factory-authorized Equipment/Systems Start-up.
6. Factory-sponsored Maintenance Services, as applicable.
7. Factory-authorized Warranty support.

1.2 EXAMINATION OF SCOPE OF WORK DOCUMENTS

A. The Proposer shall examine all published Documents, including without limitation the Scope of Work for the Project, noting particularly all requirements which will affect the Proposer's Work in any way.

B. Failure of a Proposer to become fully acquainted with the amount and nature of Work (prior to submitting a Proposal), will be considered as a basis for denial of additional compensation.

C. The Proposer shall evaluate the Project site via provided documents and related Project conditions where the work will be performed, to judge for himself all the factors affecting the cost of providing/installing the designated equipment/appropriate support services and coordinating with the pre-selected Equipment Vendor, the work and time required for its completion, including (without limitation) the following:

1. The condition, layout, and nature of the Project site and surrounding area, including sub-surface conditions, if applicable;

2. The availability and cost of Installation/Support Services labor;

3. The availability and cost of related materials, supplies and equipment for the Scope of Work;

4. Conditions bearing upon transportation, disposal, handling, and storage of related materials.

D. An inspection of the project site is strongly recommended as a function of attending the scheduled Pre-Proposal meeting on the site. Subsequent visits to the site may be arranged if approved for special situations, and shall be arranged by the Proposer through the Owner's Agent Contact – County FIRM-Palmer Conservation Consulting.

1.3 PROPOSAL FORM

A. The Proposal offered shall be submitted on the enclosed Proposal Form and submitted via regular mail or drop-off clearly marked as a proposal, indicating the Project name and the due date. The wording of the Proposal Form shall be used without change, alteration, or addition. Fully-executed Proposals are required for official submissions but additional information may be offered and/or requested with clarifications necessary for ease of complete Proposal evaluation activities – refer to Part C.

B. The Proposer shall fill in all blank spaces in the Proposal Form in ink or typewritten and not in pencil.

1. Not Applicable or a N/A must be used to fill spaces that are not applicable to the Proposer's offering.

C. In addition to the Proposal Form, the Equipment Proposer is encouraged to include a Clarification Letter on his letterhead declaring any important details about his Proposal, including exclusions and alternatives not specifically noted in the published Scope of Work Documents.

1.4 The Board of Commissioners reserves the right to waive any and all informalities and the right to accept or reject any and all proposals and/or Alternates, in whole or in part, and has the sole discretion to determine the most advantageous proposal.

A. A qualified sales agent/officer or a principal of the Contractor's corporation, partnership or sole

proprietorship shall print or type the legal name of the business entity on the line provided and sign the Proposal Form. All signatures must be original.

1.5 BID GUARANTEE/FORM

Each Bid shall be accompanied by a bid guarantee, in the form of a bid bond, a certified check, a cashier's check or a letter of credit, in conformity with the requirements of ORC 153.54 and 153.571 (B). If a bid bond is used, the bond shall be in the full amount of the bid and signed by a Surety company authorized to do business in Ohio, and accompanied by the Surety's sufficient power of attorney affirming said signature. If a certified check, cashier's check or letter of credit is used, the instrument shall be drawn on a solvent bank in an amount not less than ten percent (5%) of the Bid. The bid guarantee shall be given as security that, if the Bid is accepted, the Bidder will enter into a contract in conformity with the Bid. Bids less than twenty-five thousand dollars ($25,000.00) do not require a bid guarantee.

Bid security shall be conditioned to provide that:

a. The bidder will not withdraw their bid for a period of sixty (60) days after receipt of bids, except as allowed by law.

b. If this bid is accepted, the bidder will enter into contract with the County within 10 days of receipt of notice of acceptance and will deliver the required Performance Bond.

c. In the event of the failure of the bidder to enter into contract in accordance with the bid documents and to provide the required Performance Bond, the bidder (and if bid security is in the form of a bond, the Surety for that bond) shall be liable for the lesser of the difference between their bid and that of the next lowest and best bidder or a penal sum not to exceed 10% of the amount of their bid; or if the County resubmits the Project for bidding, the lesser of a penal sum not to exceed 10 percent of his bid or the County's costs in connection with the resubmission.

Return:

Bid securities will be returned on request within 48 hours after the County and accepted bidder have executed contracts and Performance and Payment Bonds have been received and approved by the County.

If contract and bond have not been executed within sixty (60) days after the date of bid receipt, the bid security of any bidder will be returned upon their request, except where the time for execution has been extended by mutual consent of the County and bidders.

1.6 PREVAILING WAGE

Under 4115.071, Paragraph "C" of the Ohio Revised Code, any Contractor or Subcontractor contracting with a Public Authority must submit certain personnel and payroll information to that Public Authority's prevailing Wage Coordinator during the life of the Contract.

Any Contractor or Subcontractor participating in a public works project must:

1. Supply to Prevailing Wage Coordinator of the contracting public authority a schedule of the dates during the life of his contract with the authority on which he is required to pay wages to employees.

2. Deliver to the Prevailing Wage Coordinator a certified copy of his payroll, within two weeks after the initial pay date, and supplement report for each month thereafter. If the construction period is to be less than one month, the payroll reports must be made on a weekly basis. Payroll reports must contain the following information:

a. Wages

b. Name

c. Current address

d. Social Security number

e. Number of hours worked during each day of the pay periods covered and the total for each week.

f. Hourly rate of pay

g. Job classification

h. Fringe payments

i. Deductions from his wages.

WAGE RATES

When the total overall project equals, or exceeds, $75,000, all bidders must comply with the prevailing wage rates on Public Improvements in Hamilton County and, as ascertained and determined by the Administrator of the Ohio Bureau of Employment Services (OBES) as provided in Section 4115.05 through 4115.034 of the Revised Code of the State of Ohio. It is anticipated that the Prevailing Wage Law will apply to this project. Responders must review the current prevailing wage rates and rules provided by the Ohio Department of Commerce at the following link:

View Prevailing Wage Rates | Ohio Department of Commerce

PREVAILING WAGE AFFIDAVIT

An "Affidavit of Contractor or Subcontractor, Prevailing Wage", must be executed and returned to the Owner upon completion of the project. Final payment will be retained until the document is received. Please note that the affidavit encompasses the work done by all Subcontractors as well as the Contractor's work force.

ARTICLE 2 - PROPOSAL OPENING AND CONSIDERATION

2.1 DELIVERY OF PROPOSALS

A. It is the responsibility of the Proposer to submit the requirements to the noted contact or his/her designee prior to the time scheduled for accepting proposals, at the address specified in the Proposal Form.

2.2 PROPOSAL OPENING

A. The contents of the proposal package and any opening/evaluation procedures may not be public but are targeted to be summarized for review by any interested party. Upon proper evaluation, AC/AC's agent will summarize and report the proposal review and acceptance information as applicable.

2.3 PROPOSAL EVALUATION CRITERIA AND PROCEDURE

A. The next-step recommendation shall be made to AC by the AC's Agent with reference to the Proposer who submits the most-qualified offering (including, but not limited to: timely proposal, pricing parameters,

completeness of proposal/conditions, and/or declared completion schedule) which meets the requirements/intent of the furnished Scope of Work Documents and who is deemed by the AC/AC's Agent to be fully capable of completing the Work in accordance with the targeted Scope and Schedule. The County/agents reserves the right to conduct negotiations with the offeror who submits the proposal that the Board of Commissioner or its agents determine is the most advantageous to the county based on the rankings performed and including any adjustment to these rankings based on any discussions conducted to ensure full understanding of, and responsiveness to, the requirements specified in this request for proposals.

The County intends to engage the most qualified Contractor who demonstrates a thorough understanding of the project. County/agents will use the following criteria to evaluate proposals:

- Understanding of Work to be Performed (the Scope of Services): **30 points**
- Pricing Parameters: **50 points**
- Delivery Schedule: **15 points**
- Completeness, Timeliness and Quality of Proposal: **5 points**
- **Total: 100 points**

2.4 REJECTION OF PROPOSALS

A. AC may reject any or all proposals, in whole or in part, on any basis and without disclosure of a reason, and waive all informalities and technicalities. The failure to make such a disclosure shall not result in accrual of any right, claim, or cause of action by any unsuccessful Proposer against AC.

2.5 NOTICE OF AWARD

A. AC shall notify the apparent recommended Proposer upon satisfactory review for compliance with all conditions in the intent/Scope of Work and required documents contained within the Proposal(s).

PROPOSAL FORM

NUMBER ___ DESCRIPTION: _____

PROPOSAL SUBMITTED BY:

_____

(Vendor-Proposer)

DATED: _____

DELIVER TO:

Ashtabula County, Ohio
Attn: Ms. Lisa Hawkins, Clerk of the Board
25 West Jefferson St.
Jefferson, Ohio 44047

Having viewed the Documents, Drawings and read the Specifications for the Project entitled:

Ashtabula County Courthouse HVAC Renovations 2025

and having also acknowledged, received, read and taking into account any Addenda's issued and likewise having reviewed the documents provided and the conditions affecting and governing the Project and reviewed the noted location of the site utilities and all existing structures, as applicable, the undersigned hereby proposes to furnish all materials and to perform all equipment-furnish-related labor (including the complete installation of the designated Pre-Purchased Equipment), as specified and described in said Specifications and/or as shown on the said Scope of Work documents for all work necessary to complete the Project on a timely basis and in accordance with the Contract Documents regardless of whether expressly provided for in such Specifications and Drawings.

Before completing the Proposal Form, the undersigned represents that it has carefully reviewed the Instructions to Proposers, Proposal Form, Scope of Work Documents, and the Project Schedule, if any. Failure to comply with provisions of the published Documents may be cause for disqualification of the Proposal. All addenda's must be acknowledged and submitted with your proposal packet.

AGREEMENTS AND CONTRACT:
If the undersigned is notified of proposal recommendation by AC, it agrees to furnish required documentation as indicated in Instructions to Proposers, in order to establish an accurate representation/references for the Installation/Renovations contract Scopes of Work.

COMPLETION OF WORK:
In submitting a proposal, the undersigned agrees to execute a Purchase Order in a form utilized by AC and to substantially complete its work as required by the published Documents.

NOTE A: The wording of the Proposal Form shall be used to quantify pricing figures, however it is encouraged that proposers indicate by inclusion of Scope of Services letter any specific items included (or excluded) in the proposal with reference to the established intent of Scope of Work Documents.

NOTE B: Proposer is cautioned to include only the "Brands" specified.

NOTE C: See Scope of Work Documents for description of any Alternates.

NOTE D: Proposers are required to submit the Technical Proposal contents as listed in OPR Sections and below.

PROPOSAL:
All coordination/support labor and equipment material for the items listed below. Proposer is to fill in all blanks related to the item for which a proposal is being submitted. If no proposal is submitted for an item, leave the item blank or insert "NO PROPOSAL" in the blank. For alternate items, indicate whether the amount stated is in addition to or a deletion from the base proposal amount.

PROPOSAL CONTENTS:
Proposal Envelope and Cover Sheet
Proposal Form
Proposer Letterhead with Notes/Clarifications/Exclusions affecting each Proposal
Technical Documentation: any applicable physical and performance parameters for the Proposal.

ITEM 1: BASE Courthouse HVAC Renovations 2025:
Base Scope of Work: Provide specified **COURTHOUSE HVAC RENOVATIONS 2025** designated as BASE Scope. Proposer agrees to perform all the work necessary, as described in the specifications and shown on the documents, including complete Installation of Pre-Purchased Equipment for the sum of:

_____ ($_____)
(*Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.*

Base COURTHOUSE HVAC RENOVATIONS 2025 Proposal Expected Submittal Delivery Schedule:

Proposer offers to furnish the above BASE CH HVAC RENOVATIONS 2025 Equipment Submittals within _____ days after notice of recommendation.

Base Proposal COURTHOUSE HVAC RENOVATIONS 2025 Expected Completion Schedule:

Proposer offers to complete BASE COURTHOUSE HVAC RENOVATIONS 2025 within _____ weeks after receipt of AC Purchase Order.

ITEM 1A: ALTERNATE ALT-1 – Extended HVAC Maintenance Services:
Alternate Scope of Work: Provide specified **EXTENDED HVAC MAINTENANCE SERVICES** Scope. Proposer agrees to perform all the work necessary, as described in the specifications and shown on the documents, including complete maintenance of Pre-Purchased Equipment for the sum of:

_____ ($_____)
(*Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.*

ITEM 1B: ALTERNATE ALT-2 – VAV Controller Upgrades:
Alternate Scope of Work: Provide specified **VAV CONTROLLER UPGRADES** Scope. Proposer agrees to perform all the work necessary, as described in the specifications and shown on the documents for the sum of:

_____ ($_____)
(*Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words will govern.*

Acknowledgement of Addenda:

Addendum No. _____, dated _____;

Addendum No. _____, dated _____;

The above prices for the Proposals separately shall include all: equipment (both by Contractor and Pre-Purchased by Owner), support labor, materials, project management, design engineering, (including coordination engineering for ductwork routing/sizing, accessories, packaging/shipping coordination, overhead, profit, insurance, etc., to cover the finished work of the items identified).

The TARGETED date for total completion of the work is prior to April 30, 2026.

INSTRUCTIONS FOR SIGNING

A. The person signing for a sole proprietorship must be the sole proprietor or his authorized representative. The name of the sole proprietor must be shown below.

B. The person signing for a partnership must be a partner or his authorized representative.

C. The person signing for a corporation must be the president, vice president or other authorized representative; or he must show authority, by affidavit, to bind the corporation.

D. The person signing for some other legal entity must show his authority, by affidavit, to bind the legal entity.

PROPOSER CERTIFICATIONS

The Proposer hereby acknowledges that the following representations in this proposal are material and not mere recitals:

1. The Proposer has read and understands the Scope of Work Documents and agrees to comply with all requirements contained, unless declared otherwise.

2. The Proposer represents that the proposal is based upon the INTENT specified by the Scope of Work Documents, unless declared otherwise.

3. The Proposer will visit the Project site as specifically applicable, become familiar with local conditions and will ensure observations about the intent/requirements of the Scope of Work Documents.

4. Within 30 days of the date of an appropriate recommendation, the Proposer will accept/execute a form of Purchase Order from AC and fully-coordinate with the AC/AC's Agents to begin the equipment coordinating process with selected the Pre-Purchase Vendor, including finalization of the agreed-to logistics, terms & conditions, responsibilities and proposed schedule/milestone dates.

5. The Proposer certifies that the upon the final negotiation of Purchase Order, the Proposer will ensure that all of the Proposer's Services-based employees, while working on the Project site, will not purchase, transfer, use or possess illegal drugs or alcohol or abuse prescription drugs in any way and/or submit to appropriate investigations with regards to applicable court administration/child safety standards.

6. The Proposer agrees to furnish any information requested by AC's authorized agent to evaluate that the Proposer is responsible for and that the proposal meets the intent/requirements of the Scope of Work

Documents.

NOTE: The Proposer should review the Scope of Work Documents and the site and conditions under which the Work will be performed so that he can give the acknowledgments contained above.

LEGAL NAME OF PROPOSER: _____

PROPOSER IS: _____
(sole proprietor, partnership, corporation, limited liability company or other legal entity)

NAME OF PERSON LEGALLY AUTHORIZED TO BIND PROPOSER TO A PURCHASE ORDER:

_____
(print)

SIGNATURE: _____

TITLE: _____

ADDRESS: _____

_____

TELEPHONE: _____

FAX: _____

FEDERAL
TAX I.D. # _____

DATE SIGNED _____

BID FORMS

VENDOR AFFIDAVIT FORM- to be completed and included with sealed bid

PROJECT NAME: Ashtabula County, Ohio Courthouse HVAC Renovations 2025

NON-DELINQUENCY OF PERSONAL PROPERTY TAXES- per 5719.042:
The undersigned, being duly sworn, if a contract is awarded you, states that we (the Vendor) are not charged at the time the bid was submitted with delinquent personal property taxes on the general tax list of personal property of any county in which you as a taxing district have territory and that we were not charged with delinquent property taxes on any such tax list. Nor do I have any debt owed to the State of Ohio.

N

NON-DISCRIMINATION AND EQUAL EMPLOYMENT OPPORTUNITY:

T

That we do not and shall not discriminate against any employee or applicant for employment because of race, religion, color, or national origin. If awarded the bid and/or contract under this bid, said party shall take affirmative action to ensure that applicants are employed and that employees are treated, during employment, without regard to their race, religion, color, sex, or national origin. If successful as the lowest and best bidder under the foregoing bid this party shall post non-discrimination notices in conspicuous places available to employees and applicants for employment setting forth the provisions of this affidavit. Furthermore, said party agrees to abide by the assurances found in ORC 153.59 in contract provisions with the County if selected as the successful bidder by the County.

NON-COLLUSION:
That I have not colluded, conspired, connived, or agreed, directly or indirectly, with any other bidder or person, to submit a sham bid, or refrain from bidding; have not in any manner, directly or indirectly sought by agreement or collusion, or communication or conference, with any person, to fix the bid price of affiant or any other bidder, to fix any overhead, profit or cost element of said bid price, or of that of any other bidder; to secure advantages against the County or any person or persons interested in the proposed contract; that all statements contained in said bid are true, and that, such bidder has not, directly or indirectly submitted this bid, or the contents thereof, or divulged information or data relative thereto to any other potential information or date relative thereto to any other potential bidder. Further, Affiant affirms that no county employee has any financial interest in this company or the bid being submitted.

UNRESOLVED FINDINGS OF RECOVERY W/AUDITOR OF STATE ORC 9.24 & 9.241
CHECK & COMPLETE ONLY ONE

☐ has no unresolved findings of recovery with the State of Ohio Auditor, as defined by ORC 9.24 & 9.241;

☐ has the following unresolved findings of recovery with the State of Ohio Auditor, as defined by ORC 9.24 & 9.241:

_____

_____

That we do hereby affirm the above statements to be true and in consideration of the award of the aforementioned contract, the above statements are incorporated in said contract as a covenant of the undersigned.

_____	_____
Company Name	Company Tax I.D. Number
_____	_____
Bidder/Vendor Signature	Print Name & Title

Sworn to before me and subscribed in my presence this _____ day of _____, 20____.

_____	_____
Notary Public Signature	Date Commission Expires

Ashtabula
COUNTY, OHIO

25 West Jefferson St.
Jefferson, OH 44047

OWNER'S PROJECT REQUIREMENTS

FOR:

Courthouse HVAC Renovations 2025

November 26, 2025

Prepared By:

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Dba Palmer Conservation Consulting, LLC
8866 Commons Blvd.
Twinsburg, Ohio 44087
330-289-6486, audovich@palmerc2.com

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

8866 Commons Blvd.
Suite 105
Twinsburg, Ohio 44087
Phone (216) 904-2855

5577 Airport Hwy.,
Suite 202
Toledo, Ohio 43615
Phone (419) 297-6863

Owner's Project Requirements (OPR)

Table of Contents

November 26, 2025

Project:

Ashtabula County, Ohio: Courthouse HVAC Renovations 2025

Ashtabula County Courthouse: 25 West Jefferson St., Jefferson, Ohio 44047

OPR Documents Available (may be posted/shared as multiple files) as exhibits to final Equipment POs:

- **I. Cover Sheet – Ashtabula County Courthouse HVAC Renovations 2025**
- **II. Pre-Proposal Meeting Documents – Prepare Proposers for Delivery of Qualified Proposals**
  - a. Meeting Agenda from 12/9/25 w/ Update Notes estimated by 12/15/25 (as applicable).
- **III. General Information – ITB/Front-End Specifications & Bid Form(s) – by Ashtabula County**
- **IV. Specifications Portion**
  - a. Performance Specification Criteria
    - i. 102326 – Overall Specifications
    - ii. 230900 – OPEN Temperature Control Systems
    - iii. 230916 – Variable Frequency Drives
    - iv. 230929 – HVAC Indoor Air Quality Systems
    - v. 230940 – Master Systems Integration Services
    - vi. 233113 – Metal Duct Systems
    - vii. 233300 – Air Duct Accessories
    - viii. 233316 – Air Terminal Units
    - ix. 237319 – High Efficiency Rooftop HVAC Units (Pre-Purchased Equipment)
    - x. 238126 – Mini-Split A.C & Heat Pumps Units
- **V. Drawings Portion of Mechanical/Electrical Renovations** – Schematic/To-Scale (verify)
  - a. Title/Details & Floor Plans – Mechanical/Electrical Base & ALT Scopes – as applicable
  - b. Master Systems Integration & Control System Upgrade Drawings/Details
  - c. Existing Equipment info/Details – as applicable
- **VI. Master Systems Integration Drawings** – included in above.
- **VII. Reference Documents** – Info can be found at following link:
  - a. https://drive.google.com/drive/folders/1uUqlotMDvR9tfmJnPQ8IeeRWH4c-nZPH?usp=sharing

i. Existing Structural/Architectural Drawings – original construction & recent renovations, *limited*/as applicable
ii. Existing Mechanical Drawings – original construction & recent renovations, *limited*/as applicable
iii. Existing Electrical Drawings – original construction & recent renovations, *limited*/as applicable
iv. Pre-Purchased HVAC Equipment Submittals/IOMMs
    1. High-Efficiency Rooftop HVAC Units

VIII. Addenda Issued to the OPR Documents

a. Addendum No 1 – to be determined

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

8866 Commons Blvd.
Suite 105
Twinsburg, Ohio 44087
Phone (216) 904-2855

5577 Airport Hwy.,
Suite 202
Toledo, Ohio 43615
Phone (419) 297-6863

Pre-Proposal Meeting Agenda

December 9, 2025

NOTE: This document is a part of the OPR proposal request documentation

Project:

Ashtabula County, Ohio: Courthouse (CH) HVAC Renovations 2025

County Courthouse: 25 West Jefferson St., Jefferson, Ohio 44047

Agenda:

I. Introductions

a. Owner – Ashtabula County
   i. Ms. Janet Discher, County Administrator
   ii. Ms. Lisa Hawkins, Clerk of the Board
   iii. Jim Buchan, Facilities Department – Lead Maintenance

b. Criterion Engineer/Owner's Advocate – County FIRM
   i. Scott Hoffman, Principal
   ii. Andy Udovich, Project Manager
   iii. Joe Sokol, Regional Director of Professional Services

c. Master Systems Integrator/Controls Systems Provider (MSI/TCC) – AGM Energy Services
   i. Jacob Puschel, Project Manager
   ii. Tim Horace, Technical Specialist
   iii. Oscar Martinez, Project Coordinator

d. HVAC Equipment Supplier/Vendor – Carrier
   i. Jake Bertram, Sales Representative
   ii. Service/Startup Representative – t.b.d.

e. Selected Design-Build Contractor Team(s)
   i. Mechanical – Main Scopes (BASE & ALTs)
   ii. Electrical Power, Lighting & Low Voltage Systems – Primary Sub-Contractor Scopes (BASE & ALTs)
   iii. General Trades Support Systems – Primary Sub-Contractor Scopes (BASE & ALTs)

II. Goals of Pre-Proposal Meeting – Prepare Proposers for Delivery of Qualified Proposals

a. General Items:
   i. Refer to Add No 1. For Pre-Proposal Meeting Attendance Sheet
   ii. Bid Info – 12/29/25 3 pm. via process and location indicated
   iii. Bid Bond & Bid Form as prescribed

iv. Contract duration – County will adjust based on approvals and Notice of Intent, but Contractor expected to do pre-contract final design & coordination as soon as notified: TARGET to complete entirety of project prior to cooling season April 2026.
v. Letter of Intent right after Proposals, Contract prep & approval phase after

b. Describe Expected Work - refer to Bid Form and Owner's Program of Requirements (OPR) Docs distributed prior to, at this meeting and subsequently distributed.
   i. PROJECT SITE: Ashtabula County Courthouse (CH) "B" Building, 25 West Jefferson St., Jefferson, OH 44047
   ii. BASE:
      1. Demolition of existing CH Rooftop HVAC System (packaged Rooftop HVAC Equipment, Piping, Support Curbs, etc.) and complete installation of new packaged Rooftop HVAC System as designated.
         a. A Complete Test & Balance Report will be provided as specified for the commissioned HVAC Systems, after Installation, including Main Rooftop HVAC Unit/Variable Air Volume Air Terminal Systems.
      2. Complete Design & Installation of IT Mini-Split System with applicable Monitoring Systems & complete Integration into existing/upgraded BAS Networks.
      3. Addition to/modification of Ashtabula County Standard Building Automation System (BAS) & Network Integration Services as performed by County's Master Systems Integrator/Temperature Control Systems Provider – AGM Energy Services, including:
         a. Main OPEN Temperature Controls Systems.
         b. IAQ Systems Monitoring, as applicable.
      4. Specific Demolition/Modification of existing Roofs/Walls/Floors/Ceilings Systems, Electrical Lighting, Fire Alarm & Power Distribution Systems as required by new Mechanical Scopes.
         a. Updated Interior/Exterior Lighting Systems in renovated areas as designated.
         b. Updated Line Voltage Power for HVAC/IAQ/Metering Equipment being replaced/added.
         c. Updated Low Voltage Control-System Power for new Control and Monitoring/MSI-Automation scopes.
         d. Updated Fire Alarm/Life Safety Systems as required by targeted HVAC Renovations.
      5. **<u>Includes ALLOWANCE by Bid Line Item (to be included w/ Proposals)</u>**
         a. **<u>Base ITEM 1 Ashtabula County Courthouse (CH) HVAC Renovations 2025: $30,000.00.</u>**
   iii. ALTERNATE Scope Items <u>beyond BASE Scope Line Item</u>:
      1. <u>ALT 1:</u> Provision of Extended Maintenance of new HVAC Systems as designated.
      2. <u>ALT 2:</u> Replacement of designated Variable Air Volume (VAV) Zone Equipment, complete with Re-integration into existing Building Automation System (BAS) Network.

c. Describe Delivery of the Work – Performance Specification Single Proposal
    i. Contractor **DOES** need to include Materials and Services provided by AGM Energy Services serving as County's Master Systems Integrator/Control Systems Provider, but will fully coordinate the Scopes of Work for a seamless working result.
d. Describe Anticipated Timeframes – monies are encumbered, proceed from proposals to contract negotiations without delay, key is being ready for full system operation as allowable by Project Schedules/Site Completions.
e. Established Pre-Proposal Communication pathways
    i. RFI-style E-mail preferred: to Janet Discher at Ashtabula County Facilities w/ copy to County FIRM.
    ii. Voice questions are not allowed.
    iii. County FIRM will publish all pertinent Non-PROPRIETARY info/answers to RFIs.
    iv. Last date for Proposer Questions is December 19, 2025.

III. Scope of Work

a. Project Development/History
b. Current Targets
    i. Complete installation of Replaced HVAC Systems w/Upgrades as noted for areas designated at the Ashtabula County Courthouse, utilizing the noted HVAC equipment (HVAC RTUs, etc.).
        1. Note: HVAC RTU Equipment/Startup Service has been Pre-Purchased by Ashtabula County.
    ii. Update Electrical Power Infrastructure – by Proposer as required for coordinated HVAC Replacement Scopes of Work and existing Electrical Service (existing Feeds intended to remain in service, but be properly re-worked in area for replaced HVAC Rooftop Unit).
        1. Proposer to provide Power for new & upgraded Lighting/HVAC/Controls Scopes of Work as designed/required.
    iii. Update designated Controls & Operational Systems
        1. Proposer to review & coordinate Controls & Systems Integration, Master Programming and Owner-view Commissioning Services with County's Master Systems Integrator (AGM Energy Services).
            a. Enterprise-level Equipment & Programming Services by AGM Energy Services serving as County's Master Systems Integrator (MSI)/Temperature Control Services Provider. (AGM Energy Services to supply NOTED Equipment components, Integration and Programming Services only – see published Systems Architecture & Integration Scope Diagrams, as applicable).
            b. Coordinated Installation of Wiring & Hardware by Bidder/Proposer: AGM Energy Services as MSI to supply NOTED Equipment Components, labeled Temperature Controls, Integration and coordination of Install for low voltage wiring as designated; Proposer provides all mechanical-electrical installation and power – see published Systems Architecture & Integration Scope Diagrams as applicable.

IV. Project Framework and Delivery

a. Single Performance Specification (includes applicable portions of vendor-based Final designs) Agreement with Contractor. The Project (This Project is NOT "Plan-&-Spec" construction) is to include:
    i. Options for BASE, ALTs & applicable Value-add Proposals/Clarifications.
    ii. Mechanical Prime with appropriate Main Electrical, Structural, General, Plumbing, & Low Voltage Electrical, subject to Ashtabula County/County FIRM reviews and subsequent approvals.
    iii. Final Planning & Design (this includes scopes related to applicable plan reviews, permits and approvals & detailed coordination/support from chosen/pre-arranged Vendors).
    iv. Coordination & Project Management.
    v. Complete Turn-Key Installation Services AND provision of spec'd Documentation.
    vi. County requires Contractor to provide Bond for their Work/Proposal – refer to published Front End documents from County.

V. Owner's Project Requirements (OPR)

a. Project Pre-Planning Documents, as applicable
    i. Overall Narratives, Study & Related documents – as applicable
    ii. Asbestos inspection documents – as applicable, not anticipated.
b. Front-End Documents – furnished by Ashtabula County
    i. Instructions & Notices
    ii. Bid/Proposal Forms
    iii. Specified Wages/Agreements
    iv. Anticipated Forms of Contract-Agreement/Supplemental information
c. Specifications
    i. Overall Criteria, Descriptions and Boundaries
    ii. Specific Sections/information as applicable to Owner's Standards, choices & preferences
d. Drawings – Schematic Not-to-Scale (not 'Dimensioned' set) with Best-Scale 'reference' Plans as available – refer to published online link.
    i. Schematic and Specific Demolition
    ii. Schematic and Targeted Update Descriptions
e. Reference & Product Data Information, as applicable:
    i. https://drive.google.com/drive/folders/1uUqlotMDvR9tfmJnPQ8IeeRWH4c-nZPH?usp=sharing
    ii. Complete Submittals for Pre-Purchased Equipment.
    iii. Controls & Integration Components – as coordinated by AGM Energy Services

VI. *Anticipated* Project Schedule items

a. Design-Build Proposals Due to County December 29, 2025, 3:00 p.m. EST.
    i. Single Turnkey Bid Price – Lump Sum
        1. Standard Bonding requirements apply
        2. Specified Wage schedules apply
        3. Bid/Proposal submission as noted – confirm with Front End requirements
    ii. Scope Clarification Letter
    iii. Confirmation of Project Schedule targets
b. Pre-Proposal Walk-Thru

i. Initial: December 9, 2025.
ii. Planned Subsequent Times
1. As Scheduled with County Personnel – minimum 48 hour notice

c. Bidders Scope-Reviews – Targeted December 29 thru December 31, 2025.
i. Selection Criteria: Best Value (Schedule, Scope & Pricing).

d. Recommendation/Selection of Best VALUE Bid/Proposal- Target: December 31, 2025.

e. Construction Targets:
i. Begin, Upon County Approvals & Valid Notice-to-Proceed – by January 13, 2026.
1. Notice of Intent to award (late-December) is expected to instigate 'paperwork/submittal' preparations while final Orders are being approved (early January) – to make best/flexible progress for all parties.
ii. Complete Commissioning of Project by mid-April 2026 (Cooling).

VII. Important Discussion Items:

a. Asbestos Abatement – arranged by County direct with Abatement Contractors.
i. None anticipated.

b. Simultaneous Projects – County may have standard projects going on during the Construction period/breaks. Bidders must be prepared to Coordinate Construction efforts/timing.
i. County may have a concurrent Re-Roofing Project/planning in place.

c. Work Access: building areas will be fully usable by the County during planned Construction Period. Construction activities that may impact Building Schedules will need to be worked-around (no "free" access can be planned for, but County is committed to coordination to help project).
i. Overtime/Shutdown/Weekend Efforts may be required to complete Work in time.
1. Expected End-of-Day is 4:30 p.m.
2. ***Coordinated*** Work in Mechanical Rooms/on Roof during Standard days is allowable.
3. ***Coordinated HVAC/Electric Shutdowns*** Work in Mech Rms/on Roof is REQUIRED.
ii. Parking – some is available at/near jobsite in designated areas only.
iii. Entry/Staging: Coordination with Ashtabula County Facilities/Security Personnel is required.

d. Security: Background checks and Screening/Badging **could** be required.

e. Salvage Rights – Ashtabula County reserves the rights to retain any contractor-removed items. For all items not retained by County, the Contractor is responsible for complete disposal.

f. Specific Construction Items:
i. Cleanliness – daily requirement for all areas
ii. As-built Documents – must provide accurate records for HVAC & Electrical Power
iii. Project Meetings
1. Periodic Progress Meetings with County's Key Staff may be required.

VIII. Questions

- **All questions to be submitted in "writing" to Janet Discher at Ashtabula County and Andy Udovich (contact information below)**

IX. Subsequent Tour of work areas – after Pre-Proposal Meeting.

This Meeting Agenda and subsequent NOTES are to be considered a part of the OPR Documents being used to prepare the Performance Spec Proposals. Please notify the writer if any items are not clear enough as stated or omitted as understood from the discussions.

Andy Udovich, P.E., Project Manager
County FIRM
8866 Commons Blvd., Suite 105
Twinsburg, Ohio 44087
330-289-6486 mobile
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Ashtabula County Facilities (AC)
DESIGN-GUIDE PROJECT STANDARDS

GENERAL

Purpose

The purpose of this document is to establish ASHTABULA COUNTY (AC)'s owner-requested *Criteria* to be used in the design, implementation and commissioning of each facility within the owner's jurisdiction, focused on the Balanced Total Life of the facility (construction/renovation, operation, maintenance).

Approach

Each Design-Builder/Design Professional has the liberty to act with the owner's best interests in mind, based on the individual situations/boundaries presented before design begins and based on qualified professional experience. The criteria set forth is intended to be a guideline to limit the risks of dissatisfaction over the Balanced Total Life of each facility and to make the tasks associated with long-term owning/managing the facilities as effective as it can be, including the limitation of equipment/service providers to those listed.

Adherence

All standards are to be strictly adhered to. Deviations for specific cases will be addressed during pre-design/pre-commissioning project functions.

Documentation

The Owner will facilitate the storage of all project design/specification documentation and all project-specific management materials for each project. Each design professional will coordinate the provision for the specification/collection of these documented materials as appropriate for the project (with DB/CMR/PM). Necessary documentation includes, but is not limited to:

- Construction Plans and Specifications
    - Design Materials
        - HVAC Load Calculations & Zoning Diagrams
        - Lighting Systems Layouts and Photometrics w/ Controls as applicable
        - Fire Alarm System layouts/modifications as applicable
- Product Data and Submittals
- LEED Data and Documentation (only as declared Applicable)
- Coordination Drawings (prepared by Mechanical trades in all "congested" areas)
- Operation & Maintenance Manuals, includes Labeling keys (see labeling requirements below)
- System Startup and Commissioning Documents – Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider.
- Training Schedules and documentation including videotaping – Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider
- Warranty Designations (see warranty requirements below)
- Extended Maintenance Contracts & Agreements
- As-Built Plans (furnished by all trades at job completion)
- Closeout Procedures (Demonstrations/Training Sessions/Recorded Docs, Software Licensing)

- Punch Lists confirmed complete
- Commissioning Issues Logs confirmed complete

Design Coordination

The Design Professionals shall attempt to adequately & actively coordinate design elements between construction trades/activities during design, including the evaluation commentary done by the Owner's Commissioning Authority (AGM). This shall include, but not be limited to:

- HVAC to General (fire walls, wall openings, roof system impacts, equipment weights & servicing)
- HVAC to Electrical (voltages, starters/motor control, disconnects, smoke detectors, Lighting System & Controls)
- HVAC to Plumbing (gas piping, drains & vent locations, Water makeup piping)
- Plumbing to General (piping chases & access, equipment weights, servicing)
- Plumbing to Electrical (voltages, starters/motor control, disconnects, smoke detectors)
- Plumbing to HVAC (ventilation requirements, drain & vent locations)
- Electrical to General (ceilings/finishes, fire walls, wall openings, equipment weights & servicing)
- Electrical to HVAC (voltages, starters/motor control, disconnects, smoke detectors, Lighting System & Controls, Ventilation Systems, Low Voltage/Fire Alarm Systems, Emergency Power Systems)

Standards

ASHTABULA COUNTY has set forth noted design elements, product quality, system procedures as follows, in order to establish fair competition at a desired level of results, and to keep the facilities as reasonably managed as possible. Any design elements not specifically addressed in the body of this document are expected to be dealt with using commonly-accepted practices and with the owner's benefit in mind.

PLUMBING

System Descriptions

Best Standard Practice approach to Plumbing Design shall prevail, bound by enforced/in-place Building Codes and ASHTABULA COUNTY -accepted Design Guidelines. Design Professional shall give adequate and specific consideration to:

- Constructability
- Serviceability
  - Include an alternate for an extended warranty for one additional year after the warranty expires. This warranty shall include parts and labor.
  - Include an alternate for maintenance of all equipment and accessories for a period of one year from receipt of Final Certificate of Occupancy for all work. All parts and labor shall be included in this scope of work. (Contractor to submit for review a detailed schedule of the maintenance activities prior to maintenance commencement)
- Replacement
- Vibration Isolation

- Acoustic Performance
- Domestic Hot Water Balancing – as applicable
- Building Systems Integration (BAS/Open Protocol) – Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider.

Fixtures – Commercial quality, designed for use in School atmosphere

- Toilet Room Fixture Vendors: American Standard, Kohler (Water closets to be carrier type)
- Faucet Vendors: Chicago, Peerless, Kohler
- Mixing Valves Vendors: Speakman, Leonard, Zurn
- Drain Components: Smith, Watts, Zurn
- Pump/Specialties Vendors: Aurora, Bell & Gossett, Grundfos, Taco
- Water Heater Vendors: AO Smith, Lochinvar, Bradford-White

HVAC

System Descriptions

Best Standard Practice approach to HVAC Design shall prevail, bound by enforced/in-place Building Codes, including the current adopted version of ASHRAE STD 90.1& IECC (Energy Code) and published Design Guidelines. Design Professional shall give adequate and specific consideration to:

- Constructability
- Performance – Provide SEQUENCES of OPERATION for all building systems (Reference published OPR documents, Coordinate with Control Templates on Drawings and Systems Integration requirements)
    - DESIGN PARAMETERS: Indoor Temperature Set points – Occupied
        - Heating – 72 degrees F
        - Cooling – 74 degrees F
- Serviceability
    - Include provisions for Extended Warranty & Maintenance Services coverage for designated systems
        - Extensions to Product Warranties
            - Compressors
            - Heat Exchangers
            - Variable Frequency Drives
            - Open Controls Systems Components
        - Extensions to Installation/Performance Guarantees
            - HVAC Packaged Control Systems
                - Functional Performance
                - Training
        - Include an alternate for an extended warranty for one additional year after the warranty expires. This warranty shall include parts and labor.
        - Include an alternate for maintenance of all equipment and accessories for a period of one year from receipt of Final Certificate of Occupancy for all work. All parts and labor shall be included in this scope of work, including belts and filters.

(Contractor to submit for review a detailed schedule of the maintenance activities prior to maintenance commencement)

- Equipment Replacements/End-of-Service Life
- Vibration Isolation
- Acoustic Design Performance Focus – including, but not limited to: Space/Zone levels, Piping/Equipment Vibration, Duct Velocity Noise & Roof-mtd Equipment attenuation.
- Temperature Control Zones – Internal, Perimeter, Heat Recovery Exchange for VRF/WSHP Systems, etc.
- Thermal Environmental Quality
    - Temperature
    - Humidity
    - Air Quality/Filtration/Air Sanitization
- Air, Water & VRF System Balancing
    - Ensure Devices are specified and that Performance Evaluations are performed and Documented
        - Note deficiencies found in evaluations
        - Note recommendations for eliminating and finding deficiencies
        - Prepare report/summary for use by Commissioning Agent
        - Include in the documents that the owner has the right to request up to 25% of all the balanced systems be verified during the warranty period.
- Testing of Critical Systems – Coordinated thru Master Systems Integration infrastructure & Commissioning functions:
    - Ensure Devices are specified and that Performance Evaluations are performed and Documented
        - Generator Tests – Coordinate with Electrical Design & Team Contractors
        - Condensate Drain Alarms
        - Technology Room Temperature Alarms
        - Kitchen Equipment/Food Storage Critical Temperature Alarms
        - Refrigerated Storage Temperature Alarms.
        - Submersible Sump Pumps and Critical Drain Alarms – Coordinate with Plumbing Contractor
        - Fire Alarm Systems Alarms – Coordinate with Electrical Contractor
        - Fire Sprinkler Alarm Systems – Coordinate with Electrical/Fire Suppression Contractors
        - Lighting Zone Controls Systems – Coordinate with Electrical Contractor/AGM Energy Services as Master Systems Integrator
    - Packaged HVAC Controls/Building Systems Integration (BAS/Open Protocol) – Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY’s Master Systems Integrator & Commissioning Provider.

BASIC MECHANICAL ITEMS

Valves

Usual and customary practices for duty

- Ball valves in HVAC systems – full port, three-piece construction, two-piece as specifically allowed.
- Hydronic Balancing:
  - Autoflow-type at local terminal units/coils
  - Circuit-Setter type at main loop branches
  - Multi-function type at main hydronic circulators
- Drain valves – with cap/chain and hose end connection

HVAC Drives/Motors

Standard configurations, EPAct minimum efficiencies or premium efficiencies as required by procedures/designs

- Service Factor on belt-driven sets – 1.35 minimum
- Provide multiple V-belts on fan motors > 5 HP
- Vendors – Century, Lincoln, General Electric, Baldor, US Motor

Extra Filter Materials

- One set for construction
- One set for replacement at IAQ/Process Testing
- One set at Project Turnover

Extra Controls Materials

- Refer to Standard OPEN Control System and Overall Specifications for requirements

Extra Equipment Maintenance Materials

- Refer to Standard OPEN Control System and Overall Specifications for requirements
- Include supply of spare maintenance materials according to equipment manufacturer's published documentation/recommendations.

Controls Systems Integration Design – As coordinated with AGM Energy Services

- Complete documents showing Integration Coordination on Construction Documents – Use of Control Schematic Templates encouraged
- Complete Specification documents denoting Integration Coordination between Master Systems Integration and Unitary/Applied Field Controls – each requiring use of fully OPEN/Tridium Niagara™ Platform materials.
- Include diagnostic points for utility exhaust fan status and control for building pressurization monitoring and sequences.
- Include Sequences of Operation on Construction Documents

- Include Integration to Information Technology (IT) Networks and switch services from Main Communication Systems to (separated/managed) Building Automation Systems-BAS with full design input/coordination from AGM Energy Services serving as ASHTABULA COUNTY's Master Systems Integrator.
- Include Integration into Lighting Design/Control Systems – Coordinate with Electrical Engineering functions & equipment selections.
- Include Integration into Main Energy-use metering and Sub-Metering Systems – Coordinate with Electrical Engineering functions.
- Include Integration into Main HVAC Indoor Air Quality Systems – Coordinate with Electrical Engineering functions.
- Include Integration into BAS-related Security and Life Safety (non-Fire Alarm) Systems – Coordinate with Electrical Engineering functions, (i.e. Carbon Monoxide Monitoring/Alarms and Environmental Sensor applications)

Labeling Guidelines

All labels to be ½" x 3" or larger plastic laminate (or approved equivalent) with engraved letters 3/16" high and attached to the ceiling grid. The labels should have the mark number or valve tag number. The ASHTABULA COUNTY Standard colors are as follows

• VAVs, VRFs, Heat Pumps, etc.	Black/White letters	(VAV A – 01)
• HVAC Cold Water Valves	Green/White letters	(CWS – 01)
• HVAC Hot Water/Steam Valves	Green/White letters	(HWS – 01)
• Fire/Smoke Dampers	Red/White letters	
• Domestic Cold Water Valves	White/Green letters	(CW – 01)
• Domestic Hot Water Valves	White/Green letters	(HW – 01)
• Gas Valves	Yellow/Black letters	(Gas – 01)
• Compressed Air	Blue/White letters	(Air – 01)
• Fire Suppression Valves	White/Red letters	(Zone – A)

INTEGRATED DESIGN & MAJOR RENOVATION PROJECTS

Integrate Design elements according to established project programs/scopes/budgets at Schematic Phase.

- **PLACE DESIGN EMPHASIS ON:**
  - Meters and Monitoring devices
    - Utilities : water, natural gas, electric, closed-loop Makeup Systems
    - Ventilation: Outside Air, Exhaust Air
  - Energy Use Optimization
    - Systems Choices by Professional Evaluation and referenced ASHTABULA COUNTY Standards
    - Controls & System Design to support
      - Comfort – Thermal, Acoustical, Air Quality, Humidity
      - Efficiency – Combination of Unitary & System

- Safety
- Indoor Air Cleanliness/Quality

- Place Documentation Emphasis
  - Forms and Templates
  - Energy Modeling and Reporting – as appropriate.
  - HVAC Packaged Unitary Controls/Building Automation Systems diagnostics and reporting – Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider.

NEW CONSTRUCTION & MAJOR DESIGN-BUILD RENOVATIONS – AS APPLICABLE TO SPECIFIC PROJECT SCOPES

Main Air Handling Systems

Indoor Central Station Air Handling equipment with no specialized Sound-Attenuating equipment or vision windows in access doors and/or Roof-mounted Applied Packaged HVAC/DOAS Units:

- Variable Air Volume (VAV) with variable speed Enthalpy Energy Recovery Wheel for very-high population areas (referenced to current Energy Codes/Applicable Agency requirements)
- Constant Volume (CAV) for Utility/Shop areas
- Unitary Controllers: Serial Interface – ModBus™ or BacNet™ (Preferred).
- Design layouts to allow proper air mixing in AHU/RTUs to eliminate nuisance Freeze – Stat problems
- Targeted Features:
  - Extended Mixing Chambers
  - HVAC Airflow Monitoring
  - Use of Air Blender Devices
  - Design layouts to allow proper spacing/airflow for Airflow Monitoring/Measuring Stations and IAQ System Devices
    - Demand Control Ventilation
    - UV-C IAQ Air/Coil Cleansing Systems
  - Construction – Double-wall insulated
  - Configuration – Modular for units with system design Total Static Pressures up to 5.9", Custom above 5.9" Total Static Pressure
  - Access – Sections for adequate maintenance access
  - Bearings – Upgraded quality
  - Control Dampers – Extruded aluminum, insulated, Ultra-Low Leakage
  - Fan Motor/Wheels – Energy efficient rated "premium", Direct-Drive Plenum (preferred)
  - Drain Pans – Stainless Steel
  - Filters – MERV 8 Pre-filters, MERV 13 After-filters
  - Acoustics – Limit Supply Fan outlet velocities at 2100 feet per minute or less
  - Modular AHU/Applied RTU Vendors – Carrier, Daikin, Trane, York-JCI, Pre-Approved Equals
  - Custom AHU Vendors – Air Enterprises, Buffalo Air Handling, Environmental Air Systems

Cooling Plant - Central

Water Chillers - Option

- Greater than 300 net tons – water-cooled, multiple compressors
  - Unit IPLV's near 0.45 kw/ton, or less
  - Unit Acoustics near 80 dBA, Sound Power
- 300 net tons & below – air-cooled, multiple chillers (Scroll-type)
  - Unit EERs to meet ASHRAE 90.1, Premium Efficiencies
  - Unit Acoustics near 85 dBA, Sound Power
- Serial Interface – ModBus™ or BacNet™ (Preferred),
- Cooling Towers – Induced-draft (Baltimore Air Coil, Evapco, Marley)
- Fluid – Pre-mixed Glycol (30-35% ethylene) with integral inhibitors for piping systems
- Pumps – All pumps to be lead lag in sequence (i.e. Main Secondary Loop Circ Pump, etc.)
- System – Primary (constant flow)/Secondary (variable flow), Chilled water only
- Less than 300 ton Unit Configurations – Utilize multiple smaller Scroll chillers in lieu of single Screw chiller and air – cooled condensing unit for 'separate' Administrative Area Zones
- Sound – Coordinate design of barriers with architect to diffuse chiller sound
- Chiller Vendors – Carrier, Daikin, Trane, York-JCI, Pre-Approved Equals.
- Pump/Specialties Vendors – Bell & Gossett, Armstrong, Grundfos, Pre-Approved Equals

Heating Plant

Natural Gas Hot Water Boilers, multiple units, each sized for 67% net load required, forced-draft burners

- High-efficiency Condensing (smaller systems)
- Flexible Water-Tube (partial direct-replacement systems)
- Fluid – Water with engineered water treatment systems
- Pump – All pumps to be lead lag
- System – Primary (constant flow)/Secondary (variable flow), Hot Water only
- Boiler Vendors – Cleaver-Brooks, Bryan, Lochinvar, Pre-Approved Equals.
- Serial Interface – ModBus™, or BacNet™ (Preferred).
- Pump/Specialties Vendors – Bell & Gossett, Armstrong, Grundfos, Pre-Approved Equals

Heating Terminals

Selected use of Steam/Hot Water equipment dependent upon layout or Electric Heaters in Decoupled systems (FCU, WSHP, VRF)

- Cabinet Heaters – Vestibules/Entryways - fan supported, exposed/recessed
- Unit Heaters - Utility Spaces
- Finned-Tube Radiation – Heavy duty covers (Modine, Sterling, Rittling, Trane)
- Radiant Panels – Large glass surface exposures (Airtex, Modine, Sterling)
- Vendors – Carrier, Daikin, Sterling, Trane, Rittling, York-JCI
- Electric Heat Vendors – Brasch MFG, Berko-Markey, Greenheck, Markel, Q-Mark

Technology Support/Computer Server Rooms

Refrigeration (R-410a preferred, R-32, R-454b) Low Ambient Heat Pump Split-Systems with Variable Speed Compressors

- Mini-Split Vendors – Daikin AC, Mitsubishi Electric-Trane, LG

- Serial Interface – ModBus™ or BacNet™ (Preferred),
- Option for Ducted/Larger Critical Space HVAC Split-Systems when Mini-Split approach is not adequate for spaces – Liebert, APC-Stulz, United Coolair

Variable Flow Refrigerant-based Heat Pump Heat Recovery (VRF) Systems

Air cooled (standard outdoor mounted) or Condenser (Fluid cooler/boiler) water-cooled (standard indoor mounted) modular heat pump-condensers, indoor 2-pipe refrigerant-based Fan Coil Terminals (vertical, horizontal, ceiling, wall, floor), as integrated to D-B procedures/designs. Make Provisions that all above-ceiling filter locations are known to ASHTABULA COUNTY Maintenance personnel

- Refrigerant – R-410a (preferred), R-32, R-454b
- Heat Recovery/Simultaneous Heat-Cool Operation – 2/3-Pipe Central Refrigeration Piping Network
- Zoning – Each enclosed Office and major-use space to be chosen as location for Mode-Control Refrigerant switching terminals
- Instructional spaces – Larger Horizontal/Cassette-style VRF Fan Coil Terminals
- Option for Assembly Space Service – Conventional CV or VAV AHU w/coils served by Air-Cooled or Water-to-Water WSHP (chiller/boiler duty) – Allows economizer sequences
- Dedicated Outdoor Air Systems (DOAS) – Stacked indoor AHU with variable speed Energy Recovery Wheel w/coils served by W-T-W WSHPs in Mechanical Rooms and Condenser Water Reheat in AHU for dehumidification-reheat control.
- Option for Dedicated Outdoor Air System – Stacked/Side-by-Side indoor AHU with variable speed Energy Recovery Wheel w/integral WSHPs in Mechanical Rooms and Condenser Water Reheat/Heat Recovery in AHU for dehumidification-reheat control
- Controls – ModBus™ or BacNet™ (Preferred), Standard Open Protocol Interface
- VRF Vendors (air cooled) – Daikin AC, LG, Mitsubishi Electric-Trane
- VRF Vendors (water cooled) – Daikin AC, LG, Mitsubishi Electric-Trane
- DOAS Vendors (standard RTUs/ERV AHUs) – Daikin, Trane, York-JCI, Valent Air, Pre-Approved Equals.
- Customized Indoor DOAS Vendors (dehumidification/reheat) – Air Flow Equipment, Engineered Air, Innovent Air

Ductwork Systems

Insulated Galvanized Sheet Metal, SMACNA gauges

- Dishwasher Hoods/Locker Rooms – Aluminum
- Flexible Ductwork – Limited to 5 feet total length per device
- 0.5 inch liner in main Return Air Ducts
- Perforated Doublewall spiral ductwork for first 20 feet of supply duct from Air Handling/Applied Rooftop Units

VAV Air Distribution Terminals

Series Fan-Powered VAV Terminals with Hot Water Reheat Coils. Single-duct VAV Terminals allowed in strategic design areas provided Night Setback heating terminals included. Provide with no specialized Sound-Attenuating equipment. Make provisions that all above-ceiling filter locations are known to AC Maintenance personnel. (See labeling requirements below)

- Vendors: Environmental Technologies, Price, Trane, Tuttle & Bailey

Air Distribution Devices
Aluminum construction, selected for best performance in spaces served.

- Vendors: Price, Titus, Tuttle & Bailey

Exhaust Fans
Selected for lower rpms and style appropriate for location/service in building

- Vendors: Loren Cook, Greenheck, Penn Ventilator

Variable Frequency Drives
IGBT-based VFDs with integral line reactors, electronic bypass and disconnect switch. Drives for Air Handling Equipment and Hydronic Equipment shall be the same manufacturer on each project.

- Serial Interface – BacNet™,
- Vendors – ABB, Danfoss, Yaskawa

Airflow Measuring Stations
Integrated to building DDC system to achieve Sequences of Operation and help assure energy savings, accurate at very low velocities.

- Configurations: Duct-mounted w/access doors and unit-mounted
- Vendors – Dwyer Instruments, Ebtron, Johnson Controls, Tek-Air Systems.

Packaged Unitary/Building Temperature/Energy Management Controls
Direct Digital, Tridium Niagara™ Standard Open Protocol components, integrated by ASHTABULA COUNTY's Master Systems Integrator to existing Enterprise-level host system/front-end operational, utility management and maintenance management software.

- Packaged Unitary/Device-Level platform: Niagara™ Framework – BacNet™
- Vendors for DDC components: Distech N4, Honeywell (N4-WEBs), Vykon, Johnson Facility Explorer/FX, Packaged Controls via HVAC Equipment Vendors.

RENOVATION PROJECTS – SPECIAL NOTES

Design Professional shall make evaluation with owner's input for best overall solution for each case. In general, the intent of the Design-Guide Standards for new construction applies, but design and equipment modifications may be needed for best results.

Room Air Conditioners
Commercial-grade, Unitary, Designed for in-window installations

- Vendors: Carrier, Friedrich, GE

Conventional Unit Ventilators
Vertical or Horizontal configuration, 4 – pipe, Face & Bypass

- Vendors: Carrier, Daikin/AAF, Trane, Magic Aire

Vertical Unit Ventilators
Vertical Exposed or Concealed configuration, 4 – pipe

- Vendors: ChangeAir, Temspec, United Coolair

Hydronic Fan Coil Units

4 – pipe, non-economizer configurations. Make Provisions that all above-ceiling filter locations are known to AC Maintenance personnel. (See labeling requirements below)

- Vendors: Environmental Technologies, Carrier, Daikin, Trane, York-JCI

DOAS (Ventilation) Units for VRF/WSHP/FCU Retrofits

Indoor DOAS AHUs with ERWs (chilled water, split DX or WSHP), packaged DOAS Rooftop units with ERWs, or limited-specific use of VRF System Ventilation units.

- AHU Vendors: Carrier, Daikin, Trane, York-JCI, Pre-Approved Equals.
- Condensing Unit (Split DX option) Vendors (Standard-stages Scroll Compressors): Carrier, Daikin, Trane, York-JCI, Pre-Approved Equals.
- Packaged Rooftop Option Vendors: Carrier, Daikin, Trane, York-JCI, Valent Air

Interior Lighting Installs/Retrofits

Indoor Upgrades using current technologies for lamps/emitters for applications as required, targeted for LED-based improvements.

- Option: Keep Existing Fixtures – intended for sites with fixtures less than 10 years old.
    - Bulb replacement with Ballast removal – limited to areas where existing fixtures are in acceptable visual/operational condition and where existing lighting performance supports the direct-replacement approach (light levels, colors, control-switching).
    - Retrofit Kit with Ballast removal – recommended for areas where existing fixtures have remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Option: New Fixtures – required for areas where existing fixtures have no/limited remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Life Safety/Emergency Lighting Systems: upgrade all areas for current space function/layouts and ASHTABULA COUNTY /Local code requirements.
- Lighting Control Installs/Upgrades – employ current & reasonable techniques and technologies (i.e. dimming, digital relay switching, occupancy, daylight harvesting, etc.) to allow updated lighting systems to be integrated into ASHTABULA COUNTY Control Networks - Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider. Lighting System Controller Technologies/Designs – Blue Ridge Technologies, Acuity/eNlight
- Fixture Manufacturers: Cree, Cooper, Lithonia and equivalent per AC approvals.
    - Fixture/Bulb/Driver component Warranties: target greater than 5 years/superior protection.
- Lighting Controls: Provide Integrated design capable of full-sequence interface to ASHTABULA COUNTY's Standard Niagara™ Network BAS via Blue Ridge Technologies.

Exterior Lighting Retrofits

Outdoor Upgrades using current technologies for lamps/emitters for applications as required, targeted for LED-based improvements. Intent of Exterior Upgrades to address "on-building" as well as remote-from-building"

- Option: Keep Existing Poles/Supports – intended for sites with fixture supports less than 8 years old.
    - Fixture replacement with Ballast removal – limited to areas where existing poles/supports are in acceptable visual/operational condition and where existing lighting performance supports the direct-replacement approach (light levels, colors, control-switching). For Building-mounted fixtures being upgraded, care must be taken to account for substrate changes and acceptance of decorative effects.
    - Recommended to prepare photometric study of exterior lamp coverage prior to final design choices.
- Option: New Fixtures with Poles/Supports – required for areas where existing fixtures have no/limited remaining life/value but performance enhancements are required/desired (light levels, colors, control-switching).
- Life Safety/Emergency Lighting Systems: upgrade all areas for current space function/layouts and ASHTABULA COUNTY /Local code requirements.
- Lighting Control Upgrades – employ current & reasonable techniques and technologies (i.e. dimming, digital relay switching, local/master photocells, etc.) to allow updated lighting systems to be integrated into ASHTABULA COUNTY Control Networks - Contractors to coordinate with AGM Energy Services functioning as AC's Master Systems Integrator & Commissioning Provider. Lighting System Controller Technologies/Designs – Blue Ridge Technologies
- Fixture Manufacturers: Cree, Cooper, Lithonia and equivalent per ASHTABULA COUNTY approvals.
    - Fixture/Bulb/Driver component Warranties: target greater than 5 years/superior protection.
- Lighting Controls: Provide Integrated design capable of full-sequence interface to ASHTABULA COUNTY's Standard Niagara™ Network BAS via Blue Ridge Technologies.

COMMISSIONING - Contractors to coordinate with AGM Energy Services functioning as ASHTABULA COUNTY's Master Systems Integrator & Commissioning Provider.

- Process
    - Pre-Design Conference
    - Schematic Design Review
    - Design Development Review
    - Construction Document Review
    - Pre-Construction Conference
    - Equipment Submittal Review (Concurrent with Design A/E Review)
        - Chillers
        - Boilers
        - Heat Pumps (incl. Water Source Systems)
        - Air Handling Equipment
        - Variable Refrigerant Flow Systems
        - Evaporative Condensers

        - Variable Speed Drives
        - Generators
        - Lighting Control Systems
        - Packaged Unitary Controls/Building Automation System Interfaces
        - Kitchen Equipment
        - Energy Metering & Data Inputs
    - Start Up Phase
    - Systems Integration Phase
    - Post-Construction Conference

IN-SERVICE/PROJECT TURNOVER

- Process
    - Pre-Commencement Conference – establish overall target dates for project
    - Contractor Checkout and Testing – allow ASHTABULA COUNTY Facilities to observe the following
        - Main Hydronic Fill
        - Packaged Unitary Controls and Automation/Integration checkout
    - Start Up Phase – allow ASHTABULA COUNTY Facilities to observe
    - Systems Integration Phase
    - Training Sessions & Documentation Turnover
        - Contractor Responsibilities
            - Coordinate functions, schedules & documentation with CM/GC/PM
            - Conduct In-Service/Turnover Meeting(s)
            - Provide As-Built Drawings
            - Provide Operation & Maintenance Documents
                - 1 Hard Copy (Binder)
                - 3 Electronic Copies/Shared-Site option as applicable
                - Videotaped Training Sessions
                - System Integration Components
            - Provide Specific List of Procedures for project
                - Control Sequences of Operation
                - Maintenance Items and Intervals
                - Filter Matrix
                - Fan Belt Matrix
                - Items for major equipment
                - Critical Alarms
            - Provide Specific Tools and Spare Materials as specified
                - Packaged Controls/BAS Programming Tools
                - Spare Filters and Belts
                - Acoustic Ceiling tiles as applicable

        - Major Vendor Responsibilities: Demonstration for each system
            - Chillers
            - Boilers
            - Water Source Heat Pumps
            - VRF Systems
            - Packaged DOAS/RTU/H & V Units
            - Fluid Coolers/Condenser Water Towers
            - Emergency Generators
            - Lighting Control Systems
            - Packaged Unitary Controls/Building Controls and Integration
        - Engineer-of-Record/Owner Representative Responsibilities: Overall Description of Design Intent
- Warranty Period and Guarantee Limits
    - Warranty Period Goals (with Qualified Factory-Authorized Start up)
        - Chiller Compressors – Five Years Parts/Two Years Labor
        - Heating Heat Exchangers – Ten years Parts & Labor
        - Water Source Heat Pump Compressors – Five Years Parts/Two Years Labor
        - VRF Heat Pump Compressors – Six Years Parts & Labor
        - VFDs – Two Years Parts & Labor
        - LED Lighting Fixtures/Systems - Ten years Parts & Labor
    - Guarantee Period Goals (Coverage of Costs by Contractor) – Does not include owner responsible maintenance. Refer to project specific documents for Extended term requirements.
        - Basic Functional HVAC System (pipes, ducts, pumps, equipment & operational controls) – One Year Basic
            - Controls/System Walkthru and Issue List examination at Eleven Months post In-Service/Turnover date
- Owner Responsibilities (Maintenance & Documentation)
    - Attend All In-Service/Turnover functions
    - Participate in Procedures established by the GC/Cx/A-E Criteria for reporting & logging post-construction issues
    - Perform and Document (Self or Contracted) all noted & agreed to maintenance functions according to coordinated documents

SECTION 102326 – OVERALL SPECIFICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS & GENERAL SCOPE OF WORK

A. Instructions to Proposers, Overall Scopes of Work descriptions, published Supplemental Drawings/Documents and general provisions of the Performance Specification Contract, including General and Supplementary Conditions and Documents of Owner Requirements apply to this Section.
   1. Refer to Original and subsequent RFQ/RFP Documents issued by County's Professional Services Consultants, that may be referred to as the Owner's Project Requirements (OPR). The OPR Documents in-whole are considered the minimum standard on which the Proposing Design-Build format Contractor bases his offering.
      a. Each Proposing Contractor (and necessary sub-contractors/vendors) will familiarize himself/team with all documents issued as part of the OPR, including Front-End, Exhibits and For-Reference documents in addition to typical drawings & specifications addressing the project Scopes of Work.
      b. Each Proposing Contractor will issue an RFI (Request for Information) for any apparent or possible conflict found in the OPR documents/field verification efforts in a timeframe before Proposals are due such that the County can responsibly offer a clarification on each item in question.
      c. If in the event that any conflict discovered/questioned in the OPR documents (i.e. between Specifications and Drawing references) is not properly/officially addressed prior to Proposals being due, the Proposing Contractor will base his offer on the most conservative/stringent/highest value or quantity of the interpretation of the matter, as determined by the Owner/Consultant, which will then continue into final design & coordination stages after a successful award of Contract is made.
   2. **Ashtabula County, Ohio (AC) Courthouse (CH) HVAC Renovations 2025:** Scope of Work: General – [Base Scope], refer to all of the OPR documents issued:
      a. Mechanical Upgrades:
         1) Main HVAC System Upgrade: Replace existing HVAC Equipment/Controls System & designated Systems with new HVAC Equipment/Controls as noted; components include, but are not limited to:
            a) Variable Air Volume (VAV) HVAC Rooftop (RTU) Equipment: Replace Existing HVAC unit with new Applied High-Efficiency Unit (Owner Pre-purchased) with updated AC-Standard Controls and full integration into new/updated BAS. Modify existing Infrastructure setups as required to accommodate new Equipment/Systems & Contractor-designed Duct/Acoustic materials/Wiring Systems.
            b) Complete demolition of existing equipment/piping/ductwork/wiring not required to remain in service with components as required for complete installation of replaced RTU-Ventilation/BAS/controls, (existing units, structural, electrical power, controls, etc.) – coordinate final demolition schedules with Owner. Owner retains First Right of Salvage on all removed items including sensors/heating equipment.

c) Required Supply/Return/Ventilation Air and Exhaust Ventilation Systems, Condensate Draining, control, piping & wiring for Complete HVAC System.
d) Modifications to existing Supply Ductwork Systems as designated (Courtroom).
e) Addition of Ethylene Glycol to existing Hot Water Heating Plant/System with updated AC-Standard Controls and full integration into new/updated BAS.

2) Provisions for Addition of IT Mini-Split AC Systems as designated
3) Testing, Adjusting & Balancing: Provide Measuring/Balancing Services for the following:
   a) Replaced VAV RTU System; VAV Airflows, Ventilation, etc.
   b) Other HVAC Equipment/Systems as designated.
4) Building Automation System (BAS) Upgrades (as provided by County's Master Systems Integrator: AGM Energy Services):
   a) Update Systems Integration and Temperature Controls Systems as required by the Scope of Work and as noted in supplemental OPR documents including, but not limited to:
   b) BAS-coordinated replacement/addition of new Unitary/Distributed DDC Controllers for new RTU/VFDs upgrades, Equipment/Ventilation Systems; RTU/VFD Equipment items are expected to be reviewed/coordinated for Field installation of AC-Standard DDC Controllers w/ BACnet™ Serial Communications Interfaces, connected to the local BAS Network.
   c) Control Valves/Sensors coordinated with new HVAC equipment and as designated [Hot Water, Carbon Dioxide & Humidity] and/or required for upgraded Controller designs [signal compatibility & updated Sequences/Data collection].
   d) Sequences of Operation: Sequences of Operation for Renovated Systems will be implemented as new unless noted otherwise; ALL new Temperature Control Programming will be in Unitary Controllers (not JACEs) by this Contractor – as coordinated with selected HVAC Vendors and County's Master Systems Integrator.
   e) Miscellaneous applicable Enterprise-level programming, schedule setting, graphical interface, etc. by the MSI.
   f) Associated IAQ Devices and integration into local BAS Network – provided/installed by Contractor as coordinated with the MSI, programmed by MSI as coordinated with RTU Vendor's Unitary controls.

b. Electrical Power & Lighting Upgrades:
   1) HVAC Power: None beyond that required by noted Mechanical & BAS Upgrade Scopes, including noted ventilation modifications/ requirements/additions and installation of IT Closet AC System.
   2) Lighting: Updated only as required for Mechanical Equipment Service areas meeting design requirements for system(s) served (LED with Control) and current National Electrical Code (NEC) – refer to accompanying layouts.
c. General Trades Upgrades:
   1) Roof System Replacements as they correspond to HVAC Upgrade Upgrade Scopes; NOTE: Coordinate with all-trades in this Project/Sub-Contractors for Scopes of Work being performed as part of this or adjacent/simultaneous projects.

2) Cutting & Patching as Related to HVAC/Electrical Scopes of Work including, but not limited to:
   a) Removal of Existing RTU, Ventilation Equipment
   b) Modification of Roof Curbs/Siding/Ceilings.

3. ALTERNATE ITEMS: Coordinate Proposals with published OPR Documents – Bid Form and Schematic Drawings:
   a. ALT-1: Provide Extended Maintenance Services for newly-installed and designated Systems:
      1) 5-year with provisions for 1-year approval/renewal.
   b. ALT-2: Provisions for Replacement of Existing VAV Air Terminal Unit Controllers as designated.
4. Targeted Schedule:
   a. Proposals due 12/29/25.
   b. Target Selection/Final Notice to Proceed by 1/13/26.
   c. Submittals & Coordination Complete by end-January 2026.
   d. Construction Substantially-complete by mid-April 2026.
   e. Final Commissioning (by County's Master Systems Integrator/Commissioning Provider) complete by end of April 2026.
   f. Obtain any applicable Certificates of Occupancy by 4/30/26.

1.2 SUMMARY

A. The purpose of this Overall Specification Section is to describe the project's main intent, to establish main boundaries of responsibilities (including the performance of ALL design & construction work in accordance with local/County requirements and Usual & Customary Standards for Business-Office Facilities), and to reasonably narrow the not-yet-made choices of the proposers according to Owner-driven Criteria & Project intents:
   1. Basic Form of Contract – Performance Specification Design-Build (D-B) Contractor with Guaranteed Maximum Lump-Sum Pricing (refer to supplemental documents for legal and clarifications). Mechanical/Plumbing/Electrical/General is primary under a Performance-Based (D-B) Agreement using Owner-furnished schematic design/criteria and certain Owner-evaluated equipment and services as noted.
   2. Schedule: Coordinate Proposed activities to allow project completions to coincide with target completions of this Scope of Work, based upon published schedules in RFQ/RFP documents:
      a. Added Cooling Systems fully operational: April 15, 2026.
      b. Heating Systems fully operational: March 1, 2026 (modifications commissioned prior to Cooling Turnover as feasible).
   3. Demolition: Bidder is responsible for the demolition of materials/equipment affecting the Scopes of Work. The Bidder will assume ALL project-required Asbestos-related abatements will be/have been performed by the Owner, unless noted otherwise.
      a. Coordinate Salvage Rights of Owner with Owner's designated representative prior to removals and disposals. Items not claimed by Owner through this process shall be completely removed and properly disposed.
         1) Contractor shall provide a complete (by official Transmittal to & Signed-off by Owner) Inventory of Demolished materials/items designated as "Salvaged-Retained-by-Owner", including but not limited to: Descriptions, Make/Model Numbers, Serial Numbers, Quantity, etc.
   4. General Trades Scope of Work – furnished by Bidder as appropriate for the work. This may include, but is not limited to:

a. Complete Final Design and Supportive Coordination for intended Scopes of Work noted in schematic documents and descriptions, both Base and Alternates.
    1) Both Engineering Design and Means & Methods for all General Trades items required by the new mechanical/electrical systems Scope are a part of the Performance-Based proposal. General Trades Sub-Contractor(s) will use Pre-purchased equipment information and Mechanical/Electrical Contractor's HVAC equipment/systems choices in the proposal and evaluate the building system re-works/new components that are required, coordinated with schematic plans/documents published. Specific items to note include, but are not limited to:
        a) Provision for necessary/beneficial Re-Work of existing Exterior Panels/Wall Systems in affected work areas; Exteriors Sub-Contractor to assess and evaluate best options for performing the targeted Base Mechanical Scopes with "Final-finished" Siding/Wall Systems in mind.

b. Existing Exterior Partition modifications required by intended Scope of Work (fencing, walls, ceilings, flooring, etc.): No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths - Return to Existing (risk-protected) Conditions unless noted otherwise.

c. Structural Support modifications/additions (miscellaneous foundations and structural steel): modify existing infrastructure and add new support as required to properly install New Mechanical Equipment/Systems.
    1) Both Engineering Design and Means & Methods for all structural items required by the new mechanical systems Scope are a part of the Performance-Based proposals.

d. Site modifications required by intended Scope of Work (roads, lawns, planters, pavement, etc.): No New Work intended beyond Scopes noted, Return to Existing Conditions unless noted otherwise.

e. Existing Roofing/Curbing modifications required by intended Scope of Work (rails, curb/roofing, etc.): No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths (Ventilation Intakes, etc.) - Return to Existing Conditions unless noted otherwise.

f. Coordination with Owner/Owner's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).

5. Plumbing Trades Scope of Work – furnished by Bidder as appropriate for the work. This may include, but is not limited to:
    a. Existing Interior/Exterior piping/fixture modifications required by intended Scope of Work. No New Work intended beyond that which affects the new mechanical equipment/systems and routing paths and Updated BAS Scopes (i.e. new Meters, Water line systems, Condensate Drains, etc.) - Return to Existing Conditions unless noted otherwise.
    b. Coordination with Owner/Owner's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).
    c. Complete Installation (materials and labor) of both Owner-preferred Equipment and Systems and Plumbing Sub-Contractor-furnished items.
6. Mechanical Trades Scope of Work – furnished by Bidder as appropriate for the work. This may include, but is not limited to:
    a. Complete Final design and build and Overall Project Coordination for intended Scope of Work noted in published documents and descriptions, including, but not limited to: the preparation/submission of applicable permit/coordination drawings

(All-pertinent-trades) for the purpose of obtaining a valid Occupancy condition for the Owner (design drawings, permit, inspections, approvals, etc.).

1) Both Engineering Design and Means & Methods for all Mechanical items required by the new mechanical systems Scope are a part of the Performance-Based proposal. Mechanical Contractor's HVAC equipment/BAS/systems choice(s) and Owner's Pre-purchased Equipment in the proposal will be shared & coordinated with each trade both prior to and subsequent to the final (D-B) Proposal, referenced to schematic plans/documents published. Post-Proposal and after award of contract(s), the Proposer shall also share the design choices with the Owner's Master Systems Integrator/Commissioning Provider for coordination and planning functions.
2) Piping Exposed-to-Walls or penetrating from roofs/walls/ceiling spaces thru occupied floor spaces should be located to minimize interruption to use of prime floor space and finished to protect the new piping and to match the current décor in the spaces/routes chosen for the pathways (not anticipated).

b. Coordination with Owner/Owner's Representative teams on Project Schedule and Work Progress Plans (locations, areas, shut-downs, tie-ins, etc.).
c. Complete Installation (materials and labor) of both Owner-preferred/provided Equipment and Systems and Mechanical Contractor-furnished items.
    1) For any Owner Pre-Purchased items, this contractor assumes ALL coordinational requirements for complete project management, design and installation 'as if he placed the order for the items himself'. The Owner is not prepared to coordinate any logistics on the Contractor's behalf, once the design-build orders are in place.

7. Electrical Trades Scope of Work – furnished/coordinated by Bidder as appropriate for the work. This may include, but is not limited to:
    a. Complete Final Design and Overall Coordination for intended Scope of Work noted in schematic documents and descriptions.
        1) Both Engineering Design and Means & Methods for all Electrical items required by any added Power/Lighting and new mechanical systems Scopes are a part of the Performance-Based proposal. Electrical Contractor will use Owner's Pre-Selected/Pre-purchased and/or /Mechanical Contractor's HVAC equipment/BAS/systems choices in the proposal and evaluate the electrical power system re-works to existing that are required, and properly coordinate all electrical work needed with schematic/final/permit plans/documents published/submitted.
            a) Re-Work of existing Main Power Panels/Feeds to affected/new Lighting systems, Emergency power, Ventilation Fans and Mechanical Equipment. Field-coordinate Electrical power locations and unitary components to allow for proper installations/performance based on wiring distance/routing and locations of required terminations.
            b) Include provisions for additional disconnect/safety switches/controls required for BAS/HVAC Units and electrical Accessories provided with Mechanical Equipment, (Operational Controls & Safeties, Metering and Flow Control devices, etc.).
            c) Provision for New (Local-to-affected-work-areas) Electrical Power Sub-Panels required to serve added/redistributed lighting/power panel feeds and equipment power loads and connections (i.e. new HVAC

Loads, LED Lighting, Misc. Fans, and Upgraded BAS/Energy-use and/or Flow Metering components.).

d) Provision for both added and necessary/beneficial Re-Work of existing Lighting Systems in affected work/mechanical service areas; Electrical Contractor to assess and evaluate best options for performing the targeted Base Mechanical Scopes with "Updated" Lighting Systems in mind. Any Lighting System "Updates" are included in Base Scope Pricing and coordinated with applicable General Trades (Roof repairs-patching) and HVAC (new HVAC/Ventilation Systems) Scopes of Work.

2) Both Engineering Design and Means & Methods for all newly-affected Electrical Low-Voltage Systems including affected Fire Alarm System items required by the new mechanical systems Scope are a part of the Performance-Based proposal. Electrical Sub-Contractor will use Owner's/Mechanical Sub-Contractor's HVAC equipment/systems choices in the proposal and evaluate the existing system re-works & integrations that are required (with appropriate Vendor(s)), as coordinated with schematic plans/documents published. No New Work intended beyond that which affects the required re-integration of new mechanical equipment/systems and routing paths into the existing FA System or local compliance requirements/updates/methods - Return to Existing/Current-required Conditions unless noted otherwise.

b. Coordination with Project Team on Project Schedule and Work Progress Plans (renovation locations, areas, shut-downs, tie-ins, etc.).

c. Complete Installation (materials and labor) of both Owner-preferred/provided Equipment and Systems and Mechanical Contractor-furnished items. New Work only as required to update/modify existing electrical power infrastructure to accommodate New Mechanical Renovations and designated upgrades.

1) Conduit/wiring Exposed-to-Walls or penetrating from walls/ceiling spaces thru occupied floor spaces should be located to minimize interruption to use of prime floor space and finished to match the current décor in the spaces/routes chosen for the pathways.

8. Temperature Control Systems – Main system is furnished by Design-Build Contractor using Owner's Master Systems Integrator and physically installed by the D-B /Proposer, unless specifically noted otherwise on OPR drawings. Items furnished by Bidder's Mechanical Vendor(s) and installed by Bidder's Sub-Contractor(s) to include, but not be limited to:

a. Packaged Unitary Controls (Pre-Purchased HVAC components and HVAC IAQ Systems wiring) as part of a selected Vendor system, with provisions for OPEN Systems Integration as noted.

b. Temperature-Pressure Sensors/Relays, control valves and necessary operational components for each Applied/Vendor-driven System in the Scope of Work.

Items furnished by Bidder/Proposer's Electrical Sub-Contractor and installed by Electrical Sub-Contractor (as coordinated with County's Master Systems Integrator) to include, but not be limited to:

c. Low Voltage/Communication Network wiring for Unitary-provided systems (i.e., RTUs, Mini-Splits, VFDs, HVAC IAQ System Safeties, Interlocks & Controls, etc.).

d. OPEN Systems Integration wiring components (BacNet™/Serial Communications cabling and cable/raceways for low voltage components required.).

e. Physical installation of OPEN Systems components provided by Master Systems Integrator as noted (HVAC IAQ Monitoring, HVAC Unitary Sensor-controllers, Main OPEN Architecture Controllers, etc.).

Items furnished by Contractor and installed/Commissioned by Contractor via the Master Systems Integrator to include, but is not limited to:

f. Main Computer & Energy Management Software, Integration to Packaged Unitary Controls (vendor-provided-level) and applicable BAS Network Systems, etc. to complete the designed OPEN Systems Architecture and Integration.

9. Fire Alarm Systems – No New Work expected beyond the Contractor's HVAC-focused Scope noted, applicable items furnished and installed by Contractor (alarm devices, VAV or RTU Smoke Detection devices, controls, etc.), unless noted otherwise or required by local authorities for Systems Upgrades to current installations. - Return to Existing Conditions unless noted otherwise.
10. Sprinkler Systems – Applicable items furnished and installed by Bidder under Base Scopes as required (water sprinklers, piping, controls, etc.). New Work intended includes only that which affects the new mechanical equipment/systems and routing paths – Provide for current Occupancy requirements unless noted otherwise.

1.3 RELATED SPECIFICATION SECTIONS

A. The equipment and systems designated as Owner-pre-purchased or preferred may have specification sections supplemental to this section. The Intent of any supplemental specification sections offered is to enhance the descriptions of these equipment and services items so that each Performance-Based (D-B) Proposer has reasonable information to consider in preparing his Scope/Design/pricing. Actual Completed Designs and Installations proposed are to be fully compliant with applicable customary and Owner-furnished standards, industry best practices, written installation instructions offered by the manufacturers of the equipment to be installed, and applicable local, state and national code regulations. Related sections include, but are not limited to:

1. Ductwork Systems & Accessories.
2. High Efficiency HVAC Rooftop Units.
   a. Variable Frequency Drives
   b. HVAC Airflow Measuring Systems
   c. HVAC Indoor Air Quality Systems
3. Mini-Split AC & Heat Pump Systems.

1.4 SUBMITTALS

A. Pre-Award Phase: At time of (D-B) Performance Specification Proposal and in addition to any Proposal/Bid/Clarification Forms required, provide the following documents to aid the evaluation of Proposals meeting the Criteria:
1. Schedule of Construction: timeline and expected area sequence of actions – to be continually updated for plans and progress and then shared with Construction Team.
2. Floor Plans for Project Areas with designation of RTU Ductwork Layout and designed Zoning boundaries.
3. Upgraded Ceiling Systems – layouts, materials, support systems; as applicable.
4. Lighting, Motor Controls, Ventilation Equipment and related items, & other required Preliminary Submittals, as applicable to design.

5. Main Electrical Power System Update w/ planned updates to existing One-Line Diagram and all proposed new Lighting Fixtures and circuiting.
6. Schematic Fire Protection System information as applicable to design/coordination.
7. Technical Clarification Statements, Options & Conditions.

B. Post-Award/Construction Phase: Prior to/after the completion of the Pre-Construction Meeting, provide the following documents to aid the evaluation of Proposals meeting the Criteria established:
   1. REVISED Schedule of Construction: timeline and expected area sequence of actions – to be continually updated for plans and progress and then shared with Construction Team.
      a. During Construction, approximately by 2/15/26, an updated Left-to-Do Schedule shall be published to County with critical Timeline schedule or all remaining items to complete.
   2. Final Product Data/System Submittals – refer to individual sections for Submittal requirements, but include as a minimum:
      a. Final BAS/TCS/HVAC Equipment & Accessories:
         1) Master Systems Integration and Temperature Control System components.
            a) Main BAS, TCS and Sequences of Operation.
            b) Utility Metering Components.
            c) HVAC IAQ Systems.
         2) HVAC Equipment, Ductwork & Piping Systems.
         3) Ventilation/ Fan Systems.
         4) Insulation Schedules and Products, including acoustic materials for Roof Curbs.
      b. Final Electrical Systems - Equipment & Accessories:
         1) Power Components.
         2) Lighting Fixtures and Systems.
         3) Low Voltage Systems, including required Fire Alarm System modifications.
      c. Final General Trades Equipment
         1) Roofing, Paint & Finishing Systems
      d. Accepted supplemental Scope Product/System Data-information – as applicable.
      e. Coordination Drawings/Plans as noted in BAS/HVAC Equipment specification sections.
      f. Final ALT Scopes of Work schedules/components/systems.
   3. HVAC Heating, Cooling & Ventilation Calculations.
   4. Lighting System Layouts and Calculations.
   5. Fire Protection System Layouts and Calculations.
   6. Inventory of Salvage-Rights Materials/Items – for Owner Review.
   7. Schedule of Extra Materials/Attic Stock Items being furnished – for Owner Review.
      a. Including any items addressed in Equipment Pre-purchased by Owner.
   8. Final Plan Approval/Permit and Coordination Drawing documents for applicable Scopes:
      a. Main Mechanical & Electrical Systems.
      b. Detailed Enlarged Mechanical/Electrical Room Plans.
      c. Detailed Mechanical AirFlow Diagrams/Electrical One-Line Diagrams.
      d. New/Updated Fire Alarm System.
      e. Modified Fire Protection System.

C. Product Data: For each product component proposed, <u>not Owner-furnished</u>: Include standard documentation for the purposes of Owner-review and recordkeeping. Included in this group, but not limited to the group, are the following items:

1. Warranty terms and associated project documentation.
2. Maintenance and Operation data, for inclusion in master job O & M manuals.
3. Applicable Vibration and Acoustic Performance project documentation.

D. Operation and Maintenance Data: For each product/system provided to include in emergency, operation, and maintenance manuals.
   1. Include a SPECIFIC Summary of required maintenance items for each unit/system, complete with pertinent part numbers and frequency of actions recommended.

E. Closeout Documentation & Materials: Provide complete documents as required by the Scope of Work including coordination of any Owner pre-purchased items, transmitted to the Owner's Consultants as requested, including, but not limited to:
   1. As-Built versions of all Drawings covering the Scope of Work, in hard red-line, pdf and CAD formats.
      a. Install Laminated legible Control As-Built Drawings in each applied Field Panel/Enclosure, ensuring the documents match the required field-labeling of each component utilized in that panel/portion of the Control System.
      b. Fire Alarm Systems as updated.
      c. Fire Protection Systems.
   2. Complete Startup Documentation for each System affected Equipment in Scope of Work, including coordination of any Owner pre-purchased items.
   3. Testing, Adjusting & Balancing Reports.
   4. Final Pay Applications and Waivers.
   5. Clarification that Punch Lists and Issues Logs are fully completed.
   6. Two (2) sets of any specialized tools the installed Systems/Equipment manufacturers require/recommend for Installation, Maintenance and/or Calibration of any portion of the provided Equipment/Systems.
   7. Operations & Maintenance Manuals/Data as specified.
   8. Training Documents.
   9. Warranty Documents.
   10. Systems Manuals.
   11. Extra Material/Attic Stock: Signed Receipt for delivery of all materials required.
   12. Extended Maintenance Program Documents – as applicable.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain only first-quality components.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. NFPA Compliance: Select and furnish components of installation meeting applicable sections of the current NFPA regulations.

D. Product Rating Certifications: Select and furnish components of installation meeting applicable sections of the current industry standard rating/listing/labeling regulations.

1.6 COORDINATION

A. Coordinate with all trades the placement, support and utility requirements for each major equipment item. This includes, but is not limited to:
   1. Substrate elements – Asphalt surfaces, Concrete Pads, structural steel, louver locations/lintel sizes, wall sleeves, mechanical/electrical room/closet structures.
   2. Existing Fencing/Floors/Walls/Ceilings/Partitions – coordinate with Owner/Owner's Representative team any proposed disturbances of existing substrates and/or those containing hazardous materials.
   3. Wall/Ceiling/Roofing modifications – Contractor to fully-coordinate with each trade involved in the renovation construction (HVAC, Electrical power/lighting, etc.) and also with the Owner for existing-to-remain & modified low voltage systems (audio/visual, fire alarm, security, clocks, public address, etc.) affecting existing partitions.
   4. Piping – mechanical/fire protection/plumbing service and drain piping - coordinate with Owner/Owner's Representative team any proposed disturbances of existing partitions/accessways.
   5. Ductwork/Engineered Ventilation Systems – planned routing from unit connections; coordinated with designated equipment/layouts.
   6. Electrical – power wiring, including means of disconnect and planned location/sources of power for replaced/downsized/added mechanical equipment.
      a. Provide complete installation with NEC/Local Authority panel Clearances as required.
   7. Electrical – Updated power/control wiring, including means of disconnect and planned location/sources of power for replaced/added Lighting Fixtures and equipment.
   8. Vendor-based Controls – location of components/accessories not factory-mounted or Owner-provided.

B. Provide Coordination and cooperation services to County's Consulting team for purposes of filing for public utility and/or tax credit incentives. Palmer/County FIRM has created pre-approval files for the project, according to the requirements published by the "programs" and will pursue final execution of the applicable incentives. The Contractor's team shall provide timely responses and any requested paperwork required to fully execute these functions.

1.7 PRE-COMMISSIONING CRITERIA

A. Coordinate access/layout and installation of each System component and suspension system with other construction elements that are set near existing walls, on roofs or penetrate walls/ceilings/floors or is supported by them, including light fixtures, HVAC equipment, fire-suppression systems, and partition assemblies.

B. Note operating condition of all existing systems prior to replacements & coordinate with Owner, including describing any known deficiencies in existing performance and making provisions for temporary services including, but not limited to Temporary Heating/Cooling and/or Life Safety Systems for periods between scheduled demolition and energizing of the new HVAC/Power/Life Safety Systems.

1.8 WARRANTY PROVISIONS

A. Basic Installation warranty: Provide Bidder/Manufacturer's standard forms in which Bidder/manufacturer agrees to repair or replace components of furnished equipment that fails in materials or workmanship. Submit a written warranty signed by Bidder & furnished equipment manufacturer(s) and installer(s) agreeing to furnish labor and parts for failures within a warranty period of Twelve (12) Months from the date of substantial completion/documented Start-up.

B. Extended Unit/Equipment/Installed Systems warranty: Provide Bidder/Manufacturer's standard forms in which Bidder/manufacturer agrees to repair or replace components of furnished equipment that fails in materials or workmanship. Submit a written warranty signed by Bidder & furnished equipment manufacturer(s) and installer(s) agreeing to furnish labor and parts for failures within a warranty period as described within the equipment sections from the date of substantial completion/documented Start-up.
   1. Descriptions of Systems/Component Extended Warranties required can be found in the specific equipment/systems specification sections.
   2. Coordinate terms of Extended Warranties that are part of any Owner Pre-Purchased items – not anticipated.

1.9 EXTRA MATERIALS/ATTIC STOCK

A. Furnish total sets of materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. General: Two Sets (2) of each manufacturer-recommended Standard SPARE SERVICE PARTS for each unit furnished in project, properly transmitted and labeled.
   2. New LED Lighting Fixtures: Three (3) TOTAL complete new spare LED Fixtures of each major type per Project to be used to periodically upkeep updated conditions after construction.

   3. Touch-up Paint: Quantity of complete containers to be used by Owner to maintain corrodible surfaces after construction is completed.
      a. Paint containers: One (1) for each system/equipment employed.
   4. Fan Belts: Three (3) extra for each Belt-driven Motor furnished.
   5. Filters: Extra sets for each Bank of Filters furnished:
      a. Pre-Filters, Primary HVAC & Terminal Unit Filters: Two (2) extra for each AHU/VAV, rounded to even Full-BOX quantity as commonly distributed.
      b. Final/After Filters: One (1) extra set for each Bank.
   6. Temperature Control Components:
      a. Distributed System Controllers – typical as used in TCS, quantity of Two (2).

1.10 EXTENDED MAINTENANCE SERVICES

A. Purpose of this section is to allow the Contractor/ Proposers an opportunity to offer the County (AC) a flexible option(s) for annual contracting of manufacturer/System-based full-coverage Maintenance Services for the installed and operating **HVAC Equipment & Systems** affected in this project:
   1. Each replaced RTU System, including Electrical Controls/Fans/VFDs/IAQ Systems.
   2. Each added IT Mini-Split AC System.

B. The County reserves the right to accept, reject or modify-and-accept the conditions returned in this Manufacturer-based Maintenance Services proposal.

C. Interviews and/or Scope of Services reviews may be subsequently held to clarify inclusions, exclusions and creative options prior to making any formal decisions on agreements.

D. Basic Terms & Conditions for Preventative Maintenance Services Scopes of Work:
   1. Commencement and Duration of Maintenance Agreement:
      a. Start – begins at dates stated/agreed-to by AC and consultant (Palmer Conservation Consulting).
      b. Documents: Scheduled activity Reporting & Project Completion Sign-Off Forms, including applicable WARRANTY documents, dates and Terms & Conditions.
      c. Duration of Manufacturer's Recommended Service Maintenance Agreement: **Overall FIVE Years with One-Year Annual Term Agreement updates**
   2. Sign-in & Access:
      a. Contractors will sign in at the beginning of each day.
      b. Keys & access cards are to be obtained at the AC Facilities Main office.
   3. Work Order/Tickets:
      a. Start & end labor times for each day/project are to be reported for each workorder.
   4. Notifications:
      a. Maintenance Services Contractor will notify AC Facilities Management Team monthly to review service over previous month and discuss the following month's planned maintenance.
      b. Maintenance Services Contractor will also notify AC consultant/Systems Integration Provider **(County FIRM/PCC)** at same time to review equipment/maintenance services performed over previous month and discuss the following month's planned maintenance & potential Integration impacts to overall operations of the systems.
      c. A phone number must be provided for 24/7 service and the employ of same maintenance technicians is preferred on all PM services calls to the designated site(s), both regular maintenance and any applicable emergency services agreed-to.
   5. Billing Procedures:
      a. After Services are Rendered Complete per schedules, Contractor will bill quarterly the agreed upon contracted sums.
      b. Any Approved Work completed beyond the contract is to be billed following the completion of the project.
      c. All repairs (including both labor & materials) that are not covered in this contract will be approved prior to commencement.
   6. Service Personnel:
      a. Contractor will perform all work in a timely and workmanlike manner, using only qualified maintenance technicians with a minimum of 5 years of experience with equipment types in contract, and will adhere to all code standards:
         1) Journeyman-level training on all functions, less filter media changing.
         2) Local organization and/or manufacture-recommended certifications for refrigeration-based PM Services.
         3) Similar/same personnel shall be used per site/equipment to build reliability of the PM services & operations.
   7. Preventative Maintenance Services Warranty:
      a. All work performed under this contract will carry a minimum thirty-day warranty on labor and the manufacturer's customary warranty on any materials.

E. Basic Specifications for administration of Preventative Maintenance Services:
   1. All customary Preventative Maintenance work/repairs during normal working hours are included at no additional cost.
   2. All customary Preventative Maintenance work/repairs outside normal working hours are included at no additional cost.
   3. Any additional cost to perform Preventative Maintenance work or repairs by other companies (subs) is included within this proposal.
   4. All Preventative Maintenance required repair parts, including valve actuator motors & heating/cooling valves, are to be addressed under the base PM Services.
   5. All HVAC equipment affected, including Ventilation, Rooftop Air Handling HVAC Systems and VFD services to be proposed per manufacturer's recommendations, similar to those noted as guidelines herein.
   6. One inspection per season of each system, or packaged unit listed (some units may run 24/7). Contractor to follow quarterly scope of services as detailed in subsequent sections.
   7. HVAC Units/VFD Packaged Control systems Preventative Maintenance to be performed on a quarterly basis.
   8. All units listed with this service plan will have service within four hours of trouble call instigated by AC. Service provider to stock adequate parts to ensure seamless operation.
   9. All fan belts and drive belts on all listed equipment will be replaced a minimum of once per year.
   10. Change or wash air/Water screens/filters as recommended.
   11. Cleaning of all air-cooled condensers to improve system efficiency is included, per manufacturer's recommendations, but as a minimum performed each spring & fall.
   12. Provide electronic annual report of all Preventative Maintenance per unit/system.
   13. It is the sole responsibility of the service provider to maintain the unit/s at their highest efficiency at all times.

F. The goal of this program is to eliminate HVAC mechanical equipment breakdowns and repairs before they occur through proper and manufacturer-recommended preventative maintenance measures. However, if basic repairs on equipment become necessary, it will be expected that the service (parts and labor) be accomplished at no additional cost to the County. Repairs due to events outside of the contractor's control will be reviewed individually by AC as required for compensation beyond the scope of this project. Examples of events outside the contractor's control include natural weather phenomena, vandalism, power surges, etc. that cause damage to systems under this program; No such claims are expected.

1.11 ALLOWANCES

A. Proposers are to include an Allowance amount of $30,000.00, for use in addressing unforeseen conditions/repair-level work discovered during project execution. The Owner, via County FIRM/Palmer Conservation Consulting, has the sole direction that these funds may be used for the project, including justification documentation as required. The Allowances for each bid Item are therefore:
   1. BASE ITEM 1: Ashtabula County Courthouse HVAC Renovations 2025 = $30,000.00.

PART 2 - PRODUCTS & SCOPE CRITERIA

2.1 DESIGN CRITERIA

A. Provide Complete Final Design for noted project Scope of Work utilizing schematic-phase documentation included from Owner via the OPR Documents published.

1. Building Code: Current version adopted in applicable City/County.
   a. ASHRAE 15 (Refrigeration Systems) with Alarming.
2. Energy Code: Current version of IECC and ASHRAE 90.1 as adopted/enforced.
3. Environmental (space/zone) conditions: Layouts/sizing based on current version of applicable ASHRAE/IEEE standards.
4. Ashtabula County Project Standards: reference OPR Documents and apply as applicable to intent of Scope of Work.
   a. BASE: Replace existing RTU HVAC Systems with new/complete HVAC System – targeted as one-for-one only, resized AND Re-Zoned using OPR and Owner's pre-purchased equipment; Final Designs by Contractor.
   b. BASE: Replace/Update existing BAS/Temperature Control System – Upgraded/enhanced as specified and required by designated Scopes of Work.
   c. Ventilation Intent: Meet Plan Approval and/or applicable current Design requirements in any combination of options, specific to building/application.
   d. EQUIPMENT-based Design Criteria: Refer to specific sections for design criteria including but not limited to:
      1) High Efficiency HVAC Rooftop Units (Owner Pre-purchased).
   e. Indoor Air Quality (IAQ) System Designs will include applicable portions of the following references/Standards:
      1) ASHRAE Std 62 and/or DALY approach (Disability Adjusted Life Year).
      2) ASHRAE Standard 241 Control of Infectious Aerosols.
      3) ASHRAE Guideline 36 High Performance Sequences of Operation.
5. Intent: Each design professional utilized in Bidder's proposal has the liberty to act with the Owner's best interests in mind, based on the individual situations/boundaries presented before design begins and based on qualified professional experience. The criteria set forth in this specification is intended to be a guideline to limit the risks of dissatisfaction over the Balanced Total Life of this facility/project and to make the tasks associated with long-term owning/managing the facilities as effective as it can be, including the limitation of equipment/service providers to those noted as being Owner-preferred and/or listed within these specifications.
   a. The merits of this Proposal are not dependent on specific savings in operating energy.
   b. The merits/VALUE of this proposal with reference to matching of intended Scopes, Construction Schedules anticipated, energy savings and/or operational improvements are key factors in selection/consideration.

2.2 BASIC DESIGN AND INSTALLATION REQUIREMENTS

A. Provide required actions, documents and fees for applicable plan creation and approvals, and all subsequent construction-phase inspections (rough-in, finals, etc.). Coordinate requirements with all members of Owner/Bidder teams & Owner's representatives.

2.3 SITE WORK & OUTDOOR FENCING

A. Return any disturbed grounds areas (lawns, pavement, sidewalks, etc.) to pre-construction conditions.

2.4 STRUCTURAL STEEL CONCRETE AND METAL FABRICATIONS

A. Provide materials for equipment support according to applications required using industry standard means-and-methods and common best practices. This includes, but is not limited to:
   1. Pre-bid investigation of existing equipment, wiring/piping Support & Rigging Access.
   2. Professional evaluation of support/installation modifications required for new equipment chosen/selected for the replacements and related security/access structures or partitions.
   3. All proper Final Design & submittal Documentation required by the Scope of Work for a Complete, serviceable and safe installation.

2.5 INTERIOR FINISHES

A. Provide materials for returning interior surfaces to existing conditions according to applications required using industry standard means-and-methods and common best practices.

2.6 BASIC MATERIALS AND METHODS

A. General: Provide materials for completing general, mechanical and electrical installations according to applications required (including mechanical/electrical modification-driven architectural/general trades finishes) using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:

   1. Worker and Occupant Safety Signage.
   2. Hangers and Supports.
   3. Sealing at penetrations in partitions – appropriate for application.
      a. Fire Walls: per in-effect codes/requirements.
      b. Exterior: watertight, vermin-proof.
      c. Aesthetic: to match finishes affected.
   4. Vibration Controls for moving equipment/Pipe Expansion
   5. Equipment/Piping Tagging and Identifying – Black Stencil Markings.
   6. Valves – for duty of system served.
   7. Meters and Gauges.
      a. Provide Pressure Gauges with minimum 4” Diameter, suitable for remote viewing.

2.7 DUCTWORK SYSTEMS

A. General: Provide materials for completing mechanical installations according to applications required (including applicable material choices and finishes) using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:
   1. Ductwork for Ventilation, Supply and Return Air Systems - SMACNA Gauge and Sealing by duty.
   2. Accessories for complete systems (Fire Walls/sealing, Balancing, Labeling, etc.)

2.8 PIPING

A. General: Provide materials for completing mechanical installations according to applications required using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:

1. Domestic Water Piping: Copper.
2. Heating Water Piping: Copper.
3. Condensate Drain Piping: Copper, PVC/CPVC for application.
4. Refrigeration: Copper/ACR for application.

2.9 INSULATION & JACKETING

A. Provide base Insulation and proper Exterior/Protective Jacketing for each mechanical system, unless otherwise noted. Provide Insulating products/services using industry standard means-and-methods and common best practices. This provision applies to, but is not limited to:

1. Indoor Cooling Condensate Drain piping.
2. HVAC Ductwork Systems – heating & cooling duty, concealed & exposed.
3. HVAC Piping Systems – heating & cooling duty, concealed & exposed.

2.10 MECHANICAL EQUIPMENT

A. Owner-Evaluated/purchased and Contractor-purchased Equipment and Systems include:

1. Applied RTU VAV HVAC Systems – RTUs & SAF/RAF VFD-ECMs & IAQ Devices.
   a. Includes noted Unitary & Field Applied Controls as required for full working System.
   b. Includes final coordination for Ventilation Louver/Fan/Coil installations/modifications in existing walls/ductwork.
   c. Includes final coordination for Fire Alarm System devices/sequences required for application.
2. OPEN Temperature Controls and Systems Integration of Contractor-installed Applied BAS and Unitary Controls (RTUs, HVAC IAQ/Ventilation Systems), Energy Metering Equipment as noted, (Main Domestic Water, Makeup (Glycol) Water, Natural Gas and Electric), all as fully-coordinated with County's Master Systems Integrator.

B. Ancillary Equipment coordinated with Targeted Scopes of Work, chosen for duty intended/submitted for review and coordination:
1. Lighting & Lighting Controls Systems: Refer to Drawings/Product Data Sheets included with OPR as a reference to targeted replacement/upgrade Scopes.
2. Controls Components – Provide all items required for operation of Contractor-installed MSI-designed/provided Systems, Unitary System Controls Systems (Temperature/Pressure Sensors, Sensor Wells, Relays, Hoses/Valves, Air Flow Control, etc.). Coordinate component selections and exact locations with HVAC Vendors and County's Master Systems Integrator during submittal phase.
3. Hydronic Closed Loop Specialties – Expansion Tanks, Air Separators, Make-up/Glycol-Fill Stations, Chemical Treatment Components, Balancing Valves, etc. as required for a complete working Hot Water Heating system.

a. Heating Systems – Automatic Fill, Glycol-based fluid in complete system: Allow new volume as required to maintain full system charge upon completion. Provide Glycol compound with appropriate chemical treatment, pre-mixed with appropriate inhibited antifreeze/chemical treatment to serve new glycol/piping system, with integrated Alarm (BACnet) to BAS for reservoir level.
   1) Fluid: 30% Ethylene Glycol.
b. Balancing Valves:
   1) Flanged Multipurpose/adjustable type at main hydronic loop/pumps & bypass lines; equal to Caleffi "#132xxxA".
   2) Circuit-setter type at applicable Main Branch Piping.
c. Air/Dirt Separator: Flanged ASME rated with stainless steel strainer and air vent/drain valve; equal to Grundfos "#GBSF.
d. Backflow Preventer/Pressure Reducing Valve: ¾" with gauge; equal to Caleffi "574151A".
e. Premium-construction Automatic Flow Control type at Terminal Unit Coils, as applicable.

4. Hydronic Closed Loop Chemical Treatment System & Specialties – coordinate/verify with Glycol Loop Makeup Water Meter Devices/Controls, Chemical Treatment Compounds & Components, Balancing Valves, etc. as required/recommended for a complete working Closed-loop Hot Water system. Elements to address in Closed Loop Chemical Treatment Systems include, but are not limited to:
   a. Chemicals:
      1) Corrosion/Scale Inhibiter
   b. Chemical Vessels, Probes, Sensors and Feeder Systems:
      1) Verify properly piped manual feeder as designed/applied for complete system.
   c. Owner Training, as applies to complete operating systems

2.11 ELECTRICAL

A. General: Provide materials for completing electrical installations according to applications required using industry standard means-and-methods and common best practices, assuring that each device placement is completely and safely accessible for future maintenance. This provision applies to, but is not limited to:

1. Panelboards.
2. Disconnect Switches.
3. Transformers.
4. Raceways.
5. Load Centers.
6. Conductors.
7. Grounding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Arrange installations to provide access space around equipment for service, protection and maintenance. Install so that all access doors/panels are fully operable.
   1. Make provisions to properly remove the existing HVAC units, Cabinetry/piping and Electrical Power and make safe for installation/set of the new equipment. Determine exact locations for intakes/ductwork, piping and electrical connections before demolition scope. This includes any hazardous material removals/fluid pumpdowns required for properly removing the existing refrigeration units.
   2. Install prescribed acoustic materials in each HVAC Rooftop Unit curb prior to final setting/installation of the equipment.

B. Arrange installations to provide access space around equipment for service, protection and maintenance. Install so that all access doors/panels are fully operable.

C. Controls: Refer to accompanying diagrams and specifications for Contractor's field installation of required Pre-purchased Equipment and/or OPEN AC & MSI-related temperature & operational controls/meters items. Coordinate locations & installation requirements with planned equipment/systems layouts and County's Master Systems Integrator prior to final installations. This scope of work includes, but is not limited to:
   1. HVAC Ventilation & Fan Systems, Dampers & operators.
   2. Applied BAS Controllers.
   3. Temperature/Humidity/Pressure Sensors.
   4. HVAC Air Terminal Damper Operators.
   5. Updated Motor Controls.
   6. Energy-use & Flow measuring Metering Equipment as applicable.
   7. Safeties & interlocks.

3.2 CONNECTIONS

A. Piping/Control connections are per the Schematic Drawings/submittals which indicate general arrangement of piping, fittings, and specialties, based upon manufacturer-approved methods.
   1. Provide & Install system-appropriate safety relief valves and piping per customary/code standards and manufacturer's recommendations.

B. Schematic Drawings indicate intents of general arrangement of applicable Ventilation Systems/ducts and duct accessories. Make final duct connections with flexible connections and/or manufactured fittings as applicable.

C. Electrical: Comply with applicable requirements of local codes and best practices.
   1. Properly 'label' each new/existing raceway Junction Box for source (panel) and service.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Coordinate/Engage factory-authorized service representative (including Owner's Pre-Purchase Vendors) to inspect field-assembled components and

equipment installation, including Ventilation materials, piping, control and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 STARTUP SERVICE

A. Coordinate/Engage a factory-authorized service representative to perform startup service per manufacturer's instructions and recommendations. Coordinate with County's Consultants and provide applicable Documentation to Owner.

3.5 FINAL COMMISSIONING

A. After completion of installations, fully Test, Adjust, and Balance each designated system to ensure proper design and operation, coordinating efforts with HVAC Vendor-Unitary Control Systems Installers/Programmers and County's Master Systems Integrator/Commissioning Provider. Document results.
   1. The Intent for this function is to assure Owner that the existing/upgraded BAS & new HVAC Systems (existing/new ductwork and existing VAV-RTU Ventilation Systems) are capable of delivering the expected Sequences and fluid/energy to the affected Renovated Areas, etc.: It is intended to Test, Adjust & Balance the updated HVAC System components for flow performance.

3.6 CLEANING AND SETTING

A. Clean equipment internally and externally, on completion of installation, according to manufacturer's written instructions and usual & customary practices. Clean equipment interiors to remove foreign material and construction dirt and dust.

B. After completing system installation and testing, adjusting, and balancing of equipment and air-distribution systems, clean units, install new filters and mark settings of Balancing Dampers; record settings.

3.7 DEMONSTRATION

A. Coordinate/Engage a factory-authorized service representative to demonstrate/train Owner's maintenance personnel to adjust, operate, and maintain EACH main equipment item & systems installed, including an agreed-to procedure for post-construction service during the Warranty period.

3.8 PREVENTATIVE MAINTENANCE IMPLEMENTATION GUIDELINES

A. General: the following paragraphs are intended as Service Guidelines that should be understood and applied to EACH HVAC Equipment/System item in the Scope of Work in order to quantify/qualify the nature of Manufacturer-based care for the subject equipment. Service

Providers are responsible to review what is actually recommended/published for each item furnished & covered in the Preventative Maintenance Scope of Work.

B. Comprehensive Quarterly Maintenance Guidelines for HVAC Equipment:
   1. General Instructions – in conjunction with Manufacturer's PUBLISHED Recommendations:
      a) Inspect for visual leaks and report leak check results.
      b) Repair minor leaks as required (e.g. valve packings, flare nuts & pipe joints).
      c) Brush clean coils, louvers/fill & heat exchangers.
      d) Verify electric motor starter(s) and auxiliary electric control device(s) operation.
      e) Check refrigerant charge.
      f) Verify smooth operation of any burners, compressors and fans.
      g) Change Filter media as applicable.
      h) Review operating procedures with operating personnel.
      i) Provide a written report of completed work, operating log, and indicate any uncorrected deficiencies detected.
   2. Controls and Safeties
      a) Test the operation of any Unitary Controls & Safety devices, including installed loose accessories and components (space & system temperature/pressure devices, damper/valve controls, unit-provided interfaces to Fire Alarm systems, etc). Calibrate, if applicable, and record setting.
   3. Lubrication
      a) Lubricate motor bearings, if applicable.
      b) Check oil level in the compressor(s).
      c) Check oil for acid content and discoloration. Make recommendations to the customer based on the results of the test.
   4. Electric Components, Motors and Starters
      a) Clean the starter and cabinet.
      b) Inspect wiring and connections for tightness and signs of overheating and discoloration.
      c) Check the contactors for free and smooth operation.
      d) "Meg" any major-service motor(s) and record readings.
      e) Verify the tightness of the major motor terminal connections.

END OF SECTION 10 23 26

SECTION 230900 – OPEN TEMPERATURE CONTROL SYSTEM

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

B. The Project's Owner's Project Requirements (OPR)/Construction Documents provide additional graphical schematics to delineate responsibilities for Technical Services provided by the Owner's Master Systems Integrator (MSI) and the Proposer/Contractor's Installation teams for Temperature control/BAS Network-related Scopes of Work.

1. Refer to Section 230940 for Descriptions of Master Systems Integration Services being provided to the Owner by the proposing Contractor via the Master Systems Integration & Integrated Commissioning Services Provider, (AGM Energy Services). These services include, but are not limited to:

    a. Systems Integration equipment: Supervisory Computers, OPEN-platform Controllers (JACE™ & Enterprise-level Controllers), Application Specific Controllers – as noted, IAQ Monitoring Systems components, Environmental Sensor components, Energy-use Meters – as noted, Lighting Control Panels – as noted, System/Network Computers, Workstation peripherals, etc.
    b. Integration-specific Software: OPEN System/Network-based, Lighting Control, IT Plug Load Management, Digital Signage interfaces, etc.
    c. Programming: aster level, Scheduling, Alarm Console, Energy Data & Graphing, Analytic Functions, etc.
    d. IT Systems Communication: Coordinating OPEN Control & Unitary Control interfaces with Owner's Network(s).
    e. Graphical Screens: Operational Screens & Human-Machine Interface setups, etc.
    f. Training: Specific to OPEN Integration (non-Unitary) portions of Network.
    g. Commissioning Services: Evaluation, Assurance & Documentation that intended integrations from Unitary Controls by Proposer/Contractor are reporting and functioning as intended at Master Network/Supervisory-level.

2. Refer to published Systems Architecture Diagrams for Scope of Work clarifications and specific delineations between 230940 Master Systems Integration Scopes and Temperature Control System Scopes described herein.
3. Refer to published MSI-furnished Product Data sheets/Submittals for available specifics on devices/systems being furnished for field installation by this Contractor.

C. Ashtabula County (AC)'s published Design Guide and Standards Documents, current versions.

1.2 SUMMARY

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS), utilizing Unitary-coordinated Direct Digital Controls and fully coordinating with the Owner's Master Systems Integrator (MSI) as shown on the drawings and as described herein. Drawings are diagrammatic only.

1. PROJECT CONTROLS FOCUS: Provide installation of unitary-provided control & components (furnished with Contractor-selected & furnished HVAC Equipment as required to meet design/functional intent, i.e. space sensors, duct/piping sensors, etc.) and other miscellaneous control components required to meet the project's design intent.
2. All data points in specified Scopes of Work described in this Section will be exposed by the Designing/Installing TCC to the BAS Graphical User Interface (Niagara™) to permit integration into the Owner's OT network by the Master Systems Integrator (MSI).
3. This Section includes the necessary labor and materials to comply with the Cx Commissioning efforts as required (communication coordination & Functional Testing). TCS supplier's commissioning activities are to be included in this specification section's activities and are non-compensable and cannot be a cause for delay claims.
4. This Section includes the necessary labor and materials to completely install equipment provided by the Proposer/Contractor via the Master Systems Integration Services (MSI) provider – coordinate Scope Details referring to Drawings published in the OPR, the Master Systems Integrator Services specification section and directly with the Master Systems Integrator for the Owner AGM Energy Services.

B. All labor, material, equipment and software not specifically referred to herein or in the OPR documents that are required to meet the functional intent of the OPR Documents/this specification, shall be provided without additional cost to the Owner.

1.3 SYSTEM DESCRIPTION

A. The entire Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital logic controllers communicating via current BacNet™ communication protocols to a Java Application Control Engine (JACE) N4 platform provided under division 230940 MASTER SYSTEMS INTEGRATION SERVICES (By AGM Energy Services to the Owner via the Proposing Contractor).

1. Refer to OVERALL Specifications & schematic Diagrams for additional Work-Scope and Project intent descriptions.
2. Refer to Owner's published Standards for accompanying requirements related to ancillary control systems components.

1.4 MANUFACTURERS

A. Manufacturers, General: Products must be available for purchase from at least two wholesale distributors in the state of Ohio, and Owner must have direct ability to purchase products outside the contractor relationship.

1.5 OPEN TEMPERATURE CONTROL SYSTEM PROVIDERS/INSTALLERS

A. Providers/Installers, General: The Intent is to provide HVAC Packaged HVAC Equipment manufacturer-qualified field installation of System UNITARY Control components and related MSI/TCS/Utility Metering cable-communications for the noted Scopes of Work.

1.6 SUBMITTALS

A. Coordinated with Project Requirements, properly-named electronic copies of shop drawings/product data of the entire OPEN Temperature Control System/Systems Architecture/components shall be submitted/transmitted and shall consist of a complete list of equipment and materials, including manufacturer's catalog data sheets and installation/maintenance instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as an "OPEN System". Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package, as applicable.

1. Coordinate Unitary Controls portion of the TCS Submittal with specific Specification section/System requirements including, but not limited to:

a. Packaged/Applied AHU-ACCU HVAC (VAV) Units/Systems.

b. Packaged High-Efficiency Boiler Systems (complete Heating Plant).

c. HVAC Indoor Air Quality (IAQ) Systems.

d. Packaged Engine Generator Systems.

B. Submittal shall also include a complete Point List of all connected points to the provided DDC TC System in the format as indicated in the temperature control system diagrams located on the drawings. This includes, but is not limited to:

1. BACnet™ Registers – coordinated with associated equipment.

2. Applicable PICS documentation.

3. Applicable Software Licensing documentation.

4. Naming Conventions (Points, Communications, etc.) as established by the Owner, in English TABLE form

C. In addition to above submittals, the commissioning (Cx) submittal requirements as outlined shall be included as part of this specification section requirement.

D. Upon completion of the work, provide a complete set of 'as-built' submittals/drawings on properly-labeled current magnetic media or compact disc/storage all licensed to the Owner/end user. Drawings shall be provided as AutoCAD™ or Visio™ compatible files, in addition to current Adobe PDF versions. Two "hard" copies of the 'as-built' drawings shall be provided (in addition to the documents on flash drive media or compact disc). Also provide at Final-Acceptance/Completion of the Work:

1. Applicable Warranty Conditions documentation.

2. Verification of final Training/Plans for additional training.

3. Signed certificates of Completion (coordinated with MSI/Commissioning provider).

1.7 DIVISION OF WORK

A. The Section 230900 (TCC) Contractor shall be responsible for all field labor for mounting & wiring designed/specified Building Automation System MSI/(BAS)/TCS components, (including specified Enterprise-level Devices, Energy Metering, Power Loss Panels, CO Detection & Local Annunciation Systems, Environmental Sensors & Lighting Control

System devices being furnished by the Owner's Master Systems Integration Services Provider under Section 230940), Distributed Application Specific Controllers/coordination (only as specifically noted), Coordination with HVAC/Electrical Unitary Controllers provided with Contractor-selected & furnished Equipment/Systems, ancillary control devices, required fabricated control panels, any unitary/Distributed/Applied controller programming not factory or MSI-furnished, unitary/non-applied controller programming software, labeled controller input/output and power wiring, labeled controller network wiring and (BAS)/TCS-based BACnet™ network wiring & connections to the Java Application Control Engine (JACE) N4 Networks, (applies to ALL required wiring scopes). SPECIFIC Equipment furnished under this section includes:

1. MAIN ENTERPRISE System Applied Controls: None – provide conduit, conductors and field wiring Scopes only – refer to MSI Schematics published in OPR.
2. Applied Distributed Temperature Controls: None – Controllers are furnished by the MSI, provide conduit, conductors and field wiring Scopes only – refer to MSI Schematics published in OPR.
3. HVAC/Electrical Equipment: Coordinate provision & installation with Contractor-chosen and/or Owner-preferred Unitary System Controllers as part of a factory-fabricated unit/systems. This Scope includes, but is not limited to:
    a. Packaged Heating Equipment.
    b. Packaged/Split HVAC Equipment.
    c. Packaged Air/Waterflow Measuring Stations not furnished with Packaged HVAC Equipment.
    d. Packaged HVAC IAQ Equipment.
        1. Safety Interlocks/Switches for affected NPBI/UV-installation Access Doors/Panels in Air Handling Units/Ductwork systems.
    e. Environmental Sensors.
4. Energy-use Meters: as noted in OPR, furnish, install & wire for power/communications for Listed Components below in 1.7.B.5.

B. The Section 230940 (MSI) Master Systems Integration Services provider shall be responsible for the Java Application Control Engine (JACE) N4 components & software and programming of the JACE's, graphical user interface software (GUI), development of all graphical screens, setup of schedules, logs and alarms, BACNet(tm) network management as required to interface the JACE to the Proposer/Contractor's TCS network/energy meters/lighting control systems, global supervisory control applications, general system integration of BACnet/Modbus devices as shown, integration and coordination and connection of the JACE to the local or wide area network. The Owner's Master Systems Integrator will provide the JACE(s) to the Proposer/Contractor for ALL field installation and utility meter/monitor(s) when specifically designated. SPECIFIC Equipment furnished under section 230940 and installation by Contractor includes, but is not limited to:

1. Main Supervisory Computer Equipment/Software and Maintenance Agreement(s).
2. Main JACE (N4) Network Controllers.
3. VAV Air Terminal/FCU/WSHP Controllers – only as SPECIFICALLY Noted in OPR.

4. Non-Unitary Hydronic & Air Terminal Controllers – only as SPECIFICALLY Noted in OPR.
5. Energy-use Meters: as noted in OPR; coordinate with TCC for installation & wiring of power/communications as required by Equipment/devices furnished:
    a. Natural Gas Flow – Main/Sub Service only, provided by TCC as noted.
    b. Electric Power (Demand & Consumption) – Ensure Integration to Main & Sub-Services provided by TCC as noted.
    c. Domestic Water Flow - Main/Sub Service only, provided by TCC as noted.
6. Power Loss Panel – Main emergency alarm of Loss of Power, per Owner Standards.
7. Carbon Monoxide (CO) Detection & Local Annunciation System – Space Devices and Main Office Alarm to BAS of alert concentrations of CO, per Owner Standards.
8. Lighting Control System Controllers only as SPECIFICALLY Noted in OPR.

1.8 RELATED WORK SPECIFIED ELSEWHERE

A. Division 260000 Line & Low Voltage Electrical scopes & basic installation instructions, via Proposer/Contractor's TCC and Electrical Power/low-voltage (Systems) subcontractors:

1. Providing motor starters and disconnect switches (unless otherwise noted).
2. Power wiring and conduit (all line and low voltage unless otherwise noted).
3. Provision, installation and wiring of smoke detectors (unless otherwise noted).
4. Providing labor and material for physically mounting each JACE controller, loose sensor(s) and metering/monitoring component of the Integrated System.
5. Providing labor and material for physically mounting each BACnet™ based Lighting Control System panel(s)/controller, loose sensor(s) and metering/monitoring components of the Integrated Lighting Control System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
6. Providing labor for physically mounting each BACnet™ based Carbon Monoxide Detection & Monitoring System panel(s)/controller, loose sensor(s) and metering/monitoring components of the Integrated CO Detection System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
7. Providing labor for physically mounting each BACnet™ based HVAC Indoor Air Quality System panel(s)/controllers, loose sensor(s) and metering/monitoring components of the Integrated IAQ System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
8. Providing labor and material for Generator network, Critical Temperature Measurement, Security and Power Loss Panel monitoring network connections to the JACE (unless noted in other equipment sections).
9. Providing labor and material for; intranet, internet, BACnet, Modbus, etc. networking to the JACE from other systems or facility or global wide area networks.

1.9 AGENCY AND CODE APPROVALS

A. All products of the BAS shall be provided with the following and applicable-related agency approvals. Verification that the approvals exist for all submitted products shall be provided

with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916: Energy Management Systems.
2. UL-854: Smoke Control Systems.
3. ASHRAE Standard 135: BACnet™ Communication Protocol.
4. NFPA: Applicable Life Safety and Risk-Loss Provisions.
5. ULC; UL - Canadian Standards Association
6. FCC: Part 15, Subpart J, Class A Computing Devices

1.10 SOFTWARE LICENSE AGREEMENT

A. The Owner shall sign a copy of any TCS manufacturer's standard Unitary-Control-based software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. Software license shall not expire or utilize any sort of protection hardware device for its use.

C. A software license information form describing the manufacturer’s policies and implementation shall be provided to the Owner before the job is complete.

1.11 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.12 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the OPR/Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

1.13 WARRANTY

A. TCS warranty: Provider/Manufacturer’s standard form in which provider/manufacturer agrees to repair or replace components of TCS wiring & equipment that fails in materials or workmanship. Submit a written warranty signed by the TCS provider and installer agreeing to furnish labor and parts for failures within a warranty period of one (1) year from the date of substantial completion/documented Start-up.

B. Extended warranty: Provider/Manufacturer’s standard form in which TCS provider/manufacturer agrees to furnish parts and labor for Proposer/Contractor installed non-Integration-based TCS failures within an extended warranty period:

1. Term: Two (2) years (TOTAL) from the date of substantial completion.

2. Condition: The Second year of P & L coverage begins with final acceptance of TCS beneficial operation confirmed at 11-month TCS Walkthru with Owner’s Master Systems Integrator/Commissioning Provider & Owner’s representative.

1.14 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

BAS	Building Automation System
TCS	Temperature Control System
JACE	Java Application Control Engine (Tridium/Distech N4)
Cx/CxP	Commissioning/Commissioning Services Provider
IBC	Interoperable BACnet Controller
MSI	Master Systems Integrator
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OPR	Owner's Project Requirements
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement
TCC	Temperature Control Contractor
TAB	Test, Adjust and Balance "Contractor/Report"

PART 2 MATERIALS

2.1 GENERAL

A. The Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers specified and/or provided by the Owner's Master Systems Integrator (AGM Energy Services) for installation by this section sub-contractor and other control elements & devices provided and installed as required by this section sub-contractor as specified herein to achieve a fully-operational and energy-efficient facility operations OPEN Temperature Control/Building Automation System.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet technology communication protocols (MSTP/IP). The BAS is to be delivered by the noted combination of the Owner's Master Systems Integrator (AGM Energy Services) and Proposer/Contractor/TCC provided field/unitary control components via selected Vendors/Mechanical Contractor/Electrical Contractors.

1. The Main TCS/BAS Platform furnished, installed & implemented in this project must be equal to a current-version Distech or Johnson Controls, Inc. Facility Explorer™ System, engineered to be fully (certifiable) "OPEN" on the Tridium Niagara™ Framework.

a. Main Distributed Controller elements: "Distech/Johnson-FX80" (furnished by the MSI under 230940).

b. Distributed Application Specific Controller elements: "OPEN" (Niagara N4, BACnet™) Series (furnished by the MSI under 230940 as specified).

2. The software licensing required shall have no restrictions on which brand of JACE, Supervisor or System Programming tools can interact with the system. Station Compatibility must = ALL and Tool Compatibility must = ALL.

B. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

2.3 ENERGY-USE METERING DEVICES – ELECTRIC POWER

A. General: Each Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the BAS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the BAS or shall be communicated to the BAS over the open-protocol LAN (BacNet MSTP or Modbus).

2.4 ENERGY-USE METERING DEVICES – NATURAL GAS

A. General: NG flow meters shall be a thermal mass style flow meter, which translates gas flow into electronic output signals proportional to the flow sensed for input into the JACE/Building Automation System (BAS) via BACnet MSTP network connection, unless specified otherwise for the application. Flow meters shall be in-line or insertion type as required by the specified application. Accuracy shall be +/- 2% of actual reading.

2.5 ENERGY-USE METERING DEVICES – DOMESTIC WATER

A. General: Water flow meters shall be ultrasonic-type or axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed for input into the BAS/Temperature Control System (TCS) as noted. Design and supply/install meter equipment approved for use by the local utility as applicable. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters choice/mounting shall be suited to the specific application and equipment choice, including in-line or 'insertion' type. Accuracy shall be +/- 2% of actual reading from 0.4 to 20 feet per second flow velocities. Ultrasonic Flow Meters shall be non-insertion/clamp-on setups using Doppler/Time Transit technology to transmit sensor signals to the JACE/Building Automation System (BAS) via BACnet MSTP network connection, unless specified otherwise for the application.

B. Closed & Open Hydronic Loop Makeup Systems: Provide Inline-pipe style fluid meter systems designed for pulse output with Remote Rate and Totalization capabilities. Meter equipment shall be brass body with stainless steel wetted parts, internal strainers and EPDM O-ring sealing designs. Accuracy shall be equivalent to 2% reading at or below 10% of full continuous flow rate. Output signal shall be selected and coordinated with Owner's Master Systems Integrator to ensure data collection as specified to transmit information to the JACE/Building Automation System (BAS) preferably via BACnet MSTP network connection, unless required otherwise for the application.

2.6 ANCILLARY CONTROL SYSTEM HARDWARE ELEMENTS

A. Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

1. Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.
2. Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.
4. Provide ON/OFF power switch with over-current protection for control power sources to each local panel.
5. Provide/mount “lamacoid”/similar engraved label for each major subpanel/enclosure containing TCS devices coordinated with TCS Submittals and Design/Submittal documentation issued.

B. Sensors:

1. Electronic Temperature Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
2. Resistance Temperature Detectors: Platinum, thermistor, or balco.
    a. Accuracy: Plus or minus 0.2 percent at calibration point; thermistors shall have a maximum 5 year drift of no more than .225°F maximum error of no more than .36°F
    b. Wire: Twisted, shielded-pair cable
    c. Insertion Elements in Ducts: Single point, 6 inches long; use where not affected by temperature stratification or where ducts are smaller than 4 sq. ft.
    d. Averaging Elements in Ducts: 60 inches, long, flexible for use where prone to temperature stratification or where ducts are larger than 4 sq. ft.; 264 inches long, flexible for use where prone to temperature stratification or where ducts are larger than 16 sq. ft; length as required.
    e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
    f. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
    g. Room Security Sensors: Stainless steel cover plate with insulated back and security screws.
3. Humidity Sensors: Bulk polymer sensor element.
    a. Accuracy: 2 percent at 10-90% RH with linear output.
    b. Room Sensors: Range of 0 to 100 percent relative humidity
    c. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
4. Static-Pressure Transmitter: ondirectional sensor with suitable range for expected input, and temperature compensated.

a. Accuracy: +/- 1 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA, 0-5 vDC, 0-10 vDC.
c. Building Static-Pressure Range: -.1 to .1, -0.25 to 0.25, -.5 to .5, -1.0 to 1.0 IN WC., jumper selectable.
d. Duct Static-Pressure Range: 0 to 1, 0 to 2.5, 0 to 5, 0 to 10 IN WC., jumper adjustable

5. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.

C. Equipment operation sensors as follows:

1. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 IN WC.
2. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig.
3. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable trip point, split core with an integral LED for trip indication and set to 175 percent of rated motor current.

D. Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

E. Water-Flow Switches: Pressure-flow switches of bellows actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless steel or bronze paddle. For chilled water applications, provide vapor proof type.

F. Carbon-Monoxide Detectors: Single or multi-channel, dual-level detectors, using solid-state sensors with 3-year minimum life, maximum 15-minute sensor replacement, suitable over a temperature range of 23°F to 130°F, calibrated for 50 and 100 ppm, with maximum 120-second response time to 100-ppm carbon monoxide.

G. Carbon-Dioxide Sensor and Transmitter: Single detectors, using solid-state infrared sensors, suitable over a temperature range of 23°F to 130°F, calibrated for 0 to 2 percent, with continuous or averaged reading, 4 to 20 mA output, and wall mounted.

H. Oxygen Sensor and Transmitter: Single detectors, using solid-state zircon cell sensing, suitable over a temperature range of -32°F to 1100°F, calibrated for 0 to 5 percent, with continuous or averaged reading, 4 to 20 mA output, and wall mounted.

I. Refrigerant Detectors: Dual-level detectors, using solid-state sensors, with alarm preset for 300 ppm, alarm indicator light, alarm silence light and button, alarm test light and button, and trouble light. Provide auxiliary relay preset for 150 ppm.

J. Occupancy Sensor: Passive infrared, with time delay, daylight sensor lockout, sensitivity control, and 180-degree field of view with vertical sensing adjustment, for flush mounting

K. Non-Unitary Thermostats:

1. Combination Thermostat and Fan Switches: Line-voltage thermostat with two-, three-, or four-position, push-button or lever-operated fan switch.
2. Label switches "FAN ON-OFF," "FAN HIGH-LOW-OFF," "FAN HIGH-MED-LOW-OFF." Provide unit for mounting on two-gang switch box.

L. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater.

M. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch type, or equivalent solid-state type, with heat anticipator, integral manual on-off-auto selector switch.

1. Equip thermostats, which control electric heating loads directly, with off position on dial wired to break ungrounded conductors.
2. Dead Band: Maximum 2°F.

N. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature, with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit, adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches, with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

O. Fire-Protection Thermostats: UL listed with fixed or adjustable settings to operate at not less than 75°F above normal maximum operating temperature, with manual reset with control circuit arranged to directly shutdown appropriate equipment and provide remote annunciation at the GUI.

P. Room Thermostat Cover Construction:

1. Set-Point Adjustment: Concealed or exposed
2. Set-Point Indication: Concealed or exposed
3. Thermometer: Optional
4. Color: Neutral
5. Orientation: Vertical or horizontal

Q. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.
2. Thermostat Guards: As specified in tamper prone areas
3. Adjusting Key: As required for calibration and cover screws.
4. Set-Point Adjustment: 1/2-inch diameter, adjustment knob.

R. Electric Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

S. Electric High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above set point.
   1. Bulb Length: Minimum 20 feet.
   2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

T. Heating/Cooling Valve-Top Thermostats: Proportional acting for proportional flow, molded-rubber diaphragm, remote-bulb liquid-filled element, direct and reverse acting at minimum shutoff pressure of 25 psig., and cast housing with position indicator and adjusting knob.

2.5 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action under all environmental conditions (temperature, low power voltage fluctuations, tight seal damper design, maximum air and water flow forces).

   1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   2. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   3. Spring-Return Motors for Valves Larger Than NPS 2-1/2": Size for running and breakaway torque of 150 in. x lbf.
   4. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
   5. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.

B. Electronic Damper and Valve Actuators: Direct-coupled type non hydraulic designed for minimum 100,000 full-stroke cycles at rated torque. The actuator shall have rating of not less than twice the thrust needed for actual operation of the damper or valve.

   1. Coupling: V-bolt and V-shaped, toothed cradle.
   2. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
   3. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
   4. Actuators shall have the ability to be tandem mounted.
   5. All spring-return actuators shall have a manual override. Complete manual override shall take no more than 10 turns.
   6. Power Requirements (Two-Position Spring Return): 24V ac or dc, Maximum 10VA.
   7. Power Requirements (Modulating): Maximum 15 VA at 24V ac.
   8. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
   9. Temperature Rating: -22°F to 140ºF.
   10. Run Time: 200 seconds open, 40 seconds closed.
   11. All actuators shall have a 5 year warranty
   12. Valves: Designed & Selected for application/duty designated.
      a. Size for torque required for valve close-off at maximum pump differential pressure (regardless of water loop system pressures).

b. Valve and Actuators shall come from the factory fully assembled.
c. Spring Return Manual Override shall come with a 10 Degree Valve Preload to assure tight close off.

13. Dampers: Designed & Selected for application/duty designated.

a. Size for running torque calculated as follows:

i. Parallel-Blade Damper with Edge Seals: 7 inch-pounds/sq. ft. of damper.
ii. Opposed-Blade Damper with Edge Seals: 5 inch-pounds/sq. ft. of damper.
iii. Parallel-Blade Damper without Edge Seals: 4 inch-pounds/sq. ft. damper.
iv. Opposed-Blade Damper without Edge Seals: 3 inch-pounds/sq. ft. of damper.
v. Dampers with 2 to 3 Inches wg. of Pressure Drop or Face Velocities of 1000 to 2500 FPM Multiply the minimum full-stroke cycles above by 1.5.
vi. Dampers with 3 to 4 Inches wg. of Pressure Drop or Face Velocities of 2500 to 3000 FPM Multiply the minimum full-stroke cycles above by 2.0.

b. Spring Return Manual Override actuators shall a factory set 5 Degree Damper Preload.

2.6 CONTROL VALVES

A. General: Control valves shall be 2-way or 3-way pattern (or combination Butterfly-style as noted) as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be ‘line’ size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves with sizes up to and including 2 inches shall be “screwed” configuration and 2-1/2 inch and larger valves shall be “flanged” configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed). Two/Three-way butterfly valves, when utilized, shall include a separate actuator for each butterfly segment.

PART 3 EXECUTION

3.01 GENERAL

A. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians/electricians qualified for this work and in the regular employment of the temperature control system installer. The installing office shall have a minimum of five years of installation experience with similar Scopes of Work and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the selected component manufacturer(s). Supervision, calibration and checkout of the system shall be by the employees of the local installer contracting field office. Intent is to install & wire (power and Communications) Contractor and Owner-Furnished components/systems (coordinated with Master Systems Integrator AGM Energy Services) including, but not limited to (refer to accompanying OPR documents & designated Product Data/IOMMs/Cut Sheets):

a. Distributed OPEN JACE Controllers, Meters, Sensors, communication cabling and auxiliaries.

b. Distributed OPEN Application Controllers, sensors, communication cabling and auxiliaries.

c. Electric Power Monitoring equipment – Coordinate functionality of existing meters.

d. Natural Gas Metering equipment - Coordinate functionality of existing meters.

e. Digital-Integrated Lighting Control Panels/equipment.

B. Install system and materials in accordance with acceptable industry methods & procedures, local standards and manufacturer's instructions, and as outlined/detailed in the project drawing set/OPR documents.

C. Drawings of temperature control systems in the OPR are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative to the complete satisfaction of the Owner/Design Engineers shall be furnished and installed without additional cost.

D. Install equipment level and plumb.

E. Install/implement software in Unitary control units and assure interface(s) to Owner's operator workstation(s), Coordinated with the Systems Integration Provider. Implement all features of programs to specified requirements and as appropriate to Sequences of Operation.

F. Connect and configure equipment and software to achieve Sequences of Operation specified.

G. Verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate all to ADA standards/level above the floor. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

H. Install guards or tamper proof enclosures on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.

I. Install automatic dampers according to manufacturer's listed instructions.

J. Install damper actuators on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

K. Install labels and nameplates to identify control components.

M. Install hydronic instrument wells, valves, and other accessories according to manufacturer's listed instructions"

N. Install refrigerant instrument wells, valves, and other accessories according to manufacturer's listed instructions.

O. Install duct volume-control dampers according to according to manufacturer's listed instructions.

P. Install electronic and fiber-optic cables according to manufacturer's listed instructions and NEC requirements.

3.02 JOB SITE CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It is the TCC/Proposer-Contractor's responsibility to check the Contract Documents for possible conflicts between this Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural feature.

3.03 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to manufacturer's listed instructions and NEC requirements.

B. Install building wire and cable according to manufacturer's listed instructions and NEC requirements.

C. Install signal and communication cable according to manufacturer's listed instructions and NEC requirements.

1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
2. Install exposed cable in raceway.
3. Install concealed cable in raceway.
4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.

D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

F. Where Serial Communication/BAS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.04 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Install piping adjacent to machine to allow service and maintenance.

B. Ground equipment. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL/FINAL CHECKOUT OF TCS

A. Installer's Field Service: Engage a qualified service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing. Calibration and test electric/electronic thermostats by disconnecting input sensors and stimulating operation with compatible signal generator.

1. Notify Owner/Project Construction Administration Team no less than TWO Weeks prior to scheduling the Final Checkout of EACH Major Area/Portion of the OPEN Temperature Control System and allow an Owner's Representative(s) to observe any of the scheduled Final Checkout procedures planned by the factory-TCC to achieve the Field Quality Control directives of this Specification; document results and transmissions.

B. Replace damaged or malfunctioning controls and equipment.

1. Start, test, and adjust control systems.
2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

C. Verify Unitary (manufacturer designed & factory/field-installed) DDC Systems as follows:

1. Verify software including automatic restart, control sequences, alarms, scheduling, reset controls, and occupied/unoccupied cycles.
2. Verify local control units including self-diagnostics.

D. Cooperate & Coordinate with Testing & Balancing services providers to achieve Sequences of Operation specified/final-designed.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 20 hours (“banked”) dedicated instructor time on-site.
4. Review data in maintenance manuals.
5. Schedule training with Owner, through Design Engineer, with at least seven days' advance notice.

3.07 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide for three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

1. Two of the after-completion Project Site Visits will be noted as SEASONAL with intent of making Entering Heating and Entering Cooling System assessments.
2. The Third after-completion Project Site Visit will be at the time where Eleven months has elapsed from the date of Final Project Acceptance with intent of assessing the status of the original Warranty Period and current operating conditions.

3.08 WARRANTY EXECUTION

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance as defined in 3.10 D.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Division 230900 provider at no expense to the Owner.

3.09 WARRANTY ACCESS

A. The Owner may grant to qualified Mechanical Service contractors, reasonable access to the TCS during the warranty period.

3.10 ACCEPTANCE TESTING

A. The Division 230900 provider shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The Division 230900 contractors and 230940 services provider are to coordinate the checkout of the system such that each Division has a representative present during system checkout.

B. The Division 23900 provider shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation. The Division 230940 provider shall have a representative present during system checkout by the Division 230900 provider.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: is defined as the 230900 supplier and Proposer/Contractor having completed all of the testing and demonstration activities as required by the MSI/Cx (Commissioning Services Provider – AGM Energy Services) commissioning plan including prefunctional and functional testing and bi-seasonal testing and receiving an acceptance letter issued by the OWNER/Cx for this specification section. The Proposer/Contractor & Owner will determine the date of Functional Completion after reviewing the Commissioning Provider’s recommendation for Functional Completion. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

END OF SECTION 230900

SECTION 230929 – HVAC INDOOR AIR QUALITY SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY AND INTENT

A. This Section includes framework/components for new implementations of Air Filter Media (as-noted) and newly-installed Vendor-designed HVAC Indoor Air Quality Systems. Contractors to Provide full Assessment & Design with Field-coordination for each IAQ System utilized. Basic System Configurations anticipated:
   1. Custom-designed, factory/field-installed Ultraviolet-C (UV-C) Spectrum Emitters for High-Efficiency Rooftop HVAC Units (RTU) Airflow Stream & Cooling Coil Cleaning.

B. Basic Project Parameters: The specified UV-C IAQ Systems are intended for dual-functions. Coil sanitizing UV-C systems are to be individually-engineered/selected for constant energy face-of-coil duty. Airstream sanitizing UV-C systems are expected to provide a 1 Log reduction of infectious particles at design air velocity with a minimum target dosage of 1,500 $\mu W \cdot s/cm^2$, according to current ASHRAE Recommendations/Standards. It is expected that the Proposer and UV-C Vendor design these dual-function UV-C systems and configurations appropriate for each AHU/RTU/DOAS. Some unit applications may involve compromises on expected design parameters given limited available space in the targeted unit. Significant deviations shall be investigated on a case-by-case basis and will be reviewed by the Criteria Engineer. In-duct airstream disinfection is permissible only in exposed ductwork, accessible for maintenance. Any duct-airstream UV-C required due to in-unit dimensional limitations is expected to complement separate coil disinfection UV-C Systems and maintain the same schematic design requirements for safety and integration. All required In-duct UV-C IAQ applications require new duct-mounted maintenance/access doors to be installed with related safety interlocks as specified for In-Unit applications. All outdoor installations are to use appropriate weather and exposure rated materials.

C. It is the Intent of this Project to completely final design/install/coordinate the designated Owner qualified HVAC Indoor Air Quality Systems Equipment/Piping/Wiring/Controls Systems & coordinate the applicable Vendor-based Support Services (equipment & services delivery, lead times/field-coordinate options, confirm technical performance, confirm physical information and fully integrate pertinent accessories/Options) for a Total HVAC IAQ System. The Contractor and selected HVAC IAQ Vendor (Pre-Purchased Equipment) have the ultimate responsibilities of performing the final Design & selections, coordination/recommended solutions being accepted with the chosen Vendor by this Contractor, as coordinated with the County's Master Systems Integrator. The Selected/Basis-of-Design Vendor/manufacturer of the HVAC Indoor Air Quality Systems and Services will accept and will properly execute all reasonable and required equipment furnishing & support services to this Final Design & Installing Contractor. The expected Contractor-provided Support Services required to be coordinated in this solicitation includes, but is not limited to:
   1. Detailed & complete Final/As-ordered Submittal preparation:
      a. For use in Plan Approval/Submission activities.
      b. For use in installation/field coordination.
      c. Updated for Accurate As-Built documentation.

2. Final/specific Engineering/Coordination for Line/Low Voltage Wiring components, routing & sizing for the solution(s) accepted.
3. Final/specific Engineering/Coordination for Factory-recommended Sequences of Operation and Controls/Safety Interlocks coordination as applies to identified Project Scopes of Work, including updating Sequences of Operation as applicable and as coordinated with County's Master Systems Integrator (AGM Energy Services).
4. Site-specific field-coordination for Complete Factory-authorized/recommended installations.
5. Coordination of Factory-authorized/provided Equipment/Systems Start-up, Training and Documentation.
6. Coordination of Factory-sponsored Maintenance Services, as applicable.
7. Coordination of Factory-authorized/provided Warranty support.

D. The selected Basis-of–Design Vendor of the HVAC Indoor Air Quality Systems is expected by the Owner to provide the following:
1. Detailed & complete pre-order Submittal preparation.
   a. Schedule of as-calculated performance criteria for each System (UV-C, Filters, etc.), tagged by Service/location (i.e. AHU/RTU/DOAS-XXX).
   b. For use in installation coordination, including product-related data/information published in the Design-Build Contractor bid packages.
   c. Updated for Accurate As-Built documentation.
2. Engineering/Coordination assistance for Line/Low/Communication Wiring components, routing & sizing for the solution(s) accepted, including Safety Shutdown routines.
3. Engineering for Factory-recommended Access Door Safety labeling, Sequences of Operation and Controls/Safety Interlocks coordination.
   a. Basic Sequence: interlock & operate the HVAC Indoor Air Quality Systems in conjunction with the High-Efficiency Rooftop HVAC Unit Systems such that after all safety control circuits are satisfied, the SYSTEM operates Stand-Alone to provide properly conditioned/IAQ-treated air to the facility.
   b. Unitary/Vendor Controls including full design & field implementation between the HVAC Indoor Air Quality Systems to establish "packaged HVAC Indoor Air Quality Systems Operation", including recommended updates to AHU/RTU/DOAS Heating/Cooling/Ventilation components.
   c. Coordination directly with Owner's Master System Integrator to address basic Integration (Point/Data transfers, Status, Alarms, etc.) and Operational Integrations for the HVAC Indoor Air Quality Systems (Heating/Cooling System/Fan & Door-Safety interlocks, special timing/reset sequences, scheduling, temperature setpoints, etc.).
4. Site-specific field-coordination for Factory-authorized/recommended installations.
5. Factory-authorized Equipment/Systems Start-up, Training and Documentation.
6. Factory-sponsored Preventative Maintenance Services, as applicable.
7. Factory-authorized/provided Warranty support.

E. Field-INSTALLATION (Final-DESIGN Assembly, Mounting, Ducting, Wiring, Remote Controls, furnished Accessories) of the designated HVAC Indoor Air Quality Systems IS intended for this specification, including physical/programming modifications required to any existing/applicable Ventilation Setups/Sequences to best serve the addition of the HVAC Indoor Air Quality Systems.

F. HVAC Indoor Air Quality Systems Product Design/Installation Manual Data: Refer to Vendor-prepared documents for selected Basis-of-Design layouts of Equipment/Controls/Wiring to use in preparing fully-coordinated options/proposals.
   1. Contractor/Bidders shall not hesitate to engage appropriate Basis-of-Design Vendors and/or Master Systems Integration team for provision of any additional information necessary for him to provide a complete proposal for the installation.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

B. Related Documents and Specification Sections include the following:
   1. Published Design Documents & Drawings including Schematics, Details, System Layouts and Network Architecture Schematics.
   2. Published Exhibit Documents & existing equipment Submittal Drawings including original Installation Manual documents.
   3. Division 23 Section “OPEN Temperature Controls” for basic HVAC Control System, Safety Interlocks & Monitoring elements of HVAC Indoor Air Quality Systems.
   4. Division 23 Section “Master Systems Integration Services” for basic Monitoring and Serial Communication elements of HVAC Indoor Air Quality Systems.
   5. Division 23 Section “High-Efficiency Rooftop HVAC Systems” for specific elements related to field (custom/coordinated) applications of HVAC Indoor Air Quality Systems.

1.3 GENERAL DESCRIPTIONS

A. This Section includes custom verified, calculated and designed HVAC Air Quality Systems for purpose of providing complete & safe operation and monitoring/control/feedback of installations to improve the designated environments. All fully-engineered piping/wiring/Unitary and Integrated Controls are required for complete HVAC IAQ Systems.
   1. System design includes Air Filter Media and Monitoring Systems.
   2. System design includes Airstream and Coil Cleaning Ultraviolet-C additions to High-Efficiency Rooftop HVAC /Dedicated Outside Air Unit Equipment with System Safety Interlocks and Warning Labeling.
   3. System design includes Airstream and Coil Cleaning Ultraviolet-C additions to High-Efficiency Rooftop HVAC /Dedicated Outside Air Unit Equipment with System Safety Interlocks and Warning Labeling.

B. HVAC Indoor Air Quality Systems manufacturer/Vendor is responsible for the general design & installation plan with provision for the specified/required Mechanical/Electrical equipment/accessories as shown/intended/required with full-coordination with Installing Contractor and Master Systems Integration teams, including a fully-sanctioned Training session on System installation by the Vendor prior to commencing project. Items pertaining to the HVAC Indoor Air Quality Systems that are NOT both furnished and installed by the HVAC Indoor Air Quality Systems manufacturer include:
   1. Support rails/Frame supports – furnished and installed/re-worked by Mechanical contractor; the selected HVAC Indoor Air Quality Systems will coordinate any/all mating surfaces with proposed equipment/systems and existing pads/supports prior to final ordering of equipment.

2. Electrical Power – HVAC Indoor Air Quality Systems manufacturer provides final designs for High-Efficiency Rooftop HVAC Unit-based raceways and conductors for noted line volt connections shown & as appropriate, set to receive incoming/modified field-provided power, (including any recommended/required Safety Interlocks). Electrical Sub-Contractor field-provides all final electrical connections/disconnect switches (miscellaneous field-installed only), external power wiring, safety switches, raceways, labeling, etc.
    a. Applications addressing 'Outdoor' HVAC Units (including, but not limited to both unit-mounted Systems and Exterior Duct-mounted Systems/components) will include power assessment, design and implementation according to the HVAC Indoor Air Quality Systems Vendor recommendations for the specific application.
3. Temperature Control Systems (non-Unitary) – designed/furnished/reviewed by Mechanical Contractor, unless specifically noted otherwise on layout drawings (Temperature Sensors, Safety Sensors/Switches, Flow Control Monitor devices, etc.).

C. Consideration of Alternate Manufacturers: For non-listed, but established manufacturers of HVAC Indoor Air Quality Systems, provide the following documentation a minimum of ten (10) working days prior to the published Proposal Due date, in order to be properly evaluated by the Criterion engineering design team:
1. Name of proposed manufacturer and company information/profile.
2. Name of proposed support organization (representative, distributor, etc.)
3. Product & Performance data (capacities, efficiencies, physical dimensions, acoustic ratings, etc.) of equipment proposed in the HVAC Indoor Air Quality Systems:
    a. Emitters.
    b. Basic Frames/Supports.
    c. Controls & Safeties.
    d. Accessories.
    e. Assembly Sizing & Layout.
    f. Electrical Wiring Sizing/Layout.
4. Location of nearest full-technical-service organization with full training on the proposed HVAC Indoor Air Quality Systems.
5. Disclosure of all known design, specification, installation and operational differences of proposed system from basis-of-design system.
6. Specific qualification statements relating to cautions of installations where possible safety or material degradation issues may exist while in Active Mode of operation.

1.4 LOCATION INSTALLATIONS

A. General: Coordinate final locations with published plans and documents, but prepare Vendor-designed HVAC Indoor Air Quality Systems for completely safe implementations in the following areas:
1. High-Efficiency Rooftop HVAC Units (1) total.

1.5 SUBMITTALS

A. General: Coordinated with Project Requirements & Pre-Purchased Equipment Submittal Information, properly-named electronic copies of shop drawings/product data of the entire HVAC Indoor Air Quality Systems with applicable Architecture/components shall be submitted/transmitted and shall consist of a complete list of equipment and materials, including

manufacturer's Completed Design Calculations, current catalog data sheets and installation/maintenance instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, integration descriptions, and any other details required to demonstrate that the system has been coordinated and can properly function as a Stand-alone "HVAC Indoor Air Quality System". Wiring Terminal identification for all Unitary & Field-applied control wiring shall be shown on the product data sheets. A complete written list of (integrated) Data Reporting Options shall also be included with the submittal package, as applicable.

B. Field-Review Assessment Report: for each designated implementation site (High-Efficiency Rooftop HVAC Unit System, etc.), prepare custom summary Assessment Report addressing pertinent implementation/design parameters affecting the sizing, installation, safe operation and maintaining of the HVAC Indoor Air Quality Systems. This Assessment Report shall be utilized as appropriate in selecting/sizing HVAC Indoor Air Quality Systems and shall include, but not be limited to:
   1. Verification/concerns of physical parameters (spacing, maintenance access, etc.).
   2. Verification/concerns for power & control and Safety Interlock wiring system implementation.
   3. Verification/concerns of possible-probable adverse effects of HVAC Indoor Air Quality Systems on surrounding infrastructure (surfaces, seals, etc.).
   4. Verification/concerns for complete and proper air filtration systems implementation in existing Air Handling Unit cabinetry/Air Plenums including condition of racks, supports, air baffles, etc.).

C. Product Data: For each type of HVAC Indoor Air Quality System (including applicable Air Filter Media) indicated/required, include the following:

   1. Component product data sheets (stands, frames, emitters, controls, etc.) for coordination and design review.
      a. Include complete Design Calculations demonstrating & documenting parameter used for selecting and sizing each implemented HVAC Indoor Air Quality System.
      b. Include sub-component details (Part numbers, lamp specifications, etc.) as required for continual/automatic use of system(s) proposed.
      c. Provide Product Data in 'Schedule' Form with Unit/location designations as to where/what sizes of Filters & HVAC Indoor Air Quality Systems are to be installed.
      d. Provide Warning Label items to be used post-installation for clear safety for Maintenance personnel.
   2. Wiring Diagrams: Power, signal, Communications and Unitary control wiring, including designations of any Safety circuits or wireless portions clearly noted.
   3. Installation Diagrams and Setup Instructions: Clearance designations, fastening requirements, mechanical/electrical/data systems installation, based on recommended criteria for specified applications.
   4. Point List/Data Registers for Serial Communications Interface capabilities/choices.

D. Operation and Maintenance Data: For each type/component of HVAC Indoor Air Quality System; include in emergency, operation, and maintenance manuals.
   1. Include a SPECIFIC Summary of required maintenance items for each System, complete with pertinent part numbers and frequency of maintenance actions recommended.
   2. Include Specified Start-up/Training and Turn-over/Commissioning-related Documents.

3. As applicable, provide Extended Maintenance Services Procedures, documentation, contacts, etc., complete with Dates of Service beginning and ending.

E. Upon completion of the work, provide a complete set of 'as-built' submittals/drawings on properly-labeled current magnetic media or compact disc/storage all licensed to the Owner/end user. Drawings shall be provided as Adobe or equivalent PDF compatible files. Two "hard" copies of the 'as-built' drawings shall be provided (in addition to the documents on flash drive media or compact disc). Also provide at Final-Acceptance/Completion of the Work:
1. Provide UPDATE to Product Data in 'Schedule' Form with Unit/location designations as to where/what sizes of Filters & HVAC Indoor Air Quality Systems were actually installed.
2. Replacement Media/component documentation, complete with Contact information on where to source.
3. Applicable Warranty Conditions documentation
4. Verification of final Training/Plans for additional/subsequent training.
5. Signed certificates of Completion (coordinated with County's Master Systems Integrator/Commissioning provider).

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain HVAC Indoor Air Quality Systems through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with the following references as applicable:

1. NEMA – Unitary Control panel enclosures.
2. UV-C System/Component Testing: ISO 9001:2015
3. ASHRAE – Standard 62.1.
4. ASHRAE – Standard 52.2-07, Appendix J
5. ETL/UL Listing: Provide labeled units/components as applicable to current standards of Underwriters Laboratories.
   a. UL 1598.
   b. UL 1995.
   c. UL 153.
   d. UL 900.

1.7 PRE-COMMISSIONING CRITERIA

A. Coordinate size and location of HVAC Indoor Air Quality Systems with equipment/spaces housing same, wiring systems as required and/or related systems and equipment.

1. Verify that Vendor's recommendations for complete safe and secure installations addressing serviceability and operational functions are achieved regardless of jobsite conditions at each installation.

1.8 EXTRA MATERIALS

A. Furnish total sets of materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. General: Two Sets (2) of each manufacturer-recommended Standard SPARE SERVICE PARTS for each unit/System furnished in project, properly transmitted and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Intent: The intent of below-listing specific names of manufacturers is NOT to pre-qualify compliance with the following specifications:
   1. Each submitted product AND Vendor Design Services must meet the complete intent of these specifications.
   2. Should a manufacturer's name/product be so listed, it is a requirement in the proposing process that any/all specification items NOT met are fully-disclosed at the time the offer is made.
   3. For any manufacturers not listed by name, proposer must submit to Owner's agent ten (10) days prior to closing date, a full submittal describing the product/system being proposed – refer to items in Part 1.3 of this specification.

B. Manufacturers: Subject to compliance with requirements, provide/coordinate/support HVAC Indoor Air Quality Systems by one of the following as furnished with Pre-Purchased Equipment:
   1. Air Filter Media:
      a. American Air Filter (AAF).
      b. Cam-Fil/Farr Air Filter.
      c. Clarcor-Airguard Filter.
      d. Columbus Industries, Inc.
      e. Flanders.
      f. Koch Filter.
      g. Engineer Approved Equals.
   2. Ultraviolet-C Systems:
      a. Fresh-Aire UV.
      b. Sterile-Aire.
      c. Ultraviolet Devices, Inc. (UVDI).
      d. Engineer-Approved Equals.

2.2 HVAC INDOOR AIR QUALITY SYSTEMS

A. General: Provide integrated system of components designed and assembled/installed to reliably and accurately Filter, Clean, Sanitize and Monitor/track/document Performance and Service Life of HVAC Indoor Air Quality Systems.

B. Air Filter Media: Provide specified components designed and assembled/installed to reliably and accurately Filter, Supply Air airflows in designated Air Handling Equipment. As a minimum, system to include:

1. Filters: Comply with NFPA 90A.
2. Filter Section: Provide filter holding frames arranged for angular orientation or as specifically noted on schedules/drawing details, with access doors as shown on drawings.
3. PRE-Filters - Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames.
    a. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
    b. Media and Media-Grid Frame**:** Nonflammable cardboard, Galvanized steel, or Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets.
    c. Thickness: 1, 2 or 4 inches as determined by each application.
    d. MERV Rating: 8 (for standard Pre-Filter duty).
    e. MERV Rating: 13 (for existing Filter Systems with Single Filter installations).
4. AFTER-Filters – Fully-incinerable, Extended-Surface, Disposable High-performance Cartridge/Pleated Filters: Factory-fabricated, dry, extended-surface filters designed for holding frames nominal 4-12 inch deep as suited for application.
    a. Media: Dual-layer Gradient-density Fibrous material formed into geometrically designed-V-shaped pleats/packs and held by self-supporting frame/wire/polymer pleat supports/separators for spacing & rigidity.
    b. Media and Media-Grid Frame**:** Nonflammable cardboard, Engineered polymer, Galvanized steel, or Fire-retardant beverageboard with gaskets and header frames designed for use in existing filter rack structures.
    c. Thickness: 4 to 12 inches.
    d. MERV Rating: 13 (minimum).
    e. Temperature Rating: 160 deg F.
5. Accessories: Provide the following:
    a. Provide Analog filter pressure drop gauge across each filter bank integrated into BAS as designated.

C. Ultraviolet C-wavelength Air Quality Systems: Provide Commercial/Institutional grade integrated system of Emitters Mounting Accessories and Control components designed and assembled to reliably and accurately Clean Coils & Airstreams in HVAC Air Handling Systems. As a minimum, system to include:

1. Ultraviolet-C Lamps/Emitters:
    a. Wavelength:
        1) 254 nm, 0% Ozone generation
    b. Design:
        1) Dosage Parameters (Coil Cleaning): 99.9% Aspergillus Niger.
            a) Output range Designed per application to achieve kill rate specified: minimum 1,225 $\mu W \cdot s/cm^2$ initial-thru-9000 hours of operation.
        2) Dosage Parameters (Airstream Cleaning-High Output): 99.9% Coronavirus Single-pass.
            a) Output average range Designed per application to achieve kill rate specified: 1,500-2500 $\mu W \cdot s/cm^2$
    c. Bulbs: Cold-environment, water-resistant shielded-quartz-hot-filament glass units.
        1) Environment:
            a) 35 deg F to 185 deg F.
        2) Expected Service Life:
            a) 2-years, always powered.
    d. Power Requirements: integrated power supply in NEMA enclosure (indoor-outdoor as required for design).

1) Line Voltage – 120/208/240
2) Low Voltage – 24vac
3) Communications – Coordinate with MSI

e. Safety Attributes:
1) Appropriate Use-Instructions & CAUTION Labeling
a) Inside air tunnels/ducts.
b) Outside air tunnels/ducts.
2) Shields to protect adjacent materials subject to degradation by System.

f. Accessories:
1) Radiometer:
a) Integration to BAS System – refer to Master Systems Integration specifications.
2) Appropriate Manufacturer-recommended Safety/Warning Labels for each installation.
3) Spare Components:
a) Bulbs: one set for each installation (Group).
b) Power/Controls: two spare power supplies per Group.

g. Application-designed/matched Support frame and/or rail:
1) Mounting:
a) Floor/Wall of Air Handling Unit Equipment – designed for balanced, stable, free-standing application.
2) Basic Structure options:
a) Corrosion-resistant factory-fabricated furniture-quality aluminum/steel frame & Finish:
b) Anodized/natural/polished.
c) Durable enamel paint.
d) Factory powder-coating.
e) Durable factory-fabricated furniture-quality carbon-based polymer frame & Finish.

h. Interface & Data Reporting: Provide engineered software and database-driven routines to allow HVAC Indoor Air Quality Systems to properly manage System Status, Efficacy and Service Life:
1) Data collection, Storage and Reporting:
a) Basic Database Parameters:
b) Name of System.
c) Facility & Unit Designation.
d) Name/Department Serviced.
e) Time of Initiation.
f) Time of Duration.
g) Notice of intensity-performance levels.
h) Owner-choice custom parameter(s).
i) Data Storage: engineered for local and global options.
j) Reports: Provide Flexibility in setup for: Periods (day, week, month, etc.), Sorting, Alarming, History.
2) System Data and Settings:
a) Status (based on self-diagnostic routines).
b) Scheduling: Occupied/Unoccupied.
c) Special Conditions.
d) Alarms:
e) Status Alarms.
f) System HIGH-Run Hours Alarms.

g) Critical System Alarms.

i. Serial Communications: Provide HVAC Indoor Air Quality Systems Open Standard Protocol:
1) BACnet ™

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install HVAC Indoor Air Quality Systems in accordance with system manufacturer's published installation instructions and general project intentions/locations.

1. Locate for best functionality.
2. Ensure safe & stable conditions for fixed and connected equipment.
   a. This includes the coordinated installation of Safety Devices (Access Door Switches, Alarms) as detailed and verified with HVAC IAQ Equipment/Systems vendors and County's Master Systems Integrator.
   b. This includes locating and affixing all Access Door Safety Warning Labels as detailed and verified with HVAC IAQ Equipment/Systems vendors and County's Commissioning Authority.
3. Coordinate installation to include secure/protected cabling connections.
4. Coordinate integrations of all software and Network communications.

B. Arrange installation of systems to provide access space around components for service and maintenance.

C. Electrical: Comply with applicable requirements of the NEC and in Electrical specification Sections for power wiring, field-performed Unitary wiring, and external Network cabling.

3.3 FIELD QUALITY CONTROL/FINAL CHECKOUT OF HVAC IAQ SYSTEMS

A. General: The HVAC Indoor Air Quality Systems provider shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications. With proper notification, the Division 23/25 (Master Systems Integration) contractors and 26 (Electrical/Systems) services providers are to support the checkout of the system such that each Division has a qualified representative present during system checkout.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect Units and field-installed components installation, including System's Substrate and all electrical connections. Report results in writing. Calibrate and test appropriate electric/electronic devices

and peripherals by disconnecting cables and simulating initiations, safety shutdowns/alarms and intended operations.

1. Notify Owner/Project Construction Team no less than TWO Weeks prior to scheduling the Final Checkout of each HVAC Indoor Air Quality Systems and allow an Owner's Representative(s) to observe any of the scheduled Final Checkout procedures planned by the manufacturer's representative to achieve the Field Quality Control directives of this Specification; document results and transmissions.
2. Replace damaged or malfunctioning controls and equipment as a result of installations and ready each HVAC IAQ System for proper Start-up.
    a. Start, test, and adjust complete systems.
    b. Demonstrate compliance with requirements, including calibration, testing, and verification of operational (including Safety Shutdown sequences/alarming) & reporting functionality.
    c. Adjust, integrate, and fine tune communications of equipment/systems to achieve sequences of operation and alarming/reporting as specified.
3. Verify Unitary (manufacturer designed & factory/field-installed) control/operation as follows:
    a. Verify applicable software functions including System identification & data recording, alarms, scheduling, Report generation and verification of Performance/disinfecting routines.
    b. Verify Unitary sequences including applicable self-diagnostics.
    c. Verify Communication and external data functions are executing as expected.
4. Cooperate & Coordinate with Information Technology, Fire Alarm, Security and BAS services providers to achieve integrated communications as designed.

3.4 DEMONSTRATION

A. Engage a manufacturer-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC Indoor Air Quality Systems.
    1. Schedule training with Owner, through Construction Team, with at least seven days' advance notice; document all proceedings and transmit records.
    2. Train Owner's maintenance personnel on procedures and schedules for initializing and interrupting operations, troubleshooting, servicing, self-diagnostic activities, and maintaining equipment.
    3. Provide operator training on data display/storage, alarm and status descriptors, requesting/transferring data, executing commands, calibrating and adjusting devices, resetting default values, and requesting/printing/storing Reports and logs. Include a minimum of 8 hours ("banked") dedicated instructor time on-site.
    4. Review contents provided in Operations & Maintenance Manuals.
    5. Review contents provided for Spare Materials.

3.5 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide for two (2) Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting devices and controls to suit actual conditions.
    1. One of the after-completion Project Site Visits will be noted as INITIAL FOLLOW-UP with intent of making as-operating assessments.

2. The other after-completion Project Site Visit will be at the time where Eleven months has elapsed from the date of Final Project Acceptance with intent of assessing the status of the original Warranty Period and current operating conditions.

3.6 WARRANTY EXECUTION

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of System Acceptance as defined in 3.8.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the HVAC Indoor Air Quality Systems provider at no expense to the Owner.

3.7 COORDINATION OF EXTRA MATERIAL DELIVERIES & STORAGE

A. Contractor and Suppliers of specified Extra Materials: Provide coordinated Bills-of-Materials and schedule for delivery and storage of Extra Materials with County Representatives at least 4 weeks prior to actual deliveries of equipment.

3.8 ACCEPTANCE TESTING

A. System Acceptance is defined as the HVAC Indoor Air Quality Systems supplier and main Proposer/Contractor having completed all of the testing and demonstration activities as required by the specifications, including functional testing and Training/Demonstration and receiving an acceptance letter issued by the OWNER for this specification section. The Proposer/Contractor & Owner will determine the date of Functional Completion after reviewing the Commissioning Provider’s recommendation for Functional Completion. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

END OF SECTION 230929

SECTION 230940 – MASTER SYSTEMS INTEGRATION SERVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions Specification Sections, apply to this Section.

B. The Owner's Project Requirement (OPR) documents provide additional Specification and graphical schematics (Drawings) to delineate responsibilities for Technical Services provided by the Owner's Master Systems Integrator (MSI) and the Contractor's Installation teams.

1. Refer to Section 230900 for Descriptions for field labor Installation of Master Systems Integration Services being provided to the Owner by the Design-Build Contractor via the Master Systems Integration & Integrated Commissioning Provider, (AGM Energy Services). These services include, but are not limited to:

a. Installation of low voltage cabling required.

b. Installation of network/communications cabling as required.

c. Installation of hardware components furnished as part of a Master Integrator/Contractor-selected, Vendor-supported Unitary System (i.e. Ultraviolet C-wavelength Air Quality Systems, etc.).

2. Refer to Section 230929 for Descriptions for Unitary System components and appropriate field labor Installation of HVAC Indoor Air Quality Systems being employed. These services include, but are not limited to:

a. Installation of hardware components furnished as part of a Master Integrator/Contractor-selected, Vendor-supported Unitary System (i.e. Ultraviolet C-wavelength Air Quality Systems, Filter Monitoring devices, etc.).

1.2 SUMMARY

A. This section describes the Master Systems Integration & Integrated Commissioning Services scope of work for the project. This section also coordinates the responsibilities of the Mechanical and Electrical trades (Contractor Team) contractors pertaining to control products or systems, furnished by each trade that will be integrated by this Services Provider.

1.3 MASTER SYSTEMS INTEGRATION SERVICES PROVIDER (MSI)

A. AGM Energy Services, LLC is the Owner's Master Systems Integrator (MSI) for this project. All MSI-related Services, as described in the OPR Documents, including this specification, will be covered under the Design-Build contract to the Owner in conjunction with all other related Scopes of Work/Contractors. <u>This section is provided for inclusion/reference and coordination of the Scope of Work.</u>

1. AGM will coordinate the Owner's STANDARDS for the following related functions:

a. Information Technology systems design & implementation, beyond that clearly noted as Installation scopes of Work by the Contractor.

b. Point List Naming conventions – TCC will provide English language Table-form data information for this coordination effort.

c. Graphic Screens & Navigation.

d. Programming Stations and Software functions.

e. End-of-Project Commissioning, Closeout & Training efforts specified/provided for in other MSI-related Sections.

f. Post-Project Warranty-period procedures as specified/provided for in other MSI-related Sections.

1.4 SYSTEM DESCRIPTION

A. The Building Automation and Control System (BAS) shall be comprised of Java Application Control Engine(s) (JACE) within each facility, as designed & provided by the MSI. The JACE (N4) shall connect to the Owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each JACE (N4) shall communicate to BACnet (Interoperable BACnet Controllers) components provided under Division (230900) Temperature Controls Installation Contractor & associated HVAC/Electrical Equipment specification sections (Integrations to Unitary Controllers).

1.5 SUBMITTAL

A. Submittal shall consist of a JACE detail drawing depicting communications network and protocols between the JACE and HVAC Equipment, generators, lighting controllers, power monitoring modules and Owner's internet bridge locations with a description of the communication type, media and protocol.

B. Upon completion of the work, provide a complete set of 'as-built' JACE detail drawings and application software on flash disk media or compact disc. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Multiple copies of the 'as-built' drawings shall be provided in addition to the documents on flash disk media or compact disc. The Mechanical Subcontractor (HVAC Unitary Controls), the Division (230900) Temperature Controls Contractor (TCC) and effective (260000) Electrical Systems Contractor (ESC) shall provide as-builts for their portions of work, via the Installation-focused contract. Division (230940) Master Systems Integration Provider (MSI) shall be responsible for as-builts pertaining to overall BAS architecture and network diagrams.

1.6 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

BAS	Building Automation (& Control) System
TCS	Temperature Control System
JACE (N4)	Java Application Control Engine (Vykon/Distech N4)
MSI	Master Systems Integrator
IBC	Interoperable BACnet Controller
GUI	Graphical User Interface
WBI	Web Browser Interface

POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
Cx/CxP	Commissioning/Commissioning Provider
TCC	Temperature Control Contractor
MSI	Master Systems Integrator
OPR	Owner's Project Requirements
PICS	Product Interoperability Compliance Statement

1.7 DIVISION OF WORK

A. The Section 230900 (TCC) contractor shall be responsible for all field labor & applicable materials for mounting & wiring designed/specified Building Automation System (BAS)/TCS components, (including specified Energy Metering & Lighting Control System devices), Distributed Application Specific Controllers/programming (as specifically noted), ancillary control devices, required fabricated control panels, any unitary/non-applied controller programming, unitary/non-applied controller programming software, labeled controller input/output and power wiring, labeled controller network wiring and (BAS)/TCS-based BACnet™ network wiring & connections to the Java Application Control Engine (JACE) N4 Networks, (applies to ALL required wiring scopes).

B. The Section 230940 (MSI) Master Systems Integration Services provider shall be responsible for the Java Application Control Engine (JACE) N4 components & software and programming of the JACE's, graphical user interface software (GUI), development of all graphical screens, setup of schedules, logs and alarms, BacNet(tm) network management as required to interface the JACE to the Contractor's TCS network/energy meters/lighting control systems, global supervisory control applications, general system integration of BACnet/Modbus devices as shown, integration and coordination and connection of the JACE to the local or wide area network. The Owner's Master Systems Integrator will provide the JACE(s) to the Contractor for field installation and utility meter/monitor(s) when specifically designated. SPECIFIC Equipment furnished under this section includes:

1. Main Supervisory Computer Equipment.
2. Main JACE Network Controllers.
3. Energy-use data-collecting Metering Equipment – furnished by TCC per 230900.
4. Application Specific Distributed Controllers (Terminal Units, etc.) – As Noted/Shown within published Construction (OPR) Documents.
5. Applicable Lighting Control System Equipment (as noted) – Design coordination & programming of Contractor-provided & installed Systems.
6. Data Analytics "CSV" Drivers.
7. Other elements as referenced in the OPR Documents/Systems Architecture Diagrams, including but not limited to:
    a. Specific Indoor Air Quality Monitoring Systems/Equipment.
    b. Specific HVAC Airflow Measuring Systems/Equipment.
    c. Specific Environmental Sensor-Controllers/Equipment.

d. Specific Emergency Power Systems/Equipment.

e. Specific Plumbing Systems/Equipment.

f. Specific Carbon Monoxide/Smoke Control/Airflow Management Systems/Equipment.

g. Specific Laboratory-focused Ventilation/Safety Systems/Equipment.

1.8 RELATED WORK SPECIFIED ELSEWHERE

A. Division (230900) Temperature Controls Contractor;

1. Providing control devices and systems including but not limited to:

a. Unitary-System/Equipment-based (Applied) Control panels, devices and System wiring.

b. Local controller and Temperature control device sensors/networks required for coordinated interface to unitary controllers provided by the Electrical/Mechanical Contractor via the Contractor.

c. TCC BACnet™ network connections to the JACE (N4) Controllers, Energy-use Meters, Lighting Control Panel(s)/Controllers, Carbon Monoxide (CO) Detection & BAS Monitoring Systems, Power Loss Alarms Panels, HVAC IAQ Systems, Air/Water Terminal Controllers, Packaged HVAC Units, VFDs etc.

B. Division 260000, Electrical (as coordinated by the Contractors TCC/Sub-contractors):

1. Providing motor starters and disconnect switches (unless otherwise noted).
2. Power wiring and conduit (unless otherwise noted).
3. Provision, installation and wiring of smoke detectors (unless otherwise noted).
4. Providing labor and material for physically mounting each JACE controller, loose sensor(s) and metering/monitoring component of the Integrated System.
5. Providing labor and material for physically mounting each BACnet™ based Lighting Control System panel(s)/controller, loose sensor(s) and metering/monitoring components of the Integrated Lighting Control System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
6. Providing labor for physically mounting each BACnet™ based Carbon Monoxide Detection & Monitoring System panel(s)/controller, loose sensor(s) and metering/monitoring components of the Integrated CO Detection System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
7. Providing labor for physically mounting each BACnet™ based HVAC Indoor Air Quality System panel(s)/controllers, loose sensor(s) and metering/monitoring components of the Integrated IAQ System per Owner Standards, ready for Integration into the designated BAS Network as coordinated with the Owner's Master Systems Integrator.
8. Providing labor and material for Generator network, Critical Temperature Measurement, Security and Power Loss Panel monitoring network connections to the JACE (unless noted in other equipment sections)
9. Providing labor and material for; intranet, internet, BACnet, LON, Modbus, etc. networking to the JACE from other systems or facility or global wide area networks.

1.9 AGENCY AND CODE APPROVALS

A. All products of the BAS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.

1. UL-916; Energy Management Systems
2. ULC; UL - Canadian Standards Association
3. FCC, Part 15, Subpart J, Class A Computing Devices

1.10 SOFTWARE LICENSE AGREEMENT

A. Software licensing for the JACE or Supervisor shall give the Owner the capability to control their system and determine which contractors can collaborate/engineer/apply within their system.

B. It shall be possible to ensure the Owner can prevent unauthorized partners from accessing the system for engineering changes.

C. Software licensing shall have the capability to individually manage authorized parties and independent parties.

D. The software licensing shall have no restrictions on which brand of JACE, Supervisor or System Programming tools can interact with the system. Station Compatibility must = ALL and Tool Compatibility must = ALL.

E. The Owner shall accept the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

1.11 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.12 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is the MSI/Cx Services Provider's responsibility to check the Contract Documents for possible conflicts between this Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural feature.

PART 2 MATERIALS

2.1 GENERAL

A. The Building Automation System (BAS) shall be comprised of a network of interoperable, stand-alone digital controllers specified and/or provided by the Owner’s Master Systems Integrator (AGM Energy Services) for installation by the 230900 TCS section sub-contractor. The TCS/Proposer-Contractor will also provide & install other control elements & devices as required by the intent of the BAS/OPR as specified herein to achieve a fully-operational and energy-efficient facility operation OPEN Temperature Control/Building Automation System. The BAS will also include: a computer system, graphical user

interface software, printers, network devices and other devices as specified herein. Focus of the system will be to serve the specific building/facility where installed but be OPEN connected via the Owner's network for global access & management.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall BAS.

2.2 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet technology communication protocols (MSTP/IP). The BAS is to be delivered by the Design-Build Contractor through the noted combination of the Owner's Master Systems Integrator (AGM Energy Services) and Contractor/TCC provided field/unitary control components via selected Vendors/Mechanical Contractor/Electrical Contractors.
   1. The Main TCS/BAS Platform furnished, installed & implemented in this project must be Tridium Niagara™ Vykon-OPEN System or Johnson Controls, Inc. Facility Explorer™ System, engineered to be fully (certifiable) "OPEN" on the Tridium Niagara™ Framework.
   2. Main Distributed Controller elements: Vykon "JACE 8000 Series", Distech Application Specific Controllers and/or JCI "FX80" Controllers.
   3. The software licensing required shall have no restrictions on which brand of JACE, Supervisor or System Programming tools can interact with the system. Station Compatibility must = ALL and Tool Compatibility must = ALL.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet/Ethernet IP and MS/TP.

C. All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 10/100 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Java Application Control Engine (JACE) N4, user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements, as coordinated with Owner's Informational & Operational Technology Departments:

1. Ethernet; IEEE standard 802.3
2. Cable; 10 Base-T, UTP-8 wire, category 5E
3. Minimum throughput; 10/100 Mbps

2.4 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.5 DATA COLLECTION AND STORAGE

A. The JACE shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the JACE that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the JACE and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.

D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

E. All log data shall be available to the user in the following data formats:

1. HTML
2. XML
3. Plain Text
4. Comma or tab separated values

F. Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

G. The JACE shall have the ability to archive its log data either locally (to itself), or remotely to a server or other JACE on the network. Provide the ability to configure the following archiving properties, at a minimum:

1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached it's user-defined capacity of data stores
4. Provide ability to clear logs once archived.

2.6 AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the JACE(N4). Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the JACE), to another JACE (N4) on the network, or to a server. For each log entry, provide the following data:

1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.7 DATABASE BACKUP AND STORAGE

A. The JACE shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

B. Copies of the current database and, at the most recently saved database shall be stored in the JACE. The age of the most recently saved database is dependent on the user-defined database save interval.

C. The JACE database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.8 GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System**:** The GUI shall run on Microsoft Windows current applicable version for the BAS.

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
    a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    b. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:

    a. Create, delete or modify control strategies.
    b. Add/delete objects to the system.
    c. Tune control loops through the adjustment of control loop parameters (If exposed in controller to LON or BacNET).
    d. Enable or disable control strategies (If exposed in controller to LON or BacNET).
    e. Generate hard copy records or control strategies on a printer.
    f. Select points to be alarmable and define the alarm state.
    g. Select points to be trended over a period of time and initiate the recording of values automatically.

h. Configure trends for all system devices as coordinated with CWRU for event analysis and troubleshooting.

E. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console

1. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supercede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.9 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the BAS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface. Systems that require different views or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java

authentication and encryption techniques to prevent unauthorized access shall be implemented.

2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Storage of the graphical screens shall be in the Java Application Control Engine (JACE), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
        1. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        2. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    c. View logs and charts
    d. View and acknowledge alarms
    e. Setup and execute SQL queries on log and archive information
7. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.10 SUPERVISORY SOFTWARE AND HARDWARE

A. A central server located at the designated Owner's Facility shall be provided/upgraded/integrated to with each application brought on-line into the Owner's OPEN BAS Network. The server shall support all Java Application Control Engine(s) (JACE) connected to the Owner's network whether local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, or T1 connections.

C. It shall be possible to provide access to all Java Application Control Engine (JACE) via a single connection to the server. In this configuration, each Java Application Control Engine (JACE) can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the server.

D. The server shall provide the following functions, at a minimum:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any JACE in the network, local or remote.
3. The server shall include a master clock service for its subsystems and provide time synchronization for all Java Application Control Engine (JACE)
4. The server shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
5. The server shall provide scheduling for all (JACE) and their underlying field control devices.
6. The server shall provide demand limiting that operates across all Java Application Control Engine (JACE). The server must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.
7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Java Application Control Engine (JACE).
8. Each Java Application Control Engine (JACE) supported by the server shall have the ability to archive its log data, alarm data and database to the server, automatically. Archiving options shall be user-defined including archive time and archive frequency.
9. The server shall provide central alarm management for all Java Application Control Engine (JACE) supported by the server. Alarm management shall include:
    a. Routing of alarms to displays, mobile voice devices, printers, email accounts and pagers as applicable/designated.
    b. View and acknowledge alarms.
    c. Query alarm logs based on user-defined parameters
10. The server shall provide central management of log data for all Network Area Controllers Java Application Control Engine (JACE) supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
    a. Viewing and printing log data.
    b. Exporting log data to other software applications.
    c. Query log data based on user-defined parameters

E. Server Hardware Requirements: The server hardware platform shall have the following requirements:

1. The computer shall be equal to a Dell 2600 series PowerEdge series computer with the following specifications:
    a. Intel™ Xeon™ CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors.
    b. Hard Drive: 4GB
    c. Display: Video card matched to Monitor with 1024 x 786 pixel resolution, 1080p (1920 x 1080) minimum resolution.
    d. 400MHz side Buss.
    e. 512K L2 cache.

f. 6 DDR SDRAM DIMM sockets supporting 6GB of main memory.
g. 7 expansion slots 2x64-bit/133MHz PCI-X, 4x64-bit/100MHz PCI-X, 1x32-bit/33MHz PCI.
h. LSI Logic 53C1030 Dual Integrated PCI Ultra320 LVD SCSI controller.
i. Raid Controllers – PERC4/Di, PERCC3/DC, PERC3/QC.
j. Drive Bays – Standard internal hard drive bays to support up to six 1" or Ultra320 SCSI hard drives.
k. 32X Combo CD-RW/DVD-ROM Drive.
l. Hard Drives Up to 8x1 hot plug SCSI Drives, 10,000 and 15,000 PRM (Future).
m. Provide Internal Storage 1.168TB Internal Storage in base equipment.
n. Internal Tape Backup PowerVault 100T DDS.
o. Dual Universal Serial Bus (USB) Ports.
p. 20" Flat Monitor 2000FP

2. The server operating system shall be current/best Microsoft Windows Professional and Include current/equivalent Firefox, Microsoft Edge or Google Chrome.
3. The server mobile operating system shall be iOS 12, iOS13, Android 8 Oreo, Android 9 Pie and Android 10.0 compatible, with Safari on iOS and Chrome on Android browsers.
4. Connection to the BAS network shall be via an Ethernet network interface card/adapter, 10/100 Mbps with RJ-45 connector.
5. As noted/specified for dedicated alarm printing, provide a compatible ink jet type printer, either 80 or 132 column width. The printer shall have an HSB/parallel port interface.

2.11 SYSTEM PROGRAMMING

A. The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy

identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.

2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.12 SERIAL NETWORK MANAGEMENT

A. The Graphical User Interface software (GUI) shall provide a complete set of integrated BACnet/LonWorks network management tools for working with BACnet/LonWorks networks. These tools shall manage a database for all BACnet/LonWorks devices by type and revision and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing BACnet/LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing BACnet/LonWorks devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Java Application Control Engine (JACE), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.13 OBJECT LIBRARIES

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
2. Calendar Object: The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to affect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the user's screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the

override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.

11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Java Application Control Engine (JACE). At a minimum, provide the following as part of the standard library included with the programming software:

1. BACnet/LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide BACnet/LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the BACnet/LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the BACnet/LonMark profile shall be provided by the device manufacturer.
2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.
3. For BACnet devices, provide the following objects at a minimum:
    a. BACnet AI
    b. BACnet AO
    c. BACnet BI
    d. BACnet BO
    e. BACnet Device
4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
5. For Modbus devices, provide the ability to interface to specific "data registers" as documented and supplied by the equipment vendor. Such as;
    a. Modbus GenericBI
    b. Modbus GenericBO
    c. Modbus GenericAI
    d. Modbus GenericAO
    e. Modbus 6xRecord
    f. Modbus BitsToRegister
    g. Modbus PresetCoil
    h. Modbus PresetRegister
    i. Modbus RegisterToBits.

2.14 ENTERPRISE-LEVEL CONTROLLERS - Java Application Control Engine (JACE)

A. The Division (230940) Master Systems Integration Contractor shall supply one or more Java Application Control Engine (JACE), as part of this contract – directly to the Owner via the Contractor. Number of area controllers required is dependent on the type and quantity

of devices provided under Divisions (230900) Temperature Controls and (260000) Electrical Systems. It is the responsibility of the Division (230940) Master Systems Integration Services provider to coordinate with the Division (230900) Temperature Controls Contractor and (260000) Contractors to determine the quantity, type and designated location of the Enterprise-level Controller devices.

B. The Java Application Control Engine (JACE) shall provide the interface between the LAN or WAN and the field control devices and provide global supervisory control functions over the control devices connected to the JACE (N4). It shall be capable of executing application control programs to provide:

1. Calendar functions
2. Scheduling
3. Trending
4. Alarm monitoring and routing
5. Time synchronization
6. Integration of LonWorks controller data and BACnet controller data
7. Network Management functions for all LonWorks based devices

C. The Java Application Control Engine (JACE), Vykon/Distech N4 platform must provide the following hardware features as a minimum, or as appropriate for the application:

1. Two Ethernet Port – 10/100 Mbps
2. Two RS 485 ports (BACnet MSTP compatible)
3. One USB port
4. Four option card slots/capacity
5. NRIO port (RS485 and/or IO16 or IO34 module local IO compatibility)
6. Designed for DIN rail mounting
7. Standard drivers include BacNet™, LonWorks™.
8. One LonWorks Interface Port – 78KB FTT-10A (via option card)
9. Provide Modbus Capability
10. SRAM data / memory backup
11. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity).
12. The JACE must be capable of operation over a temperature range of -20 to 60°C.
13. The JACE must be capable of withstanding storage temperatures of between -40 and 85°C.
14. The JACE must be capable of operation over a humidity range of 5 to 95% RH, non-condensing.

D. The JACE shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the JACE shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.

E. The JACE shall support standard Web browser access via the Intranet/Internet.

F. Event Alarm Notification and actions

1. The JACE shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

2. The JACE shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to:
    a. To alarm
    b. Return to normal
    c. To fault
4. Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
5. Provide timed (schedule) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

G. Control equipment and network failures shall be treated as alarms and annunciated.

H. Alarms shall be annunciated in any of the following manners as defined by the user:

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
    a. Day of week
    b. Time of day
    c. Recipient
3. Mobile Voice Devices via coordinated services that initiate a text-message upon receipt of call/email message.
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer
6. Audio messages

I. The following shall be recorded by the JACE for each alarm (at a minimum):

1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, accessway, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

J. Alarm actions may be initiated by user defined programmable objects created for that purpose.

K. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

L. A log of all alarms shall be maintained by the JACE and/or a server (if configured in the system) and shall be available for review by the user.

M. Provide a "query" feature to allow review of specific alarms by user defined parameters.

N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

O. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

2.15 DDE DEVICE INTEGRATION

A. The Java Application Control Engine (JACE) shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Java Application Control Engine (JACE) shall act as a DDE client to another software application that functions as a DDE server.

B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the BAS. Objects provided shall include at a minimum:

1. DDE Generic AI Object.
2. DDE Generic AO Object.
3. DDE Generic BO Object.
4. DDE Generic BI Object.

2.16 INTEROPERABLE OPEN BACnet™ APPLICATION SPECIFIC CONTROLLERS

A. Distributed-level Controls shall be microprocessor-based OPEN Interoperable BACnet (programmable) Controllers in accordance with the ANSI/ASHRAE Standard 135-1995. Controllers shall be provided for: Air Handlers, Heating Plants, Cooling Plants, Unit Ventilators, Fan Coils, Heat Pumps, Variable Air Volume (VAV) Terminals and all applications as shown on the OPR documents/drawings to meet the intentions of Distributed Systems Architectures for reliability and system functionality/Sequences of Operation. The application control program shall be resident within the same enclosure as the input/output circuitry, which translates the sensor signals. The system supplier must provide a PICS document showing the installed systems compliance level to the ANSI/ASHRAE Standard 135-1995.

B. The OPEN Distributed Controllers shall communicate with the Enterprise-level controller via an Ethernet connection at a baud rate of not less than 10 Mbps or via the RS485 connection at a baud rate of not less than 38 kbps.

C. The Controller Sensor(s) shall connect directly to the Controller and shall not utilize any of the I/O points of the controller. The Controller Sensor(s) shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The Controller Sensor(s) shall provide a communications jack for connection to the BACnet communication trunk to which the Controller is connected. The Controller Sensor(s), the connected Controller, and all other devices on the BACnet bus shall be accessible by a compatible Portable Operators Terminal.

D. All Controllers shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the Controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

E. The MSI will formulate/summarize & document the distributed application specific Controllers layout and intended function for each device, with the following information at a minimum:

1. BACnet Device; MAC address, name, type and instance number.
2. BACnet Objects; name, type and instance number.

F. The MSI shall supply a working, licensed copy of the programming software for all controllers to the Owner – refer to SUBMITTALS section for details.

G. It is the responsibility of the MSI to ensure that the proper BACnet objects are provided in each Controller, as required by the Sequences of Operation/Point Listings in the OPR/drawings.

2.17 RADIOMETERS

A. General: Select and Provide Ultraviolet-C Sensor/Controller as part of integrated Indoor Air Quality Systems in locations designated complete with housing, power supply, local display, and alarms/buzzer designed for installation in Indoor Air Handling Units. Each Radiometer shall be equal to model 'UVT-RAD-100DL' by UVTronix Corporation and have the following attributes/features:

1. Operation Indication: LED, multi-color.
2. UV intensity sensor: programmable for spectrum designed with operational feedback:
    a. Saturated condition.
    b. Open Circuit/Fault Condition.
3. Monitoring Functions:
    a. Light Intensity (nm).
    b. Days Counter.
    c. Abnormal Operation.
4. Relay Output – dry contact.

2.18 ENVIRONMENTAL SENSORS

A. General: Select and Provide multi-purpose/multi-function Indoor ceiling-mounted Environment Sensor Controllers in locations designated complete with Live Display, Tamper Alarm and IK10 Vandal-proof housing designed for installation in high-traffic areas. Each Environmental Sensor shall be equal to model 'Halo' by IPVideo Corporation and have the following attributes/features:

1. Vape and THC Detection and Reporting.
2. Indoor Air Quality Monitoring (Air Quality Index).
3. Indoor Environment Monitoring:
    a. Temperature.
    b. Humidity.
    c. Air Particulates.
    d. Light Levels.
    e. Acoustic Levels.
4. Aggression (including audible spoken Key word) Detection with Reporting.
5. Vandalism/Trespassing Alert Functions with Reporting.
6. Gunshot Detection and Reporting.
7. Chemical/Gas Detection and Reporting:

a. Carbon Dioxide.

b. Total Volatile Organic Compounds.

c. Carbon Monoxide.

d. Ammonia.

8. Operating Conditions:

a. Temperature: 32 deg F to 122 deg F.

b. Humidity: 0-90% Relative Humidity, non-condensing.

9. Network Communications: Ethernet RJ-45 (10/100 Base-T).

a. BACnet.

10. Alarm Functions:

a. Local Status Light.

b. Relay outputs – two, configurable.

c. Speaker – configurable.

2.19 ENERGY-USE METERING DEVICES – ELECTRIC POWER

A. General: Each Power Measurement Interface (PMI) device shall include the appropriate current and potential (voltage) transformers. The PMI shall be certified under UL-3111. The PMI shall perform continuous true RMS measurement based on 32 samples-per-cycle sampling on all voltage and current signals. The PMI shall provide outputs to the FMCS based on the measurement and calculation of the following parameters: (a) current for each phase and average of all three phases, (b) kW for each phase and total of all three phases, (c) power factor for each phase and all three phases, (d) percent voltage unbalance and (e) percent current unbalance. These output values shall be hard-wired inputs to the FMCS or shall be communicated to the FMCS over the open-protocol LAN (BacNet or Modbus).

2.20 ENERGY-USE METERING DEVICES – NATURAL GAS

A. General: NG flow meters shall be a thermal mass style flow meter, which translates gas flow into electronic output signals proportional to the flow sensed for input into the JACE/Facility Management Control System (FMCS). Flow meters shall be in-line or insertion type as required by the specified application. Accuracy shall be +/- 2% of actual reading.

2.21 ENERGY-USE METERING DEVICES – DOMESTIC WATER

A. General: Water flow meters shall be ultrasonic-type or axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed for input into the BAS/Temperature Control System (TCS) as noted. Design and supply/install meter equipment approved for use by the local utility as applicable. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag. Flow meters choice/mounting shall be suited to the specific application and equipment choice, including in-line or ‘insertion’ type. Accuracy shall be +/- 2% of actual reading from 0.4 to 20 feet per second flow velocities. Ultrasonic Flow Meters shall be non-insertion/clamp-on setups using Doppler/Time Transit technology to transmit sensor signals to the JACE/Building Automation System (BAS) via BACnet MSTP network connection, unless specified otherwise for the application.

B. Closed & Open Hydronic Loop Makeup Systems: Provide Inline-pipe style fluid meter systems designed for pulse output with Remote Rate and Totalization capabilities. Meter equipment shall be brass body with stainless steel wetted parts, internal strainers and EPDM O-ring sealing designs. Accuracy shall be equivalent to 2% reading at or below 10% of full continuous flow rate. Output signal shall be selected and coordinated with Owner's Master Systems Integrator to ensure data collection as specified to transmit information to the JACE/Building Automation System (BAS) preferably via BACnet MSTP network connection, unless required otherwise for the application.

PART 3 EXECUTION

3.1 INSTALLATION

A. All work described in this section shall be performed by the Owner's Master System Integrators or qualified sub-contractors that have a successful history in the design and implementation of integrated control systems.

B. Coordinate implementation of system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

1. Locate Indoor Air Quality System Monitoring Devices as coordinated with Design/Implementation of Unitary Systems provided by the Contractor (UV-C).

2. Locate Environmental Sensors in following areas, coordinate with Published Layouts/Drawings:

a. Main Toilet Room Areas.

b. Main Locker Room Areas.

C. Drawings of BAS network are diagrammatic only and any apparatus not shown but required to make the system operative to the complete satisfaction of the Owner shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the BAS/control diagrams shall be furnished and installed as noted by the Contractor via his pre-qualified Division 230900 Temperature Control Installer in accordance with the specifications in Divisions 230000 and 260000.

3.2 WIRING

A. All electrical control wiring and power wiring to the JACE, computers and network components shall be the responsibility of the Contractor via his pre-qualified Division 230900 Temperature Control Installer and in accordance with the specifications in Divisions 230000 and 260000. Coordination of this implementation is provided by the (230940) MSI contractor (AGM Energy Services).

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 260000), the National Electrical Code and any applicable local codes. All BAS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 260000) unless otherwise allowed by the National Electrical Code or applicable local codes. Where BAS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.3 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) reviewed/coordinated by the MSI.

3.4 WARRANTY ACCESS

A. The Owner shall grant to the Division (230940) MSI contractor, reasonable access to the BAS during the warranty period. The Owner shall allow the contractor to access the BAS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.5 ACCEPTANCE TESTING

A. Upon completion of the installation, the Division 230940 (MSI) shall load all system software and start-up the system. The Division 230900 (TCC) contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications. The Division 230940 (MSI) and Proposer/ Contractor via his pre-qualified Division 230900 Temperature Control Installer are to coordinate the checkout of the system such that each Division has a representative present during system checkout.

B. The Division 230900 (TCC) contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation. The Division 230940 (MSI) contractor shall have a representative present during system checkout by the Division 230900 (TCC) contractor.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: is defined as the 230940 Master Systems Integration provider having completed all of the testing and demonstration activities as required by the Cx's (Commissioning Agent) commissioning plan including prefunctional and functional testing and bi-seasonal testing and receiving an acceptance letter issued by the Owner's Commissioning Agent (Cx) for this specification section. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the BAS hardware and software has been established the Temperature Control sub-contractor shall provide on-site operator instruction to the Owner's operating personnel. Operator

instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. The Division 230940 (MSI) contractor shall provide 12-30 hours of instruction to the Owner's designated personnel on the operation of the BAS and describe its intended use with respect to the programmed functions specified. Operator orientation of the BAS shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Initial Training: One day session (2-8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the Owner's personnel can start to familiarize themselves with the system before classroom instruction begins.

2. First Follow-Up Training: One/Two days (8-16 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.

3. Warranty Follow Up: One day (2-6 hours total) in no less than 2 hour increments, to be scheduled at the request of the Owner during the one year warranty period. These sessions shall cover topics as requested by the Owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

3.7 CLOSEOUT SUMMARY & INTEGRATED COMMISSIONING

A. The Division 230940 (MSI) Services Provider shall refer to & coordinate Items addressed in sections included in 230000 and with section 230900 (TCC) to determine what level of control the Java Application Control Engine (JACE) must provide, which is the responsibility of this OPEN Master Systems Integrator. It is the responsibility of the 230940 (MSI) Services Provider to coordinate control functions, such as scheduling and supervisory-level global control with the Contractor via his pre-qualified Division 230900 Temperature Control Installer(s).

END OF SECTION 230940

SECTION 233113 - METAL DUCT SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Related Sections "Overall Specifications" for Commissioning phase requirements for systems served by metal duct systems.
2. Related Sections "HVAC Airflow Measuring Systems" and “HVAC Indoor Air Quality Systems” for metal duct system requirements affected by installation of Control & Integration affected applications.
3. Related Section "High Efficiency Rooftop HVAC Units” for metal duct system requirements affected by Main VAV Unit applications.
4. Related Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts

1.2 PERFORMANCE REQUIREMENTS

A. Duct construction (Indoor/Outdoor), including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:
1. Factory- and shop-fabricated ducts and fittings.

2. Fittings.
3. Seam and joint construction.
4. Equipment installation based on equipment being used on Project.
5. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Coordination Drawings (For information only): Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct/Equipment installations in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1-2007, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2004, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 1-5, "Longitudinal Seams - Rectangular Ducts," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Linx Industries Inc.
    b. EHG Air Distribution Systems
    c. McGill AirFlow LLC.
        1) Model “K-27” for Insulated Doublewall Sections w/ perforated inner linings.
    d. SEMCO Incorporated.
    e. Sheet Metal Connectors, Inc.
    f. Spiral Manufacturing Co., Inc.
    g. SET Duct
    h. Lapine Metal Products

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Transverse Joints - Round Duct," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Seams - Round Duct and Fittings," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M G90.
   1. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: STM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL. The entire perimeter of all joints shall be sealed.
   1. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

C. Round Duct Joint O-Ring Seals:

   1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
   2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
   3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged. Properly prepare each exposed duct section/associated air devices for field painting by others.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
3. Unconditioned Space, Exhaust Ducts: Seal Class C.
4. Unconditioned Space, Return-Air Ducts: Seal Class B.
5. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
7. Conditioned Space, Exhaust Ducts: Seal Class B.
8. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 4-1, "Rectangular Duct Hangers Minimum Size," and Table 4-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

A. Clean duct systems after installation and before testing, adjusting, and balancing as required so that entire air distribution system is free of dirt and debris.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Division 23 Section "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.

3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-Handling Unit/Rooftop Unit/ Unit Ventilator internal surfaces and components including mixing box, coil sections, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

3.7 START UP

A. Air Balance: Comply with requirements in Related OPR Sections covering "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Duct dimensions shown are free inside dimensions and shall be followed unless job conditions require alterations. Duct size revisions shall be based on the equal friction method.

B. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

C. Supply Ducts:

1. Ducts Connected to Variable/Constant-Air-Volume Air-Handling Units:

    a. Pressure Class: Positive 4-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 6.
    d. Supply Ducts for first 12 feet in any direction from HVAC Unit Opening: 2” thick doublewall acoustic duct equal to United McGill “K-27”.

D. Return, Outdoor Air, and Exhaust Ducts:

1. Ducts Connected to Terminal Units, Air Handling Units, or Fans:

    a. Pressure Class: Positive or negative 2-inch wg.
    b. Minimum SMACNA Seal Class: B.
    c. SMACNA Leakage Class for Rectangular: 12.

E. Intermediate Reinforcement shall match duct materials.
1. Provide cross-width angle supports for Return Ducts greater than 48” wide near unit openings at 18” on centers along the length of the run.

F. Liner:

1. Supply Air Ducts or Plenums: Fibrous glass, Type I, 1-1/2 inches thick.
2. Return and Exhaust Air Ducts or Plenums: Fibrous glass, Type I, 1 inch thick.
3. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-3, "Vanes and Vane Runners," and Figure 2-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-3, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
        1) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-6, "Branch Connections."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "90 Degree Tees and Laterals," and Figure 3-5, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Flange connectors.
6. Turning vanes.
7. Duct-mounted access doors.
8. Flexible connectors.
9. Flexible ducts.
10. Duct accessory hardware.
11. Louvers.
12. Ventilation Hoods.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
1. Exposed-Surface Finish: Mill phosphatized.

C. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.

D. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

E. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.2 DAMPERS – BACKDRAFT, VOLUME, CONTROL, FIRE, SMOKE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff
5. Ruskin Company.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 3000 fpm.

C. Maximum System Pressure: 2-inch wg.

D. Frame: 0.052-inch- thick, galvanized sheet steel, with welded corners.

E. Blades: Multiple single-piece blades, maximum 6-inch width with sealed edges.

F. Blade Action: Parallel.

G. Return Spring: Adjustable tension.

H. Bearings: Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.

I. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Material: Galvanized steel.

6. Screen Type: Bird.
7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

1. Damper and blade material to match ductwork material
2. Standard leakage rating.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Hat-shaped, galvanized-steel channels, 0.064-inch minimum thickness.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Rectangular dampers shall be single blade type in ducts up to 11" high and shall be opposed blade type in ducts 12" high and above.
    b. Round dampers shall be single blade type.
    c. Stiffen damper blades for stability.

6. Provide end bearings on all dampers. On multiple blade dampers bearing shall be oil-impregnated nylon or sintered bronze.

7. Provide locking indicating quadrant regulators on all dampers. Where rod lengths exceed 30-inches, provide a regulator at both ends.

8. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

9. Jackshaft:
    a. Size: 1-inch diameter.
    b. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
    c. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

10. Damper Hardware:
    a. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
    b. Include center hole to suit damper operating-rod size.
    c. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Frames:

1. Galvanized-steel channels, 0.064 inch thick.
2. Mitered and welded corners.

B. Blades:

1. Multiple blade with maximum blade width of 8 inches.
2. Opposed-blade design.
3. Galvanized steel.
4. 0.064 inch thick.
5. Blade Edging: Closed-cell neoprene edging.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

C. Blade Axles: 1/2-inch- diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

D. Bearings:

1. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
2. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Provide UL-Rated Fire Damper Systems with Sleeves, Curtains, Links and Access in sizes and configurations required to maintain Fire Wall Ratings in each partition where project-applicable ductwork passes thru a rated partition.
1. Standard: UL 555, current and applicable
2. Design: Static or Dynamic as required for application.
3. Configuration: Type A, Type B or Type C to meet field applications.

2.7 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

A. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-3, "Vanes and Vane Runners," and 2-4, "Vane Support in Elbows."

B. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.9 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 2-10, "Duct Access Doors and Panels," and 2-11, "Access Panels - Round Duct."

1. Door:

    a. Double wall, rectangular.
    b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
    d. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches

2.10 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0428-inch stainless steel.

D. Fasteners: Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.11 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Material shall be crimped into a metal edging strip and shall be approximately 3 inches wide.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Minimum Tensile Strength: 500 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 175 deg F.
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1-2007.

D. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; fire resistive vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1-2007.

E. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with hex screw to tighten band with a worm-gear action or Nylon strap in sizes 3 through 18 inches, to suit duct size.

2.13 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.14 LOUVERS

A. General: Provide Heavy-duty Extruded Aluminum construction, Drainable with accessories required for each designated application including but not limited to:
1. Flanges/Mounting Hardware
2. Screens (Bird, Insect) – as noted/appropriate for the application.
3. Finishes: Kynar Enamel, standard colors.
4. Dampers: see descriptions in this section.

B. Performance: Select/Design Size, Depth and Blade-design to provide proper airflows without water penetration/carryover, based on industry standards and manufacturer’s published guidelines.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming & Ventilating, Inc.
2. Greenheck.
3. Ruskin.

2.15 VENTILATION HOODS

A. General: Provide Heavy-duty spun Aluminum construction with accessories required for each designated application including but not limited to:
1. Roof Mounting Curbs and Flashings
2. Screens (Bird, Insect) – as noted/appropriate for the application.
3. Finishes: Kynar Enamel, standard colors – as noted.
4. Dampers: see descriptions in this section.

B. Performance: Select/Design Size, Height and Hood-design to provide proper airflows without water penetration/carryover, based on industry standards and manufacturer's published guidelines.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cook.
2. Greenheck.
3. Penn.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume & Control dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Install Fire Dampers per manufacturer's published recommendations, locally-administered requirements and codes.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure

relief access doors; and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. Maximum 75-foot spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

J. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with draw bands plus tape.

P. Install Louvers with proper supports/lintels, sleeves and sealants.

Q. Install Ventilation Hoods with proper (sloped) roof curbs, flashings and integrations into roofing systems as applicable.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233616 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and overall Specification Sections, apply to this Section.

B. Refer to Overall Specification Sections and Schematic Drawings for information regarding Design & Selection for Air Terminal Units:
   1. Zoning:
      a. Single Zone spaces with Fan-powered Terminals:
         1) Conference Rooms
         2) Large Classrooms
         3) Entryways/Stairwells
         4) Toilet Areas/Commons
      b. Multiple Zone spaces with Fan-powered Terminals:
         1) Corner Offices
         2) Larger Common Exposure offices
      c. Multiple/Single Zone spaces with Single-Duct Terminals:
         1) Stand-alone or Grouped by common exposure
   2. Reheat Coils:
      a. Provide each Air Terminal Unit with a Hot Water Coil, as designated.
      b. Exception: lower-floor Internal Zones as determined by Final Design

C. Refer to OPEN Temperature Control Systems Specification Section for elements related to new DDC Controllers being Designed & installed.

1.2 SUMMARY

A. This Section specifies Air Terminal Units intended to serve Direct Digital Controlled units and includes the following anticipated choices [Focus of project is replace each existing Air Terminal unit controller with new including new controllers with Airside System Balancing and Zoning revisions as noted/required]:
   1. Fan-powered air terminal units.
      a. Series configuration.
   2. Single-duct air terminal units.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories for designer’s review.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.

1. Include a schedule showing unique model designation, room location, model number, size, performance criteria (fans, dampers, coils) and accessories furnished.
2. Wiring Diagrams: Power, signal, and control wiring.
3. Acoustic Performance Ratings: include a schedule showing BOTH specific 8-band decibel-based ratings and common-use Noise Criteria (NC) ratings for each air terminal unit according to most recent published rating criteria at submitted (designed) operation point. Clarify criteria used for submitted ratings (ceiling factors, inlet pressures, acoustic linings, etc.). Provide Common-use NC ratings data for both Radiated and Discharge.
4. Acoustic Performance Calculations: Provide logarithm-based Acoustical Analysis prepared by a manufacturer's factory-authorized engineer to estimate the acoustical performance for each proposed air terminal unit. Issue reports to demonstrate compliance with expected acoustical performance based on actual acoustic performance of unit(s) submitted and actual conditions for the installation in the building (including estimated effect of installed ceiling/walls/partitions).

C. Coordination Drawings: Reflected ceiling/space plans, drawn to scale for areas affected, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Noted locations of each terminal above the ceiling with controls/utility "handing" shown.

2. Ceiling suspension assembly members.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Ceiling/Space-mounted items including heaters, lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

D. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Overall Section "Closeout Documentation," include the following:

1. Instructions for resetting minimum and maximum air volumes.
2. Instructions for adjusting software set points.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. ETL Listing: Provide Air Terminals with ETL listing and labeling.

D. NFPA Compliance: Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.5 PRE-COMMISSIONING CRITERIA

A. Coordinate layout and installation of air terminal units and suspension system with other construction that penetrates ceilings or is supported by them, including heaters, light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate locations/sizing/capacity of service-access area and new connections to new/existing infrastructure items (electrical power, HVAC water & duct systems, etc.) prior to preparing submittal documents for approval.

1.6 WARRANTY

A. Terminal Unit warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of Air Terminal Unit equipment that fails in materials or workmanship. Submit a written warranty signed by the Air Terminal Unit manufacturer and installer agreeing to furnish labor and parts for failures within a warranty period of one (1) year from the date of substantial completion/documented Start-up.

1.7 EXTRA MATERIALS/ATTIC STOCK

A. Furnish total sets of materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. General: Two Sets (2) of each manufacturer-recommended Standard SPARE SERVICE PARTS for each Air Terminal Unit/System furnished in project, properly transmitted and labeled.
   2. Filters: Extra sets for each Bank of Filters furnished:
      a. Pre-Filters and Primary Air Terminal Unit Filters: Two (2) extra sets for each Air Terminal Unit as applicable, rounded to even Full-BOX quantity as commonly distributed.

PART 2 - PRODUCTS

2.1 AIR TERMINAL UNITS

A. Manufacturers: Provide specified Air Terminal Units from one of the following manufacturers:

   1. Environmental Technologies, Inc.
   2. Metalaire.
   3. Price.
   4. Titus.
   5. Trane.
   6. Tuttle & Bailey.

B. Configuration:
   1. Fan Powered: Volume damper assembly and fan in series arrangement inside unit casing with control components positioned inside a protective metal shroud.
      a. Power Connection: Single Point with Master Disconnect for Fan, Heat & Controls.

2. Single Duct: Volume damper assembly inside unit casing with control components positioned inside a protective metal shroud.
    a. Power Connection: Single Point with Master Disconnect/Transformer for Controls.

C. Casing: 22-gauge steel with G60 zinc coating.

1. Casing Lining: 3/4-inch-thick, coated, dual-density fibrous-glass duct liner complying with ASTM C 1071; secured with adhesive. Cover liner with nonporous foil.
2. Air Inlets: Round stub connections or S-slip and drive connections for duct attachment.
3. Air Outlet: S-slip and drive connections for a singular rectangular outlet.
4. Access: Removable panels for access to dampers and other parts requiring service, adjustment, or maintenance; with airtight gasket and quarter-turn latches.
5. Sound data: Refer to scheduled drawing values for maximum sound power criteria.

D. Volume Damper: 22-gauge galvanized steel with peripheral gasket and self-lubricating bearings with internal stops for full-open and full-closed position.

1. Maximum Damper Leakage: ARI 880 rated, 1 percent of nominal airflow at 3-inch wg inlet static pressure.
2. Velocity sensors: Differential-pressure multi-point array utilizing equal cross sectional area method for determining air volumes (center-averaging). Provide 2.5 amplification of pressure signal to terminal controller.

E. Fan Section for Fan-Powered Configuration: Galvanized-steel plenum, with direct-drive, forward-curved fan with air filter and backdraft damper.

1. Motor: Multi-tap, 3-speed permanent split-capacitor or fully-integrated ECM type.
    a. Fan-Motor Assembly Isolation: Rubber isolators.
    b. Thermal overload protection.

2. Air Filter: 1-inch-thick, fiberglass throwaway.
    a. MERV 8.

F. Hot-Water Heating Coil: Copper tube, mechanically expanded into aluminum-plate fins; leak tested underwater to 350 psig; and factory installed with built in access door/plate.
1. Selection Criteria at full design heating airflow:
    a. Entering Air Temperature: 55 deg F.
    b. Leaving Air Temperature: 95 deg F.
    c. Entering Water Temperature: 150 deg F.
    d. Leaving Water Temperature: 110 deg F.
    e. Max Water Pressure Drop: 10 ft. hd.

G. Factory-Mounted and -Wired Controls: Electrical components shall be mounted in control box with removable cover. Incorporate single-point electrical connection to power source.

1. Power/Control Transformer(s): Factory-mounted for Main Line Voltage (field-verified) Power/control voltage on electric and electronic control units with terminal strip in control box for field wiring of temperature sensor and power source.
    a. Target configuration/capacity (to be coordinated with County's Master Systems Integrator/Temperature Control System provider): 24VAC/50kVa class 2.

2. Wiring Terminations: Fan and controls to terminal strip, and terminal lugs shall match quantities, sizes, and materials of branch-circuit conductors. Enclose terminal lugs in terminal box that is sized according to NFPA 70.
3. Disconnect Switch: Factory-mounted, toggle-switch type.
4. Fan Relay Switch integrated to Air Flow safety switch for Fan-powered Air Terminals.

H. Control Panel Enclosure: NEMA 250, Type 1, with access panel sealed from airflow and mounted on side of unit.

I. DDC Controls Coordination: Air terminal unit manufacturer shall take receipt of the DDC temperature control system components (furnished by District's controls supplier) for the air terminal unit manufacturer and factory-mount these components. The manufacturer's factory-installation of the temperature control components shall be compatible with industry standard temperature controls procedures for Air Terminals with all applicable published Controls-integration drawings and associated Sequences of Operation.

J. DDC Controls (furnished by Contractor): Integral/Bidirectional damper operator and microprocessor-based controller with integral airflow transducer and remote room sensor shall be compatible with standard Air Terminal Unit temperature controls and shall have the following features:

1. Proportional, plus integral control of room temperature, with matched sensor/thermostat – fan speed control.
2. Modulating/Three-stage-point reheat-coil control.
3. Occupied and unoccupied operating mode.
4. Remote reset of airflow or temperature set points.
5. Adjusting and monitoring with portable terminal.
6. Communication with temperature-control system via BacNET™.

K. Accessories: Provide the following options and accessories for each Air Terminal device:
1. Foil-faced insulation.
2. Acoustic Linings and sound-trap devices to meet scheduled acoustic (multi-band dB) performance parameters scheduled & qualified on drawings/schedules.
   a. Select for Effective Radiated limit of 39 NC.
   b. Select for Effective Discharge limit of 36 NC.
3. Integral-casing Sound Attenuator (Single Duct Terminals as applicable).

2.2 SOURCE QUALITY CONTROL

A. Identification: Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and AHRI certification seal.

B. Verification of Performance: Rate and label air terminal units according to AHRI 880.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air terminal units level and plumb. Maintain sufficient clearance for recommended service and maintenance.

B. Install air terminal units with filter sections accessible for routine maintenance. Provide designation markers/labels below ceiling tiles for each air terminal unit filter in concealed location.
   1. Make provisions to properly install the new VAV Terminal units and make safe for installation/set of the new equipment. Determine exact locations for ductwork, piping and electrical connections before final install scope.
   2. Pipe Hot Water Coils in manner where all piping connections/valves can be easily accessed.

3.2 CONNECTIONS

A. Piping/Wiring installation requirements are specified in Overall Specification Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install connections to air terminal units to allow manufacturer specified service and maintenance.

C. Connect ducts to air terminal units according to manufacturer’s recommendations and usual & customary installation standards/means & methods.

D. Connect wiring to air terminal units according to manufacturer’s recommendations and usual & customary installation standards/means & methods.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

   1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.
   2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions and do the following:

a. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
b. Verify that controls and control enclosure are accessible.
c. Verify that power and control connections are complete.
d. Verify that nameplate and identification tag are visible.
e. Verify that controls respond to inputs as specified.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units. Refer to Overall Sections for Closeout Procedures.

END OF SECTION 233616

SECTION 237319 – HIGH EFFICIENCY ROOFTOP HVAC UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS AND INTENT

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Overall Specification Sections, apply to this Section.

B. It is the Intent of this Project to completely final design/install/coordinate the applicable Owner qualified/Pre-purchased Equipment & coordinate the applicable manufacturer-based Support Services purchased (equipment & services delivery, lead times/field-coordinate options, confirm technical performance, confirm physical information and fully integrate pertinent accessories/Options) from the selected Vendor(s) designated with the declared responsibilities of performing the final pre-order coordination/recommended solutions being accepted with the Vendor(s) by this Design Build Contractor. The selected Vendor(s)/manufacturer of the High-Efficiency Rooftop HVAC Equipment/Services has accepted and will properly execute all reasonable and required equipment furnishing & support services to this Installing Contractor. This Contractor is expected to administer to designated Vendor-provided Support Services required for a complete installation as if he had place the equipment order himself. The services to be coordinated in this solicitation includes, but is not limited to:
   1. Detailed & complete Final/As-ordered Submittal preparation:
      a. For use in installation coordination.
      b. Updated for Accurate As-Built documentation.
   2. Final/specific Engineering/Coordination for applicable Ductwork & Piping Systems, Drain Piping/Wiring components, routing & sizing for the solution accepted.
   3. Engineering/Coordination assistance for field-installed Controls Components, Duct-Mounted/Piping & Wiring components, routing & sizing for the solution(s) accepted.
   4. Final/specific Engineering/Coordination for Factory-recommended Sequences of Operation and Controls Interlocks coordination as applies to identified Project Scopes of Work, including coordination with main Ventilation Sequence Controls and any field-applied portions of the Indoor Air Quality (IAQ) Systems.
      a. Basic Sequence: interlock & operate the High-Efficiency Rooftop Units for designated HVAC Airflows such that after all safety control circuits are satisfied, the SYSTEM operates Stand-Alone to provide conditioned Airflow to the facility with proper/designated Energy-efficiency routines in place, including interface required for IAQ Systems.
      b. Ventilation Controls: engineering assistance for updated Outdoor Air (Ventilation) and Building Pressure Control Systems and upgrades/modifications required to meet High-Efficiency Rooftop HVAC Unit Manufacturer’s requirements.
      c. Unitary/Vendor Controls include full design & field implementation between the High-Efficiency Rooftop HVAC Units to establish “packaged HVAC Rooftop System Operation”, including updates to applicable building Ventilation System Controls. Refer to published Sequences of Operation, as applicable.
      d. Coordination directly with Owner’s Master System Integrator to address basic Integration (Point/Data transfers, Status, Alarms, etc.) and Operational Integrations for the upgraded High-Efficiency Rooftop HVAC Systems (Main System interlocks, special timing/reset sequences, scheduling, temperature setpoints, etc.)

5. Site-specific field-coordination for Factory-authorized/recommended installation.
6. Provision of Factory-authorized Equipment/Systems Start-up.
7. Vendor expertise and support for end-of-project Commissioning Provider and/or Balancing Contractor activities.
8. Manufacturer-based Equipment/Systems/Product/Accessories and Sequences of Operation Training for Owner.
9. Coordination of Factory-sponsored Maintenance Services, as applicable.
10. Provision of Factory-authorized Warranty support.

C. Field-INSTALLATION and Final Commissioning (Rigging, Final Assembly, Mounting, Ducting, Piping, Wiring, Remote Controls, field install of furnished Accessories) of the designated HVAC Equipment IS intended for this specification, but does include Vendor-based coordaintion and physical/programming modifications required that affect existing HVAC & Ventilation Setups/Sequences to best serve the new/replaced Equipment. Specific Installation phase items to be noted for final design and inclusion:
1. Acoustic Materials to be installed inside Roof Support Curbs by Installing Contractor (Fiber-boards, Blankets, Sealers, etc.).
2. Testing, Adjusting & Balancing Services with documentation.

1.2 SUMMARY

A. Configuration and Setup: This Section includes Packaged High-Efficiency Rooftop HVAC Units for outdoor installations as shown on layout drawings and Pre-purchased equipment submittals and IOMM information. Scope is to coordinate, prepare and fully-Install High-Efficiency Packaged Rooftop HVAC unit(s) in the following Configuration(s)/ Controls Setup(s):
1. **RTU-1:** Multiple Zone Variable Air Volume (VAV)
   a. Direct Expansion Multi-circuit Cooling with Low-Load Capacity Control.
   b. Hot Water Heating (65 deg F Leaving Air Temperature, based on inlet conditions noted).
   c. Direct Expansion Dehumidification-Reheat capability.
   d. Return Fan with Integral Building Pressure, Demand Ventilation & Economizer Control.
   e. Unit Section for completion/Field installation of integral UV-C Airstream and Coil Cleaning System.

B. High-Efficiency Rooftop HVAC Unit manufacturer is responsible for the unit housing (walls, floors, roof) and provision for the specified Mechanical/Electrical equipment as shown. Items pertaining to the High-Efficiency Rooftop HVAC Units that are NOT both furnished and installed by the High-Efficiency Rooftop HVAC Units manufacturer include:
1. Support curb-steel/Concrete supports – furnished and installed by Mechanical Contractor/General Trades Sub-Contractors.
2. Support Roof Curb – New (matched-to-Unit) Pre-Fabricated Full-Perimeter Roof Support Adapter Curb furnished by Rooftop Unit manufacturer and installed by Mechanical Contractor.
3. HVAC, Plumbing and Fire Protection piping/installation – provision of general supports for piping and piping systems are to be done in field by the trade contractors in a coordinated effort.
4. Electrical Power – High-Efficiency Rooftop HVAC Unit manufacturer provides internal raceways and conductors for noted 120-volt receptacles & lighting. Mechanical

Contractor/Electrical Sub-Contractor field-provides all final electrical connections, external power wiring, raceways, labeling, etc.

5. Temperature Control & IAQ Systems (loose components & systems integration) – installed by Mechanical Contractor, unless specifically noted otherwise in specifications/schedules (Airflow Control Monitor devices, UV-C Systems, etc.)
6. Fire Alarm Systems – furnished and installed by Electrical Contractor (alarm devices, smoke detectors, controls, etc.), unless noted otherwise in Selected Equipment information.

1.3 RELATED SECTIONS (as applicable)

A. The equipment manufactured under the descriptions noted in this specification section is integrally-related to other building systems and the proposer/manufacturer of the High-Efficiency Rooftop HVAC Unit equipment/systems is responsible for complying to and coordinating with the related sections. Any construction costs required by Installing Contractor/selected Equipment manufacturer for a complete System Installation are the joint responsibility of the designated HVAC Vendor(s) and this Mechanical contractor/proposer. Related sections include, but are not limited to:

1. "Overall/General HVAC Items":
   a. Basic Mechanical/Electrical Materials and Methods (wiring, pipe supports, labeling, etc.)
   b. External-to-unit Vibration Isolation Devices
   c. Piping and insulation systems.
   d. Fire Protection Sprinkler Systems (piping, valves, controls, etc.).
   e. Fire Alarm Systems (controls, devices, raceways, conductors, smoke detectors, etc.) as related to alarms/safeties regarding Hi-Efficiency Rooftop Units.
2. "Metal Duct Systems" for HVAC Ductwork items.

1.4 SUBMITTALS (refer to published Submittal/info of Pre-purchased Equipment)

A. Product Data: For each type of High-Efficiency Rooftop HVAC Unit indicated, include documentation on the following:

1. Fan-performance curves with system operating conditions indicated.
2. Fan/Unit-sound power ratings.
3. Unit Efficiency Ratings (IEER).
4. Unit Static Pressure Calculation.
5. Vibration Isolation Devices.
6. Heat Exchanger/Coil-performance ratings with system operating conditions indicated.
7. Compressor/condenser components with system efficiencies and operating conditions indicated, including information on refrigerant.
8. Motor ratings, electrical characteristics, and motor and fan accessories.
9. Material gages and finishes (walls, floors, roof) with leakage rate performance noted.
10. Piping components and internal unit arrangements – valves, flow measuring devices, refrigerant piping specialties, etc.
11. Filters/accessories with performance characteristics.
12. Control Dampers.
13. Louvers & hoods.

14. Pre-Fabricated Roof Support (Adapter-type) Curbs – Matched-to-Unit (Manufacturer-standard and/or Custom as required by application).
    a. Acoustic Materials to be installed inside Roof Support Curbs by Installing Contractor (Fiber-boards, Blankets, Sealers, etc.).
15. Control System components and accessories, indicating which items are furnished in the factory and what is field-installed by others, including Airflow Monitoring Systems.
16. Factory/Field-applied Indoor Air Quality Systems, Components, Controls – coordinate Utility Sections in RTU required for complete IAQ System implementation.
17. Unitary Control Programming and Sequences of Operation.
18. BacNet™ PICS Statement-documentation.
19. Unit factory Certification Reports – as applicable.
20. Unit factory testing Reports.
21. Warranty terms and associated project documentation
22. Maintenance and Operation data, for inclusion in master job O & M manuals.

B. Control System (BAS) Interface Data: Provide complete Serial Communication Point List information for chosen control integration interface (BACNet™). This includes, but is not limited to, PICS statements and Open Standard Protocol PROFILEs.

C. Shop Drawings:

1. Dimensioned drawings of equipment, clearly noting shipping pickup points and Access Door/Panel locations.
2. Base/footprint drawings, coordinated and dimensioned for structural support means.
3. Roof Curb (Adapter-type) drawings specifically matched to unit for application noted.
4. Piping/equipment support layouts.
5. Unit-furnished electrical wiring layouts.
6. Unit-furnished Temperature Control Devices/System, both unit-mounted in factory and field-mounted by installers.

D. Operation and Maintenance Data: For each type of High-Efficiency Rooftop HVAC Unit, include in emergency, operation, and maintenance manuals:
1. Include a SPECIFIC Summary of required maintenance items for each unit, complete with pertinent part numbers and frequency of actions recommended.
2. Include Specified Start-up/Training and Turn-over/Commissioning-related Documents.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain High-Efficiency Rooftop HVAC Units through one source from a single manufacturer, unless noted otherwise.

B. Experience: Provide High-Efficiency Rooftop HVAC Units from a manufacturer with a minimum experience level:
1. Five (5) years

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of High-Efficiency Rooftop HVAC Units and are based on the specific system indicated.

1. Seismic Certifications: Provide Packaged Units as required to meet applicable local "seismic" design standards/certifications with regards to ratings/components necessary for compliance.
2. Wind-Load Certifications: Provide Packaged Units as required to meet applicable local "wind load resistance" design standards/certifications with regards to ratings/components necessary for compliance.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Insulation: Provide High-Efficiency Rooftop HVAC Units with internal insulation products/methods meeting NFPA 90A and 90B with regards to flame spread and smoke developed safety ratings.

F. ARI/AHRI Certification: High-Efficiency Rooftop HVAC Units shall have their applicable components be factory tested according to current standards, including, but not limited to: ARI/AHRI 410, "Central-Station Air-Handling Unit Coils," and ARI/AHRI 1060 "Energy Recovery Ventilators" and shall be listed and labeled by ARI/AHRI.

G. ETL Listing: Provide labeled units subject to the requirements of ETL/UL 60335-2-40.

H. ASHRAE 90.1 Compliance: Provide High-Efficiency Rooftop HVAC Units and equipment tested and rated to achieve SPECIFIED system efficiencies according to the latest version of the locally-enforced energy standard, including applicable Sequence of Operation recommendations found in ASHRAE Guideline 36.

I. ASHRAE 15 Compliance: Provide High-Efficiency Rooftop HVAC Units and equipment that is designed, tested and rated to achieve required system safeties according to the latest version of the locally-enforced refrigeration safety standard, including applicable leak detection and leak mitigation recommendations found in ASHRAE Standard 15.

J. Sound Performance: Provide High-Efficiency Rooftop HVAC Units with sound performance established by the procedures in the applicable AHRI/ANSI Standard.

1.6 COORDINATION

A. Coordinate with all trades the placement, support and utility requirements for each High-Efficiency Rooftop HVAC Unit. This includes, but is not limited to:
1. Substrate elements – Roofs, Roof curbs, structural steel, concrete pads, exterior ductwork locations/sizes, wall sleeves, applicable mechanical room/closet structures.
2. External-to-Unit Sound-absorbing/Insulation materials installed in Roof Curb cavities.
3. Proximity to existing Plumbing System & HVAC Exhaust Vents.
4. Piping – mechanical heating water/condensate drain piping.
5. Ductwork – planned routing from unit connections.
6. Electrical – power wiring, including means of disconnect.
7. Controls/IAQ Systems – location of components/accessories not factory-mounted.

1.7 PRE-COMMISSIONING CRITERIA

A. Coordinate layout and installation of High-Efficiency Rooftop HVAC Units and suspension systems with other construction elements that penetrate ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Receive High-Efficiency Packaged Rooftop HVAC Systems from the factory fully ready for Coordinated Systems Installation. Provide protective coverings to electronic components and open piping connections.

B. Handle and store High-Efficiency Packaged Rooftop HVAC Systems per manufacturer's published recommendations, including, but not limited to: protection from weather and unclean jobsite conditions.

1.9 HIGH-EFFICIENCY ROOFTOP HVAC UNIT STARTUP

A. Coordinate with designated Vendor and provide complete Startup for High-Efficiency Rooftop HVAC Units must be performed by Factory-trained personnel experienced in working with specified equipment and Controls/Sequences, including specified IAQ Systems. Coordinate integrated functions with Owner's Master Systems Integrator.

1.10 WARRANTY (coordinate with published Submittal/info of Pre-purchased Equipment)

A. Basic Unit warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of High-Efficiency Rooftop HVAC Unit equipment that fails in materials or workmanship. Submit a written warranty signed by the High-Efficiency Rooftop HVAC Unit manufacturer and installer agreeing to furnish labor and parts for failures within a warranty period of one (1) year from the date of substantial completion/documented Start-up.

B. Packaged Unitary Controls Extended warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of High-Efficiency Rooftop HVAC Unit Controls equipment that fails in materials or workmanship. Submit a written warranty signed by the High-Efficiency Rooftop HVAC Unit manufacturer and installer agreeing to furnish labor and parts for failures within a warranty period of two (2) years from the date of substantial completion/documented Start-up.

C. Compressor Extended warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressor(s) that fail in materials or workmanship. Submit a written warranty signed by the High-Efficiency Rooftop HVAC Unit manufacturer and installer agreeing to furnish parts and labor for compressor failures within a warranty period of five (5) years from the date of substantial completion/documented Start-up.

D. Heat Exchanger Extended warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger(s) that fail in materials or workmanship. Submit a written warranty signed by the High-Efficiency Rooftop HVAC Unit manufacturer and installer

agreeing to furnish parts and labor for heat exchanger failures within a warranty period of ten (10) years from the date of substantial completion/documented Start-up.

E. Motor Control/VFD Extended warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace Variable Frequency Motor Controller(s) that fail in materials or workmanship. Submit a written warranty signed by the High-Efficiency Rooftop HVAC Unit manufacturer and installer agreeing to furnish parts and labor for motor controller failures within a warranty period of two (2) years from the date of substantial completion/documented Start-up.

1.11 EXTRA MATERIALS/ATTIC STOCK (coordinate with published Submittal/info of Pre-purchased Equipment)

A. Furnish total sets of materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Touch-up Paint: Quantity of complete containers to be used by Owner to maintain corrodible surfaces after construction is completed
   a. Paint containers: One (1) for each system/equipment employed.

2. Mechanical Unit Belts: Three (3) complete sets of new spare belts for each unit affected.

3. Filters: Extra sets for each Bank of Filters furnished.
   a. Pre-Filters: Two (2) extra for each terminal, rounded to even Full-BOX quantity as commonly distributed.
   b. Final/After Filters: One (1) extra set for each Bank.

PART 2 - PRODUCTS

2.1 HIGH-EFFICIENCY ROOFTOP HVAC UNIT MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide High-Efficiency Packaged Rooftop HVAC Units by the following:

1. Carrier, selected via Equipment Pre-purchase process.

2.2 MANUFACTURED UNITS

A. High-Efficiency Rooftop HVAC Units shall be factory assembled and consist of fans, motor and drive assemblies, coils, heat exchangers, dampers, plenums, filters, condensate pans, mixing dampers, full-perimeter pre-fabricated roof support curb (adapter-type) and accessories as specified herein/Related Sections and as noted on the layout drawings.
1. High-Efficiency Rooftop HVAC Unit manufacturer shall fully-assemble and run-test entire unit prior to shipment.
   a. Refrigerant Circuit Run Test.
   b. Unit Controls Systems checkout.
   c. Refrigerant Leak Test.

2. Configuration, as specified and described on the OPR drawings & selected for Application(s) noted:
   a. Outdoor.
   b. Packaged.
   c. Direct-Expansion Cooling.
   d. Electric Resistance Heating – as applicable.
   e. Return/Relief Fan.

2.3 CABINET

A. Materials: Formed and reinforced double-wall insulated panels, designed & fabricated to allow removal for access to internal parts and components, with joints between sections/panels sealed.

1. Unit Panel (Walls, Floors, Roof Partition) Assembly: nominal 2 inch thick (minimum), Thermal-break doublewall assembly, injected with foam insulation for minimum R-value of R-13 (wall), non-condensing on all surfaces for design stated.
2. Outer Panel – G-90 Galvanized Steel
3. Outer Panel Finish – Smooth, Pre-painted Enamel Finish (Std. color), meeting ASTM B117, 750 hours, capable of field-applied paint finish.
4. Inner Panel – 22 Ga. G-90 Solid Galvanized Steel.
5. Inner Panel Finish – Smooth Solid
6. Cabinet Pressure Design: 5.0 inches w.c.

B. Roof System: Sloped frame structure over unit roof partition panels, one-half inch overhang minimum.

C. Curb-Ready Rail: Entire unit shall have a full perimeter Curb-ready base rail for structural rigidity and condensate trapping. Provide the required height of the baserail to allow for adequate drainage.

D. Pre-Fabricated Roof Curb (Adapter-type): Provide full perimeter structural Roof Curb "Matched" & ready to receive base rail of unit. Provide a minimum height of 14 inches, or as required to result in OA intakes above the expected moisture intake limit and as required to allow required supply and return ductwork transitions to be field installed (to new duct systems as applicable).

E. Access Panels and Doors: Same materials and finishes as cabinet, complete with quick-release, full-height doors & non-corrosive hinges (no screwed-in panels allowed), latches/handles, and continuous-perimeter corrosion-resistant compression gaskets. Inspection and access panels and doors shall be sized and located to allow periodic maintenance and inspections, without complete removal of the panels. Provide access panels and doors in the following locations:

1. Fan Section.
2. Coil/Heat Exchanger Sections.
3. Control Panel & Motor Control Sections.
4. Filter Section: Doors to allow periodic removal and installation of filters.

F. Condensate Drain Pans: Provide pans of non-corrosive materials complying with requirements found in ASHRAE 62. Fabricate pans with slopes in three planes to collect condensate from

cooling coils (including coil piping connections) when units are operating at maximum catalogued face velocity across cooling coil.

1. Insulated Construction: Provide non-condensing construction and seal moisture tight.
2. Drain Connections: One end of pan, threaded.

2.4 FAN SECTIONS

A. Fan-Section Components: Double Width Double Inlet (DWDI) Belt-driven Steel blade or Single Width Single Inlet (SWSI) Direct-drive aluminum blade fans consisting of wheel, fan shaft, bearings, motor/drive assembly (conventional or ECM-type) and support structure and equipped with slide-out channel base for integral mounting of fan, motor, and access for fully safe servicing.

B. Fan Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower. Perform Trim Balance prior to unit being shipped from factory.
   1. Vibration Isolation: provide equivalent performance to 2” Spring isolation on each unit fan/assembly.

C. Modulation Control: Provide Supply fan capable of modulation from 30% to 100% of scheduled design airflow, without surge at any point of operation.

D. Fan-Section Source Quality Control:

   1. Sound Power Level Ratings: Fans shall bear AMCA-certified sound ratings seal.

2.5 MOTORS

A. General: Provide Unit-mounted/matched VFD or totally enclosed Electrically Commutated motor(s) (ECMs) that are speed controlled by Rooftop unit unitary controller. Include:
   1. Thermal Overload Protection.
   2. Phase Failure Protection.
   3. Shaft Grounding Rings.

B. Noise Rating: Quiet.

C. Efficiency Rating: Premium.

2.6 COILS

A. Coil Sections: Common or individual, insulated, galvanized-steel casings for heating and cooling coils. Design and construct to facilitate removal and replacement of coil for maintenance and to ensure full airflow through coils.

B. Refrigerant Coils: Main Cooling and Hot Gas Reheat Coils designed for use with specified compressor/condensing unit, fabricated according to AHRI 410, connected with brazed fittings.

   1. Tubes: Copper.

2. Frames: Galvanized steel, channel frame.
3. Configuration: Draw-thru.
4. Main Cooling Rows: Minimum 3-rows, or as scheduled on drawings.
5. Circuiting: multi-circuit interlaced.
6. Control: Standard/Electronic-controlled Expansion Valve with Hot Gas Reheat System.
7. Ratings: Design tested and rated according to ASHRAE 33 and ARI/AHRI 410.

C. Water Coils: Fabricated according to ARI 410.

1. Designed for use within Packaged Rooftop Unit Cabinetry.
2. Piping Connections: Threaded or welded or grooved. Extend coil connections a minimum of 5 inches beyond coil casing for final connections underneath unit by installer.
3. Tubes: Copper.
4. Fins: Aluminum
5. Fin and Tube Joint: Mechanical bond.
6. Headers: Red Brass or copper with drain and air vent tappings.

2.7 CONDENSING UNIT SECTION – AIR-COOLED

A. General: Provide condensing section open on the sides and bottom to provide access and to allow airflow through the coils. Condenser coils shall be all-aluminum Microchannel-type or multi-row coils fabricated from 3/8" high efficiency rifled copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested with high-pressure air under water. Each refrigerant circuit shall include a subcooling circuit to provide 15 degrees of liquid subcooling.

B. Condenser Fans: Provide Hi-efficiency PSC Motor or Electrically Commutated Motor (ECM), direct drive, propeller type fans designed for low tip speed (Low Sound Energy), vertical air discharge, and include service guards. Fan blades shall be constructed of composite material. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral coated-steel guard.
1. Provide Thermal Overload Protection.
2. Provide Phase Failure Protection.

C. Temperature Operation: Units shall have condenser fans controlled to maintain positive head pressure. Integral controls shall allow the refrigeration system to operate at 25º F ambient.

D. Compressors: Each unit shall have multiple, R-410a (preferred), R-32, or R-454B heavy-duty scroll compressors. Each compressor shall be complete with gauge ports, suction and discharge service valves, crankcase heater, oil-level adjustment, anti-reversal protection, motor overload protection, high & low pressure limit controls, and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.

E. Refrigerant Circuiting: Each unit shall have multiple and easily serviceable independent refrigeration circuits designed for (VAV) Cooling and Dehumidification/Reheat Sequences noted and to operate compressor tandems efficiently and reliably.

F. Capacity Control: Refrigeration capacity control shall be accomplished by manufacturer-designed automatic staging of the unit's multiple compressors and use of Hot Gas Bypass circuiting as required to provide reliable compressor & discharge air temperature control at lower load conditions. All compressor capacity control staging shall be controlled by the factory installed main unit control system.
   1. Low Load Design Expectations: 20% of maximum cooling tonnage at 30% of maximum Supply Air volume.

2.8 DAMPERS/HOODS - ECONOMIZER

A. General: Damper leakage rate, according to AMCA 500, "Laboratory Methods for Testing Dampers for Rating," shall not exceed 2 percent of air quantity at 2000-fpm face velocity through damper and 4-inch wg (1000-Pa) pressure differential. Refer to drawings for configuration of unit openings and damper locations.

B. Economizer Configuration: Parallel blade dampers with jamb seals for proper mixing and control/measurement of Outside Air, Return Air and Exhaust Air.
   1. Actuators for OA/RA: Modulating, spring-return, controlled by RTU packaged unit controller.
   2. Temperature Control: Comparative Enthalpy.
   3. Ventilation Control: Sub-Minimum setting with Demand-Controlled Sequence override and Building Pressure Sequence interlocks.
   4. Hood(s): Prepainted Steel to match unit finish, factory-mounted with bird screen and moisture eliminator/design for no-carryover inlet velocities.

2.9 FILTER SECTION

A. Filters: Comply with NFPA 90A.

B. Filter Section: Provide filter holding frames arranged for flat orientation, with access doors as shown on drawings.

C. PRE-Filters - Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames.

   1. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
   2. Media and Media-Grid Frame**:** Nonflammable cardboard, Galvanized steel, or Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets.
   3. Thickness: 2 inches.
   4. MERV Rating: 8.

D. AFTER-Filters - Extended-Surface, Disposable Panel Filters: Factory-fabricated, dry, extended-surface filters with holding frames, 4 inch deep.

   1. Media: Fibrous material formed into deep-V-shaped pleats and held by self-supporting wire grid.
   2. Media and Media-Grid Frame**:** onflammable cardboard, Galvanized steel, or Fire-retardant, 3/4-inch (20-mm) particleboard with gaskets.

3. Thickness: 4 inches (min).
4. MERV Rating: 13.

2.10 ENHANCED CONFIGURATIONS

A. Outside Air Inlet: Provide sections with Inlet Hoods to minimize inlet velocities.

1. Provide for Outdoor Airflow Measurement Device(s) at unit Inlet: to be utilized in Demand-Controlled Ventilation and Building Pressurization Control sequences.

B. Indoor Air Quality (IAQ) Systems: Provide unit-matched Utility Section with full size access doors for coordinated/designed systems to allow field/factory implementation of Ultraviolet C-spectrum devices as part of field-applied & engineered IAQ Systems installed within the Packaged RTU Units.
1. Basic Project Parameters: The specified UV-C IAQ Systems are intended for dual-functions. Coil sanitizing UV-C systems are to be individually-engineered/selected for constant energy face-of-coil duty. Airstream sanitizing UV-C systems are expected to provide a 1 Log reduction of infectious particles at design air velocity with a minimum target dosage of 1,500 $\mu W \cdot s/cm^2$, according to current ASHRAE Recommendations/Standards. It is expected that the Proposer and RTU/UV-C Vendors design these dual-function UV-C systems and configurations appropriate for each application noted. Some unit applications may involve compromises on expected design parameters given limited available space in selected units. Significant deviations from having systems be properly installed within RTU cabinetry may be necessary to provide in-duct components of IAQ Systems. In-duct airstream disinfection is permissible only in exposed ductwork, accessible for maintenance. Any duct-airstream UV-C required due to in-unit dimensional limitations is expected to complement separate coil disinfection UV-C Systems and maintain the same schematic design requirements for safety and integration. All required In-duct UV-C IAQ applications require new duct-mounted maintenance/access doors to be installed with related safety interlocks as specified for In-Unit applications. All outdoor installations are to use appropriate weather and exposure rated materials.

2.11 AUXILLIARY ELECTRICAL COMPONENTS

A. Provide GFCI receptacle in Fan/Control section. Factory wire devices to a junction box and on-off switch mounted on the outside of the cabinet for each specified electrical device. Final Main Unit connections are provided by field electrician.

2.12 CONTROLS

A. Manufacturer must provide a stand-alone programmable digital control system for complete temperature & humidity control of the delivered supply air and relative building pressure. The manufacturer will provide a standard sequence of operation for the type of equipment provided per this specification. The controller will be manufacturer-programmed to control:
1. Supply Air temperature.
2. Supply Air Volume/(duct pressure).
3. Ventilation Air volumes.

4. Zone Building Pressure (Relative Local).
5. Zone temperature – only as specifically noted beyond Air Terminal Controls.
6. Zone/Area humidity.
7. Monitoring & Alarms:
    a. Return Air Temperature & Humidity.
    b. Unit/Setpoint Faults.
    c. Smoke Detectors
    d. Filter Bank Pressure Drops.

B. STAND ALONE DDC CONTROLLER**.** Controller shall be provided with required sensors and custom programming for the specified VAV configurations (air handling unit, duct pressure/fan speed, discharge air temperature, etc.). Controller shall be factory programmed, mounted, and tested. Controller shall have a user terminal with LCD readout for changing set points and monitoring unit operation. Functional capabilities for the unitary DDC controller shall include, but not be limited to, the following:

1. Mixing Box Damper Modulation, based on Supply Air/Zone Temperature.
2. Cooling Modulation, based on Supply Air/Zone Temperature.
    a. As applicable: HGRH for Zone Humidity/Zone Dewpoint Temperature.
3. Economizer with applicable lockout control & related Enhanced Sequences specified.
    a. Building Pressure Control/Airflow Monitoring Station integrations.
    b. Demand Controlled Ventilation routines.
4. Occupied/Unoccupied Mode control.
5. Fan Enable/Disable.
6. Fan(s) Speed VFD/ECM control.
7. Indoor Air Quality Systems Integrations.
    a. UV-C Sanitizing and Coil Cleaning Stations.
8. Remote Control Interface/Integration: BacNet™
9. Filter Pressure Drop – analog for each bank utilized.
10. Alarms.
11. Smoke Detection input (redundant to Fire Alarm System).
12. Data Tracking – provide Controller collection and storage of applicable operating parameters for a minimum period of 30 days to be used for systems management & troubleshooting.

C. SEQUENCES OF OPERATION: The Stand-alone DDC controller shall perform the following basic control sequences employing the applicable ASHRAE Guideline 36 Trim & Respond methods (Optimizations, Resets, Fault Detection, Alarm Suppression routines, etc.):
1. Unit OCCUPIED Command
    a. Outside air/Mixing Box damper actuators are powered.
    b. DDC controller confirms damper end switch status.
    c. Supply fan starts after damper is open (minimum of 120sec delay, adjustable).
    d. Heating, cooling, economizer operation per below.
2. Unit UNOCCUPIED Command
    a. Supply fan is de-energized.
    b. Outside air damper actuator is de-energized, dampers spring return closed.
    c. Dampers are closed after the fans are de-energized.
3. OCCUPIED Mode – Base (Opposite for UNOCCUPIED Mode)
    a. Supply fan ON, Relief/Return Fan ON/Ready.

1) VAV Control sequence to meet Supply Air Temperature Control w/ Reset, Optimizations & Limits, Duct Static Pressure w/ Reset, Optimization & Limits, Ventilation Air Setpoints and Building Pressure balance.

b. OAD is open to sub-minimum, executing Demand-Controlled Ventilation as required (minimum, then increase on CO2 sensor).

c. UNOCCUPIED DEHUMIDIFICATION Mode: On a call for dehumidification (room %RH – differential, 70%RH-5%RH=65%RH) supply fan cycles on, and the cooling decreasing the Zone-Area %RH. Unit cycles off when room humidity reaches the unoccupied set point 50%RH, adjustable)

4. Re-Heating Mode:
   a. Lockout: The heating will be locked out when the outside air is > 70°F + 2°F hysteresis, adjustable
   b. Heat Stage 1: The heating (HGRH Option) is controlled to maintain the Discharge supply temperature set point (Dehumidifcation mode Reheat).
   c. Heat Stage 2: The Heating Section is controlled to maintain the Discharge supply temperature set point.
5. Cooling Mode
   a. Lockout: The cooling will be locked out when the outside air is < 55°F - 2°F hysteresis, adjustable
   b. Temperature Control: The cooling is controlled to maintain the supply temperature set point
   c. Dehumidification Control: The cooling/hot gas reheat coil is controlled to maintain the supply dew point temperature set point.
6. Safeties
   a. SAFETIES:
      1) (OA PRE-FILTER) DIRTY FILTER SWITCHES. If the outside air or return air filter differential pressure rises above the switch set point (adj.), the differential pressure switch shall signal the DDC to activate an alarm
      2) SUPPLY DISCHARGE LOW LIMIT. If the supply discharge temperature drops below 40°F (adjustable), the DDC shall de-energize the unit after a preset time delay
      3) HIGH DUCT STATIC PRESSURE. If the supply duct differential pressure rises above the switch set point (4" w.c., adj.), the differential pressure switch shall signal the DDC to de-energize the unit
      4) LOW DUCT STATIC PRESSURE. If the return duct differential pressure falls below the switch set point (-4" w.c., adj.), the differential pressure switch shall signal the DDC to de-energize the unit
      5) ALARM INDICATION. DDC shall have one digital output for remote indication of an alarm condition. (i.e. Blower current/differential pressure switch, damper end switches, freeze stat, fire stat, smoke, dirty filters…)

2.13 ACCESSORIES (refer to & coordinate w/ published information on Selected Equipment)

A. Provide the following accessories for High-Efficiency Rooftop HVAC Units:
   1. Non-fused Disconnect Switch.
   2. Full Hail Guard protection for exposed Condenser Coils.
   3. Full-coverage insulated pan below unit for horizontal discharge configurations.
   4. Provisions for Outdoor Air Measurement System as part of Demand Controlled Ventilation and Building Pressurization Control sequences (DCV/BPC) – field/factory-installed as applicable.

5. Provisions for Indoor Air Quality Systems as part of required coil cleaning/air sanitizing UV-C Lighting Systems – field/factory-installed as applicable.
6. Carbon Dioxide Sensor (DCV) – field-installed as applicable.
7. Return Air Smoke Detector(s) – field-installed as applicable.
8. Building Pressure/Space Static Pressure Sensor(s) – field-installed as applicable.
9. Pre-fabricated Roof Curb (Adapter-type) – minimum to provide 16 inches clear above roof surface & required clearances for Outdoor Air Intakes and as required to allow required sound attenuation systems & supply and return ductwork transitions to be field installed.

PART 3 - EXECUTION

3.1 INSTALLATION (Instructions for Installing Contractors with full Vendor-based Coordination)

A. General: Proposers are responsible for field-verifying all existing conditions for how they may impact/relate to providing the new Scopes of Work. No post-proposal compensation is expected to cover costs of reasonably-accessible and known existing conditions.
   1. Make provisions to properly coordinate HVAC Units/piping and Electrical Power and make safe for installation/set of the new equipment. Determine exact locations for ductwork, piping and electrical connections before final rigging scope.

B. Install High-Efficiency Rooftop HVAC Units with the appropriate curb-based sound attenuation materials and vibration devices as applicable for the application (multi layers of dense board and top layer of batt insulation).

C. Arrange installation of units to provide access space around High-Efficiency Rooftop HVAC Units for service and maintenance and to avoid proximity to proximate HVAC & Plumbing System Vents.

D. Install High-Efficiency Rooftop HVAC Units on equipment supports or pre-fabricated roof curbs as specified.
   1. Install Curbs per manufacturer's instructions/recommendations for the application.
   2. Complete preparations of existing roof decks and roofs to properly accept new equipment, piping and ductwork systems.
   3. Install Sound-dampening materials in base of pre-fabricated roof curbs prior to setting of unit: full cavity coverage - two layers of thin dense absorbing material and one thicker layer of less-dense absorbing material.
   4. Install new hot water heating coil piping to existing piping with new control valve integrated to unit controller.
   5. Install new duct systems external to unit and connect to existing duct systems complete with proper supports and insulation systems/coverings.

3.2 CONNECTIONS

A. Piping connections noted on the Drawings which indicate general arrangement of piping, fittings, and specialties – all to be field-verified prior to actual final design & installations.

1. Coordinate proper & safe custom installations of IAQ Systems within the RTU Cabinetry (Electrical power, equipment and controls).

B. Install and properly label piping/IAQ Equipment within/adjacent to equipment to allow safe service and maintenance.

C. Complete installation of all drain pan piping, with traps per manufacturer's recommendations.

D. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections per manufacturer's requirements and with proper flexible connections, duct-width stiffeners and indoor/outdoor insulation & jacketing systems (Interior/Exterior).

E. Electrical: Connect Power and Controls wiring according to manufacturer's documented instructions and applicable/Overall specification means and methods.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage Vendor-provided factory-authorized service representative to inspect field-assembled components and equipment installation, including external piping and electrical connections.

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 STARTUP SERVICE

A. Engage Vendor-provided factory-authorized service representative to perform startup service as per manufacturer's instructions and recommendations. Coordinate activities with Owner's Commissioning Services provider.
1. Complete installation and startup checks according to manufacturer's written instructions and do the following, as a minimum:
    a. Notify Owner's personnel of scheduled Check-Test-Start activities and allow personnel to witness all procedures.
    b. Verify that inlet duct connections are as recommended by High-Efficiency Rooftop HVAC Unit manufacturer to achieve proper performance.
    c. Verify that condensing sections are properly installed and charged with refrigerant.
    d. Verify that temperature-humidity-pressure controls/IAQ Systems and control enclosures are accessible.
    e. Verify that temperature-humidity-pressure control/IAQ Systems connections are complete & all factory-programmed/(field adjusted) unitary-based VAV sequences are met.
    f. Verify that nameplate and identification tag are visible.
    g. Verify that controls respond to inputs as specified – coordinate directly with Owner's Master Systems Integrator/Commissioning Services Provider.

B. Document installation and startup checks according to manufacturer's written instructions.

C. Provide basic RTU System Testing, Measuring & Adjusting/Balancing services to assure installed components deliver expected performance results; with documentation accompanying As-Builts. Refer to Overall Specification Section - Testing, Adjusting, and Balancing for High-Efficiency Rooftop HVAC Unit testing, adjusting, and balancing.
   1. The Intent for this function is to assure Owner that the controls & new RTUs VAV Systems (new HVAC RTUs) are capable of delivering the expected Sequences and Airflows to the existing spaces being served/constructed: It is intended for Installing Contractor to Test, Adjust & Balance the overall RTU System components for airflow/control performance.

3.5 CLEANING

A. Clean High-Efficiency Rooftop HVAC Units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing High-Efficiency Rooftop HVAC Units, IAQ Systems and air-distribution systems, clean filter housings and install new filters.

3.6 DEMONSTRATION

A. Engage Vendor-provided factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain High-Efficiency Rooftop HVAC Units. Coordinate activities with Owner’s Commissioning Services provider.
   1. Document Training procedures completed.
   2. Document Start-up & Coordinate Commissioning activities with Owner’s Master Systems Integrator/Commissioning Services Provider.
   3. Document Warranty Contacts, Provisions & Responsibilities.
   4. Document Warranty-Period/Termed Maintenance Provisions & Responsibilities – as applicable.

END OF SECTION 237319

SECTION 238126 – MINI-SPLIT A. C. & HEAT PUMP UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and any general provisions of the project, including General and Supplementary Conditions noted, apply to this Section.

1.2 SUMMARY

A. This Section covers an OPTION for an Equipment specification that applies to the BASE/ALT Additional Mini-Split Systems for IT Closet items in the Scope of Work.

B. This Section includes Inverter-based R-410a (preferred)/R-32/R-454b Mini-Split A. C. & Heat Pump Systems (Indoor Direct Expansion Fan Coil Units and Outdoor Air-cooled Condensing Units, Space Sensible Cooling Control Primary-duty).
   1. One-to-One Configuration.
   2. Multi-split Configuration as applicable (not VRF).

1.3 SUBMITTALS

A. Product Data: For each mini-split system, include documentation for rated capacities, operating characteristics, acoustic performance, furnished specialties, and accessories. Include equipment dimensions, weights and structural loads, required clearances, method of field assembly, components, and location and size of each field connection.

B. Wiring Diagrams: Power, signal, and control wiring.

C. Startup Personnel Certification: Provide evidence of factory training of each Refrigeration Technician scheduled to be utilized in installation/startup/commissioning of mini-split systems.

D. Operation and Maintenance Data: or Mini-split system to include in emergency, operation, and maintenance manuals.

E. Warranty: Special warranty specified in this Section.

1.4 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of mini-split systems and are based on the specific system indicated. The application includes provisions for responsible redundancy based on service duty declared.

B. Performance Ratings: Certify published performance of Mini-split A. C. & Heat Pump units according to ARI Standard 210/240 covering Unitary Heat Pumps.

C. Electrical Components, Devices, and Accessories: ETL Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Fabricate and install refrigeration systems according to ASHRAE 15, "Safety Code for Mechanical Refrigeration."

1.5 COORDINATION

A. Coordinate installation of unit component locations, piping/wiring routing & concealing roof curbs, equipment supports, and roof/wall penetrations.

B. Coordinate location of piping and electrical rough-ins.

1.6 WARRANTY

A. Unit warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of mini-split equipment that fail in materials or workmanship. Submit a written warranty signed by the mini-split manufacturer and installer agreeing to furnish labor and parts for failures within a warranty period of one (1) year from the date of substantial completion/documented Start-up.

B. Compressor warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressor(s) that fail in materials or workmanship. Submit a written warranty signed by the mini-split manufacturer and installer agreeing to furnish parts and labor for compressor failures within a warranty period of six (6) years from the date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer specified.

1. Carrier/Bryant.
2. Daikin AC.
3. Hitachi/York.
4. Lennox Industries.
5. LG.
6. Mitsubishi Electric/Trane.
7. Panasonic.

B. General Description: Factory-assembled and tested, in split configurations as scheduled, consisting of unit casing, fans, filters, coils and controls.
1. Refrigerant: R-410a (preferred)/R-32/R-454b.

2. Thermostat/Controller option: Wired.

C. Evaporators: Direct-expansion copper tube/aluminum fin evaporator coil with fan, configured in integral cabinet complete with electronic controls. Provide mounting plate/hardware, integral polypropylene air filter and piping/wiring connections (refrigerant, condensate drain and electrical). Provide Unit(s) in following configuration(s), as best determined by intent of Scope of Work:
1. Wall Cassette -Surface-mounted.
2. Ceiling Exposed.
3. Ceiling Cassette.
4. Ducted.

D. Outdoor Condensing Unit Description: Factory assembled and tested, air-cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls. Provide direct-expansion air-cooled condensing unit in accessible polyester powder-coated galvanized steel casing, suitable for outdoor use. Provide copper tube/aluminum fin condenser coil, Variable-speed rotary/swing-hermetic compressor w/ internal overload protection, plastic-resin condenser fan and integral electronic operating controls, including refrigeration ports/headers/connections. Include the following:
1. Condenser coil grille to protect coil from physical damage.
2. Mult-port Headers & Piping Accessories.

E. Indoor Fan Coil Unit Description: Factory assembled and tested, refrigerant-piped; consisting of casing, evaporator fans and motors, and unit controls. Provide direct-expansion air-cooled cooling/heating coils, suitable for indoor use. Provide Variable-speed evaporator fan w/ internal overload protection, plastic-resin housings and integral electronic operating controls, including refrigeration thermal expansion valve. Include the following:

F. Indoor Unit Features: Provide Mini-Split Systems with the following features:

1. Auto Random Restart - automatic, randomly restarts the unit at the last setting in the event of a power failure.
2. LCD Remote Controller - includes: Power on/off, Mode Selection: Auto, Cool, Dry, Fan, Heat, 3 Fan-Speeds, Air Swing, Sleep Mode, Temperature Setting and 15-hour delay timer.
3. Fan Cycle Selection - runs the fan at low speed during thermostat cycle cut-off and includes additional options to stop the fan or combine both modes at specific intervals.
4. Auto Fan Speed Control - automatically selects the fan speed based on indoor room conditions to achieve optimum cooling and heating performance and cost efficiency.
5. Auto Mode and Sleep Mode Control - setting changes automatically between Cool and Heat mode depending on the room temperature and set temperature required for maintaining comfortable conditions.
6. Automatic Air Swing (Up and Down) - enables air to be evenly distributed to every corner of the room.
7. Self-Diagnosis Function - detects and diagnoses system faults using blinking LED lights.
8. Three Stage HAF Filters - First: The Anti-Fungus Air Filter removes comparatively large particles such as dust from the air. Second & Third: Dual Action Atomizer and Photocatalytic Deodorizer Filter are able to remove microscopic particles and deodorize the air.
9. Soft Dry Operation - provides additional dehumidification while causing little temperature variance.

10. 15-hour Delay Timer - programs the air conditioner to turn on or off 1 to 15 hours ahead of time.
11. Washable Air Intake Grille - detachable grill is easy to clean with water.

G. System Accessories: (as required by design for Scope of Work)

1. Low Ambient Control/Baffle Kit: Field-installed kit to control condenser fan speed/allow to operate down to -10 deg F.
2. Mounting accessories (pads, Racks, Rails, etc.) – Factory-designed and matched for equipment choice and substrate.
   a. Provide Pre-fabricated Roof Support Rails/Piping Supports as designed and coordinated with substrate (roof/deck/insulation) conditions and dimensions/weight/pipes/electrical of equipment being supported.
3. Pre-charged and Pre-insulated Refrigerant Line Sets selected for the application.
4. Refrigerant Piping Roof Portal/Curb with flashing/caps selected for the application.
5. Condensate Pump – integral set into drain pan and/or remote condensate lifter to properly allow removal of collected coil condensate.
6. Serial Communication Interface:
   a. BacNet™

2.2 MOTORS AND ELECTRICAL

A. Provide Premium-Efficiency Motors:

1. Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Provide Electrical devices and connections per NEC and manufacturer’s instructions.

2.3 SOURCE QUALITY CONTROL

A. Testing Requirements: Factory test sound-power-level ratings according to ARI 270.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances and with proper access/routing to floor drains for condensate removal.

B. Install roof-mounted or pad-mounted units on equipment supports per manufacturer’s instructions & usual & customary methods based on substrate items & conditions. Install grade-mounted units in vandal-resistant manner.

C. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

D. Insulate all System Piping per manufacturer’s requirements.

3.2 CONNECTIONS

A. Provide piping installation per manufacturer’s requirements. Schematic drawings indicate general arrangement of piping, fittings, and specialties.

B. Install insulated refrigerant piping and power wiring adjacent to equipment to allow service and maintenance. Seal/flash any penetrations made in existing partitions water and vermin-tight.

C. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories.

D. Connect wiring according to manufacturer’s documented instructions and customary means and methods.

3.3 STARTUP SERVICE

A. Perform Startup of Inverter-based R-410a (preferred)/R-32/R-454b mini-split systems using only manufacturer-trained refrigeration technicians.

B. Complete installation and startup checks according to manufacturer's written instructions.

C. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain mini-split systems, including an agreed-to procedure for post-construction service during the Warranty period.

END OF SECTION 238126

ASHTABULA COUNTY

COURTHOUSE
HVAC RENOVATIONS 2025

Ashtabula COUNTY, OHIO

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

PROJECT SITE: ASHTABULA COUNTY COURTHOUSE - "B" BUILDING

ADDRESS: 25 W JEFFERSON ST, JEFFERSON, OH 44047

N

PROJECT SCOPE BREAKDOWN

BASE SCOPE:

- PROVIDE RIGGING, INSTALLATION, CONNECTIONS, ETC. FOR NEW ROOFTOP UNIT (UNIT PRE-PURCHASED BY OWNER).
- PROVIDE ASSOCIATED DUCTWORK AND PIPING MODIFICATIONS AS NOTED FOR NEW ROOFTOP UNIT
- PROVIDE NEW GLYCOL FILL STATION AND ASSOCIATED FLUID
- PROVIDE DUCTWORK MODIFICATIONS AS NOTED
- TESTING, ADJUSTING, AND BALANCING OF NEW ROOFTOP UNIT AND ALL EXISTING-TO-REMAIN VAV AIR TERMINALS AND HYDRONIC HEATING TERMINALS IN THE "B" BUILDING. PROVIDE COMPREHENSIVE TAB REPORT AT PROJECT COMPLETION.

ALT-1 SCOPE:

- PROVIDE PREVENTATIVE MAINTENANCE SERVICES FOR NEW ROOFTOP UNIT FOR PERIOD OF (5) YEARS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDED MAINTENANCE SCHEUDLE.

ALT-2 SCOPE:

- PROVIDE CONTROLS UPGRADE FOR EXISTING VAV TERMINAL UNITS (QTY 40). SCOPE INCLUDES NEW CONTROLLERS, NOTED SENSORS, AND THERMOSTATS

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E-01	ELECTRICAL NOTES AND FIRST FLOOR NEW WORK PLAN
SA-01	SYSTEM ARCHITECTURE DIAGRAM

PROJECT FORMAT OVERVIEW

EACH DESIGN PROFESSIONAL UTILIZED IN CONTRACTOR'S PROPOSAL HAS THE LIBERTY TO ACT WITH THE OWNER'S BEST INTERESTS IN MIND, BASED ON THE INDIVIDUAL SITUATIONS AND BOUNDARIES PRESENTED BEFORE DESIGN BEGINS AND BASED ON QUALIFIED PROFESSIONAL EXPERIENCE. THE CRITERIA SET FORTH IN THESE SPECIFICATIONS AND DRAWINGS IS INTENDED TO BE A GUIDELINE TO LIMIT THE RISKS OF DISSATISFACTION OVER THE BALANCED TOTAL LIFE OF THIS PROJECT, THE FACILITY, AND THE OWNER. GENERAL GOALS ARE TO MAKE THE TASKS ASSOCIATED WITH LONG-TERM OWNING/MANAGING THE FACILITY AS EFFECTIVE AND EFFICIENT AS POSSIBLE, INCLUDING THE LIMITATION OF EQUIPMENT/SERVICE PROVIDERS TO THOSE NOTED AS BEING OWNER-PREFERRED AND/OR LISTED WITHIN THESE SPECIFICATIONS.

PROVIDE MATERIALS FOR COMPLETING ELECTRICAL INSTALLATIONS AND OTHER FINISHES ACCORDING TO APPLICATIONS REQUIRED USING INDUSTRY STANDARD MEANS-AND-METHODS AND COMMON BEST PRACTICES.

THESE SCHEMATIC DRAWINGS SHOW INTENDED CONFIGURATION OF EQUIPMENT AND MATERIALS WHERE NOTED ALONG WITH EXISTING CONFIGURATIONS FOR REFERENCE TO NEW WORK AND DEMOLITION SCOPES. COORDINATE REMOVAL OF EXISTING AND INSTALLATION OF NEW EQUIPMENT, FIXTURES AND FURNISHINGS WITH INFRASTRUCTURE ALREADY IN-PLACE. CONTRACTOR IS HIGHLY ENCOURAGED TO FIELD VERIFY ALL COUNTS, MEASUREMENTS, DIMENSIONS AND PATHS. DESIGNS AND WORK SHALL COMPLY WITH APPLICABLE REQUIREMENTS OF NATIONAL, STATE AND LOCAL CODES AND BEST PRACTICES.

MECHANICAL SYSTEMS - GENERAL NOTES

(APPLIES TO ALL SHEETS)

GENERAL HVAC INTENT:
THE GENERAL INTENT OF THIS PROJECT IS TO DESIGN AND PROPERLY INSTALL A FULLY-FUNCTIONAL AND COMPLIANT SYSTEM TO CORRESPOND DIRECTLY TO NOTED/DESIGNED UPDATES TO THE BUILDING. IT IS EXPECTED THAT THE REPLACEMENT OF DESIGNATED EQUIPMENT IS PROVIDED AS A BASIS-OF-DESIGN AND BE COMPLETELY COORDINATED WITH ACCOMPANYING DOCUMENTED SCOPES OF WORK, INCLUDING DESIGNATED IMPROVEMENTS.

DESIGN CRITERIA:
PROPOSERS SHOULD REFER TO ALL SPECIFICATIONS AND ACCOMPANYING OWNER'S PROJECT REQUIREMENT (OPR) DOCUMENTS PUBLISHED FOR DESIGN INTENT AND GUIDELINES.

DESIGN AND CONSTRUCTION COORDINATION:
PROPOSERS SHALL IDENTIFY AND COORDINATE REMOVALS OF EXISTING EQUIPMENT (REFER TO SHEET NOTES) AND COMPLETE IMPLEMENTATION OF NEW HVAC SYSTEM. THIS COORDINATION/CONSTRUCTION INCLUDES, BUT IS NOT LIMITED TO:
- MAIN HVAC EQUIPMENT, DUCTWORK, PIPING SYSTEMS
- CENTRAL AND LOCAL VENTILATION EQUIPMENT (OUTSIDE AIR, EXHAUST AIR, RELIEF AIR, ETC.)
- HVAC ELECTRIC POWER SYSTEMS REQUIRED BY UPGRADES
- HVAC LOW-VOLTAGE SYSTEM COMPONENTS (CONTROLS, INTERFACE TO FIRE ALARM/SECURITY SYSTEMS, ETC.)
- EVALUATION/USE OF SUBSTRATE COMPONENTS IN GOOD CONDITION (ROOFS, CEILING/FLOORS, MISC. SUPPORTS, ETC.)

MAIN EQUIPMENT LOCATIONS:
COORDINATED WITH ESTABLISHED PROJECT GUIDELINES, PROPERLY DESIGN/LOCATE NEW HVAC EQUIPMENT FOR FUNCTIONALITY, ACOUSTICAL PERFORMANCE AND SERVICING AND MAKE PREPARATIONS FOR ALL ASSOCIATED WORK REQUIRED BY OVERALL SCOPES OF WORK (POWER, CONTROL, DRAINS, CEILINGS, LIGHTS, ETC.). EXISTING MECHANICAL/UTILITY SPACES, EXISTING WALL/ROOF PENETRATIONS ARE PREFERRED.
- INDOOR EQUIPMENT: ABOVE CEILINGS, MECHANICAL ROOMS
- OUTDOOR EQUIPMENT: ROOF

HVAC PIPING, VENTING AND DRAINING:
DESIGN AND PROPERLY INSTALL PIPING SYSTEMS, FITTINGS, VALVES, INSULATION ACCORDING TO MANUFACTURER'S INSTRUCTIONS. INTENT IS NOT TO DISTURB FINISHED SUBSTRATE (WALLS, HARD CEILINGS, FLOORS) BEYOND WHAT IS REQUIRED FOR NEW SYSTEM IMPLEMENTATION. PROVIDE CONDENSATE PANS/DRAIN LINES FOR PROPER REMOVAL OF CONDENSATE. PROVIDE APPLIANCE VENTS/FLUES FOR PROPER REMOVAL OF EXHAUST GASES AND PRESSURE RELIEF.

HVAC-RELATED POWER SYSTEMS:
DESIGN AND PROPERLY INSTALL ELECTRIC POWER SYSTEMS REQUIRED TO SERVICE NEW HVAC SYSTEMS. COORDINATE SCOPES OF WORK WITH MAIN POWER SYSTEMS/EQUIPMENT UPGRADES (SIZING, LOCATION, DISTRIBUTION PANELS, ETC.). REFER TO MAIN ELECTRICAL SYSTEMS SCOPE NOTES.

HVAC CONTROLS:
DESIGN AND PROPERLY INSTALL UNITARY/PACKAGED CONTROL SYSTEMS AND COMPONENTS AS REQUIRED FOR THE RENOVATED HVAC SYSTEMS, INCLUDING ANY REQUIRED ELECTRICAL POWER. EXCEPT FOR VENDOR-DESIGNED PACKAGED SYSTEMS OR UNITARY CONTROLS, REFER TO SYSTEMS ARCHITECTURE DIAGRAMS AND FLOOR PLANS FOR SCOPE DESCRIPTIONS.

FLOOR PLANS:
FLOOR PLANS SHOWN ON THESE DRAWINGS ARE EXISTING PLANS PROVIDED FOR REFERENCE ONLY, UNLESS NOTED OTHERWISE. THESE PLANS REPRESENT AVAILABLE RECORDS AND MAY CONSTITUTE A COMBINATION OF CONSTRUCTION AND AS-BUILT DOCUMENTS. FINAL WORK MUST BE FIELD VERIFIED BY PROPOSER. ADDITIONAL EXISTING DRAWINGS MAY BE PUBLISHED AS AN EXHIBIT TO THE OPR DOCUMENTATION.

AS-BUILTS:
EXPECTATION IS TO DELIVER THE OWNER A COMPLETE PROJECT AS-BUILT DRAWING SET FOR NOTED UPGRADES INCLUDING EQUIPMENT SCHEDULES, FLOOR LAYOUTS, HVAC PIPE AND DUCT PATHS AND SIZES, ZONING LAYOUTS, THERMOSTAT LOCATIONS, ETC.

ELECTRICAL SYSTEMS - GENERAL NOTES

(APPLIES TO ALL SHEETS)

GENERAL ELECTRICAL INTENT:
THE GENERAL INTENT OF THIS PROJECT IS TO DESIGN AND INSTALL FULLY-FUNCTIONAL AND COMPLIANT ELECTRICAL POWER (APPLICABLE EQUIPMENT AND DISTRIBUTION) WITH DESIGNATED IMPROVEMENTS TO CORRESPOND DIRECTLY TO NOTED/DESIGNED UPDATES TO THE BUILDINGS. IT EXPECTED THAT ALL REQUIRED WORK BE PROVIDED AND BE COMPLETELY COORDINATED WITH ACCOMPANYING DOCUMENTED SCOPES OF WORK, INCLUDING ANY REQUIRED SERVICE AMP-DISTRIBUTION UPGRADES TO ADEQUATELY AND SAFELY POWER NEW EQUIPMENT.

DESIGN CRITERIA:
PROPOSERS SHOULD REFER TO ALL SPECIFICATIONS AND ACCOMPANYING OWNER'S PROJECT REQUIREMENT (OPR) DOCUMENTS PUBLISHED FOR DESIGN INTENT AND GUIDELINES.

DESIGN AND CONSTRUCTION COORDINATION:
PROPOSERS SHALL IDENTIFY AND COORDINATE REMOVALS OF EXISTING EQUIPMENT (REFER TO DEMOLITION NOTES) AND COMPLETE IMPLEMENTATION OF NEW SYSTEMS. THIS COORDINATION/CONSTRUCTION INCLUDES, BUT IS NOT LIMITED TO:
- MAIN SWITCHGEAR UPDATES, AS APPLICABLE
- DISTRIBUTION PANELS (HVAC POWER, LIGHTING/LIGHTING CONTROL PANELS, RECEPTACLE PANELS, INCLUDING RE-WORKS OF LEGACY PANELS AS REQUIRED, ETC.)
- HVAC LOW-VOLTAGE SYSTEM COMPONENTS (UNITARY CONTROLS, INTERFACE TO EXISTING FIRE ALARM/SECURITY SYSTEMS, ETC.)
- EVALUATION/USE OF SUBSTRATE COMPONENTS IN GOOD CONDITION (ROOFS, CEILING/FLOORS, MISC. SUPPORTS, ETC.).

MAIN EQUIPMENT LOCATIONS:
COORDINATED WITH ESTABLISHED PROJECT GUIDELINES, PROPERLY DESIGN/LOCATE NEW MAIN ELECTRICAL EQUIPMENT FOR FUNCTIONALITY, SAFETY, AND SERVICING, AND MAKE PREPARATIONS FOR ALL ASSOCIATED WORK REQUIRED BY OVERALL SCOPES OF WORK (PANELS, EQUIPMENT, CONTROLS, WALLS, CEILINGS, FLOORS, ETC.). EXISTING MECHANICAL/UTILITY SPACES AND EXISTING WALL LOCATIONS PREFERRED, SELECTED AND CONSTRUCTED FOR HEAVY-DUTY ENVIRONMENTS.
- INDOOR SWITCHGEAR EQUIPMENT: IN EXISTING ACCESSIBLE AND SERVICEABLE UTILITY ROOMS (COORDINATE LAYOUTS).

MAIN ELECTRIC RACEWAYS:
DESIGN AND PROPERLY INSTALL MAIN ELECTRIC POWER FEEDS, RACEWAYS AND CABLES WITH INSULATION/ACCESS ACCORDING TO USUAL AND CUSTOMARY METHODS AND PERTINENT REGULATIONS. INTENT IS NOT TO DISTURB FINISHED SUBSTRATE (WALLS, HARD CEILINGS, FLOORS) BEYOND WHAT IS REQUIRED FOR NEW SYSTEM IMPLEMENTATION.

HVAC-RELATED POWER SYSTEMS:
DESIGN AND PROPERLY INSTALL ELECTRIC POWER SYSTEMS REQUIRED TO SERVICE NEW HVAC SYSTEMS. COORDINATE SCOPES OF WORK WITH MAIN POWER SYSTEMS AND EQUIPMENT UPGRADES (SIZING, LOCATION, DISTRIBUTION PANELS, ETC.).

FLOOR PLANS:
FLOOR PLANS SHOWN ON THESE DRAWINGS ARE EXISTING PLANS PROVIDED FOR REFERENCE ONLY, UNLESS NOTED OTHERWISE. THESE PLANS REPRESENT AVAILABLE RECORDS AND MAY CONSTITUTE A COMBINATION OF CONSTRUCTION AND AS-BUILT DOCUMENTS. FINAL WORK MUST BE FIELD VERIFIED BY PROPOSER. ADDITIONAL EXISTING DRAWINGS MAY BE PUBLISHED AS AN EXHIBIT TO THE OPR DOCUMENTATION.

AS-BUILTS:
EXPECTATION IS TO DELIVER THE OWNER AN ELECTRICAL AS-BUILT DRAWING SET FOR NOTED UPGRADES INCLUDING PANEL SCHEDULES, FLOOR LAYOUTS, RECIRCUITING, COMPLETE UPDATED ONE-LINE DIAGRAM, ETC.

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

25 W JEFFERSON ST
JEFFERSON, OH 44047

PROJECT NUMBER:	2500105
DRAWN BY:	AEU
CHECKED BY:	SBH

#	ISSUE	DATE
-	FOR PROPOSAL	11/26/25

DRAWING TITLE:

COVER SHEET

DRAWING NUMBER:

T-01

MECHANICAL DEMO NOTES
(APPLIES TO ALL MECHANICAL SHEETS)

A. THESE DRAWINGS ARE TO BE USED AS A GUIDELINE FOR DEMOLITION AND NEW WORK. THE CONTRACTOR MUST VISIT THE SITE PRIOR TO PROPOSAL TO VERIFY ALL WORK REQUIRED FOR A COMPLETE PROJECT AND INCLUDE THE COST OF SUCH WORK IN THEIR PROPOSAL.
B. THE MECHANICAL CONTRACTOR SHALL COORDINATE LOSS OF EXISTING SERVICES TO THE EXISTING AREAS AS REQUIRED, AND IF NECESSARY SHALL PROVIDE TEMPORARY SERVICES IN AFFECTED SPACES AS COORDINATED WITH ACCEPTED PROJECT SCHEDULES.
C. ANY SYSTEMS SHOWN AS BEING REMOVED SHALL BE REMOVED COMPLETELY AND MADE SAFE INCLUDING CONTROLS, PIPING, DUCTWORK AND ANY ASSOCIATED INFRASTRUCTURE NOT REMAINING FOR USE, UNLESS NOTED OTHERWISE ON PLAN.
D. ALL WALLS, CEILING, FLOORS, ETC. BEING DISTURBED BY THE WORK SHALL BE RETURNED TO FINISHED CONDITIONS TO MATCH EXISTING. CUTTING, PATCHING, LABELING, AND PAINTING ARE TO BE INCLUDED, AS NECESSARY.
E. EXISTING PLAN BACKGROUNDS USED IN THIS DRAWING SET MAY NOT ACCURATELY REPRESENT FIELD CONDITIONS OR QUANTITIES. CONTRACTOR IS TO VERIFY EXISTING FIELD CONDITIONS, QUANTITIES, AND CONFIGURATIONS BEFORE SUBMITTING PROPOSALS OR COMMENCING WORK.
F. COORDINATE WITH OWNER THE RIGHT OF SALVAGED MATERIAL. PROPERLY DISPOSE OF MATERIAL NOT CLAIMED.

MECHANICAL INSTALLATION NOTES
(APPLIES TO ALL MECHANICAL SHEETS)

A. COORDINATE OVERALL DESIGN, PIPING LAYOUT, CONTROL COMPONENTS, AND VALVING WITH EXISTING CONDITIONS AND EQUIPMENT MANUFACTURER(S). MAINTAIN REQUIRED CLEARANCES ON NEW DEVICES AND EQUIPMENT.
B. PROVIDE ALL HANGERS, SUPPORTS AND MISCELLANEOUS COMPONENTS REQUIRED FOR A COMPLETE INSTALLATION.
C. COMPLETELY INSULATE ALL NEW PIPING AND DUCTWORK PER INDUSTRY STANDARDS AND APPLICABLE ENERGY CODES. USE PROTECTIVE COVERS WHERE APPROPRIATE AND LABEL SERVICE FLOW.
D. PROVIDE COMPLETE INSTALL OF DRAIN AND VALVE ACCESSORIES PER MANUFACTURER RECOMMENDATIONS, INCLUDING BALANCING/ISOLATION VALVES FOR EACH PIPING BRANCH AND TERMINAL CONNECTION.
E. FLUSH AND CLEAN SYSTEM PRIOR TO OPERATION. REMOVE FACTORY STRAINERS, INSTALL PERMANENT STRAINERS, AND REPLACE AIR FILTERS PRIOR TO PROJECT COMPLETION.
F. PROVIDE POWER TO HVAC UNITS AND CONTROLS (LINE AND LOW VOLTAGE). COORDINATE LOW VOLTAGE CONTROL AND LIFE SAFETY WIRING SCOPE WITH OWNER'S SYSTEM INTEGRATOR AND SYSTEM PROVIDERS.
G. PROPOSER SHALL PROVIDE AIR AND WATER BALANCE REPORTS FOR ALL NEW EQUIPMENT IN THIS PROJECT INCLUDING RTU, VAV BOXES, AND ASSOCIATED HEATING WATER COILS/TERMINALS.
H. IT IS EXPECTED THAT A FINAL DESIGN/INSTALLATION DRAWING SET FOR NOTED UPDATES WILL BE PROVIDED BY THE PROPOSER DURING THE SUBMITTAL REVIEW PROCESS. PROPOSER WILL BE RESPONSIBLE FOR APPLICATION AND PAYMENT RELATED TO PERMITTING, INSPECTION, AND PLAN APPROVALS.
I. FIELD VERIFY EXISTING AREAS WITH RETURN AIR PLENUMS AND ENSURE ANY NEW MATERIALS PROVIDED THEREIN ARE PLENUM-RATED.

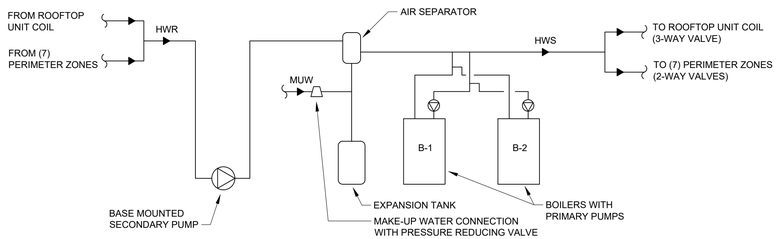
MECHANICAL LEGEND

EXTENT OF DEMOLITION	
CONNECT TO EXISTING	
DEMO LINETYPE	
EXISTING LINETYPE	
NEW WORK LINETYPE	
HEATING WATER SUPPLY	HWS
HEATING WATER RETURN	HWR
(E)	EXISTING TO REMAIN
THERMOSTAT	T
QTY	QUANTITY
TYP	TYPICAL
MSI	MASTER SYSTEMS INTEGRATOR
SA	SUPPLY AIR

Tag	Serves	Type
VAV-07	Lobby	Cooling Only
VAV-08	Office (Sandy Jacobs)	Cooling Only
VAV-09	Office (Mary Ann)	Cooling Only
VAV-10	Mediator Conf Room	Cooling Only
VAV-11	Library	Cooling Only
VAV-12	Library	Cooling Only
VAV-13	Library	Cooling Only
VAV-14	Library	Cooling Only
VAV-15	Restrooms	Cooling Only
VAV-16	Probate Court East	Cooling Only
VAV-17	Probate Court West	Cooling Only
VAV-18	ECC Judge	Cooling Only
VAV-19	East County Courtroom	Cooling Only
VAV-20	Deputy Clerk	Cooling Only
VAV-21	Probate Judge	Cooling Only
VAV-22	East County Court	Cooling Only
VAV-23	Probation Office	Cooling Only
VAV-24	Lobby	Cooling Only
VAV-25	Record Storage	Cooling Only
VAV-26	Court Admin	Cooling Only
VAV-27	Jury Room (Schroeder)	Cooling Only
VAV-28	Courtroom (Schroeder)	Cooling Only
VAV-29	Courtroom (Schroeder)	Cooling Only
VAV-30	Courtroom (Schroeder)	Cooling Only
VAV-31	Courtroom (Schroeder)	Cooling Only
VAV-32	Bailiff (Schroeder)	Cooling Only
VAV-33	Judges Secretary	Cooling Only
VAV-34	Prosecutor's Office	Cooling Only
VAV-35	Clerk of Courts	Cooling Only
VAV-36	Clerk of Courts	Cooling Only
VAV-37	Clerk of Courts Lunchroom	Cooling Only
VAV-38	Jury Room (Harris)	Cooling Only
VAV-39	Courtroom (Harris)	Cooling Only
VAV-40	Courtroom (Harris)	Cooling Only
VAV-41	Courtroom (Harris)	Cooling Only
VAV-42	Courtroom (Harris)	Cooling Only
VAV-43	Bailiff (Harris)	Cooling Only
VAV-44	Office (Harris)	Cooling Only
VAV-45	Magistrate/Staff Arrorney	Cooling Only
VAV-46	Child Support Secretary	Cooling Only

1 EXISTING VAV BOX SCHEDULE

SCALE: N/A



2 EXISTING HEATING WATER FLOW DIAGRAM

SCALE: N/A DIAGRAM PROVIDED FOR REFERENCE ONLY

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

25 W JEFFERSON ST JEFFERSON, OH 44047

PROJECT NUMBER: 2500105
DRAWN BY: AEU
CHECKED BY: SBH

#	ISSUE	DATE
-	FOR PROPOSAL	11/26/25

DRAWING TITLE:

MECHANICAL NOTES, LEGEND, SCHEDULES, AND DETAILS

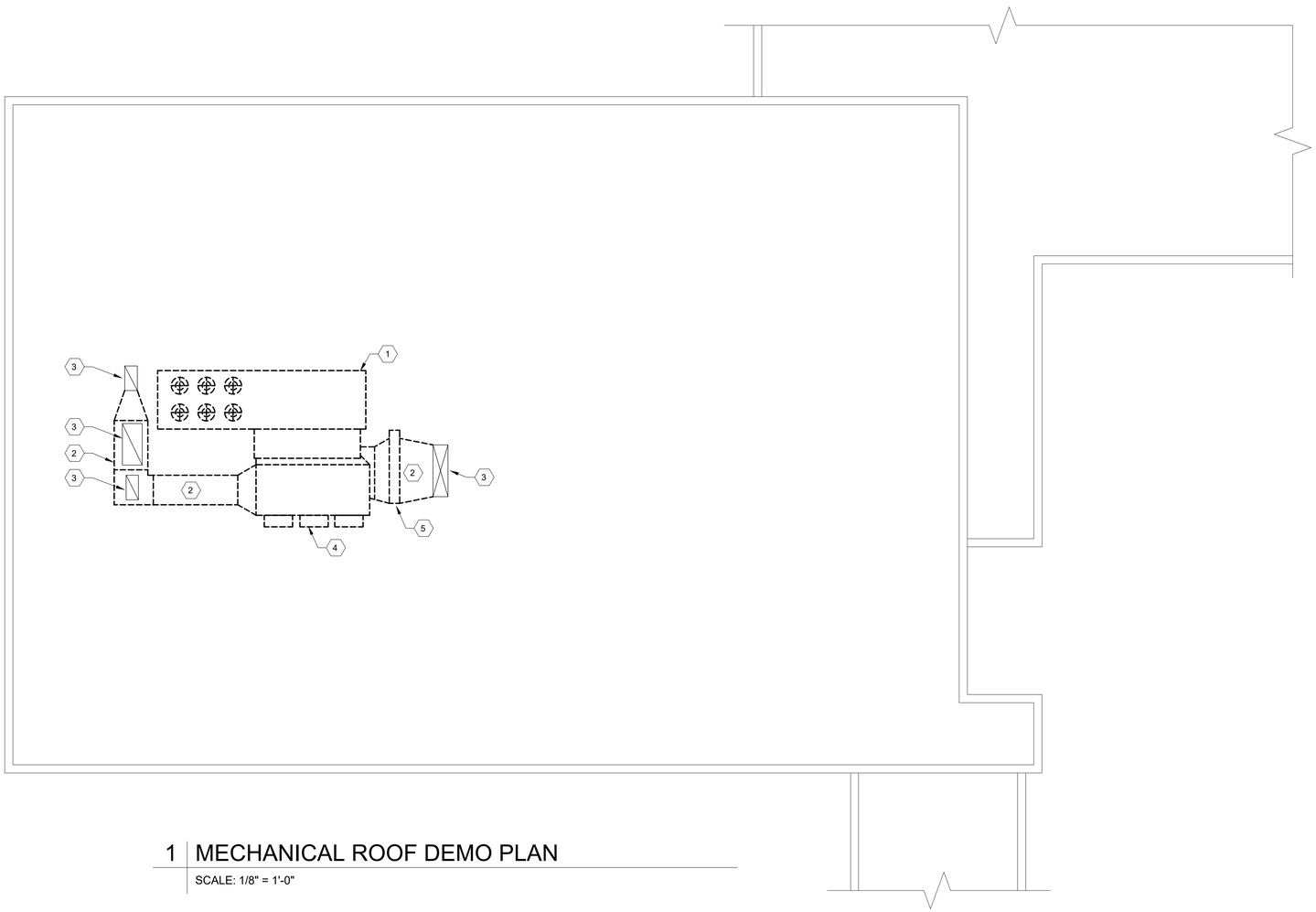
DRAWING NUMBER:

M-01

CODED NOTES
MECHANICAL ROOF DEMO PLAN

X

1. REMOVE EXISTING ROOFTOP UNIT. DISCONNECT EXISTING ELECTRICAL AND CONTROL FEEDS FOR POSSIBLE REUSE WITH NEW UNIT IF FEASIBLE. EXISTING CURB SHALL REMAIN IF FEASIBLE FOR NEW WORK.
2. REMOVE EXISTING SUPPLY AND RETURN DUCTWORK ON ROOF IN ITS ENTIRETY INCLUDING SUPPORTS. PATCH ROOF AS REQUIRED.
3. EXISTING DUCT DROPS THROUGH ROOF (QTY 1 SUPPLY AND QTY 3 RETURN) SHALL REMAIN. COVER OPENINGS DURING CONSTRUCTION.
4. REMOVE EXISTING RELIEF/EXHAUST LOUVER SECTION OF DUCTWORK IN ITS ENTIRETY
5. REMOVE REMOTE HEATING COIL, ASSOCIATED WATER PIPING ON ROOF, AND PIPING PORTAL. PATCH ROOF AS REQUIRED. EXISTING WATER PIPING AND ACTUATOR BELOW ROOF SHALL REMAIN IN COORDINATION WITH NEW WORK SCOPE.



1 MECHANICAL ROOF DEMO PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM

FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

25 W JEFFERSON ST
JEFFERSON, OH 44047

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DRAWING TITLE:

MECHANICAL ROOF DEMO PLAN

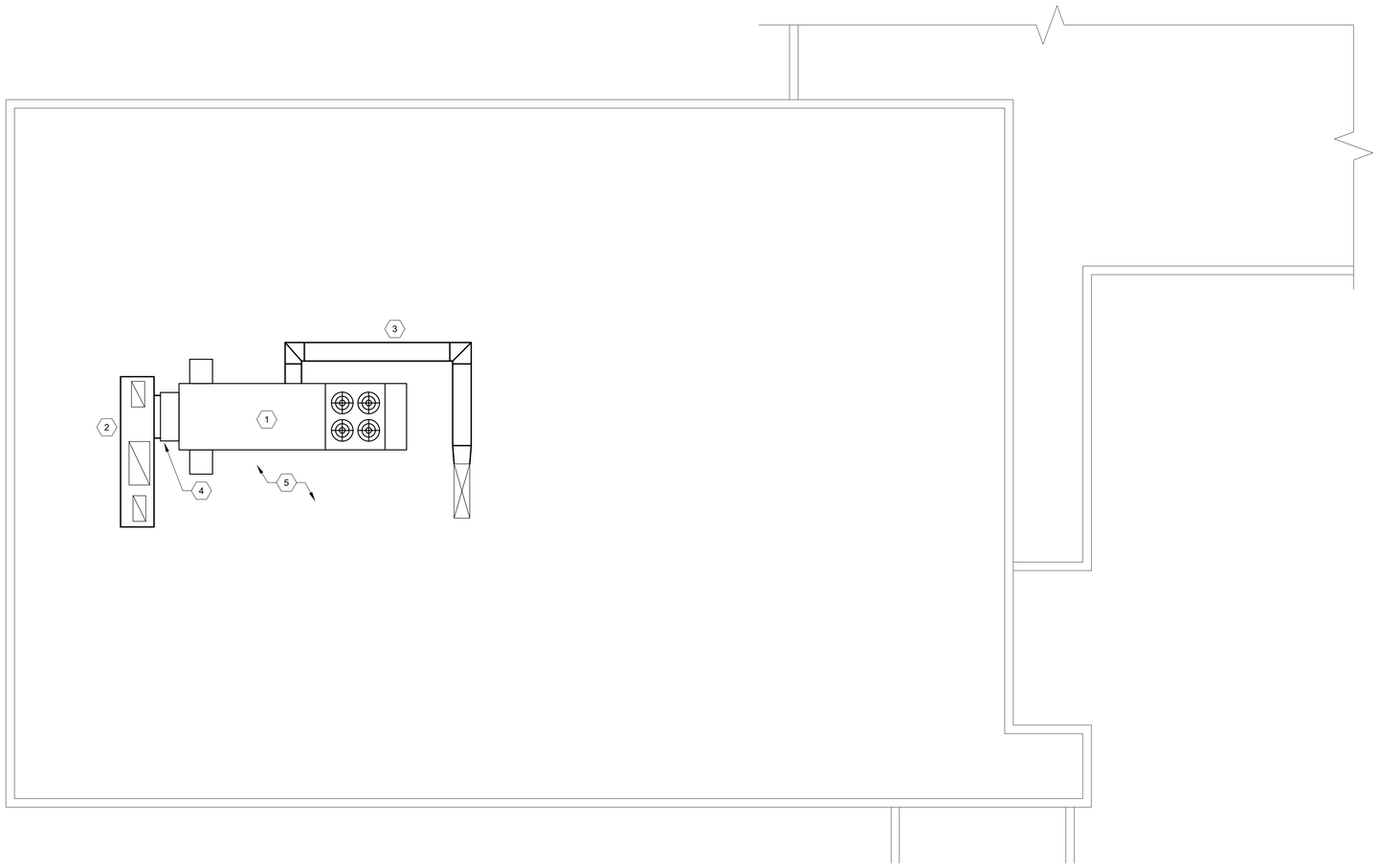
DRAWING NUMBER:

M-02

CODED NOTES
MECHANICAL ROOF NEW WORK PLAN

X

1. INSTALL ROOFTOP UNIT (PRE-PURCHASED BY OWNER). UNIT HAS DX COOLING, HEATING WATER COIL, UV-C LIGHTING SYSTEM, AND PACKAGED CONTROLLER (REFER TO EXHIBITS INCLUDED IN THIS OPR FOR RECORD SUBMITTAL INFORMATION). PROPOSER SHALL VERIFY EXISTING STRUCTURE IS ADEQUATE FOR NEW UNIT AND PROVIDE STRUCTURAL MODIFICATIONS AS REQUIRED. IT IS PROPOSER'S OPTION TO PROVIDE A NEW ROOF CURB/ADAPTER OR TO REUSE EXISTING CURB (IF IN GOOD CONDITION AND PROPERLY ALIGNED). PROVIDE NEW INSULATION UNDER UNIT AND WITHIN CURB/ADAPTER (MINIMUM R-13). PROVIDE ALL CONNECTIONS, SUPPORTS, ETC. FOR PROPER ATTACHMENT TO ROOF. TARGETED MINIMUM HEIGHT OF UNIT ABOVE ROOF IS 12" (COORDINATE WITH UNIT REQUIREMENTS TO PROHIBIT ADVERSE AFFECTS OF SNOW ACCUMULATION). PROVIDE ASSOCIATED CONTROL AND ELECTRICAL CONNECTIONS FOR A FULLY OPERATIONAL UNIT.
2. PROVIDE NEW RETURN AIR PLENUM DUCT WITH CONNECTIONS TO ALL THREE EXISTING RETURN DUCTS THROUGH ROOF. EXTEND PLENUM TO NEW ROOFTOP UNIT AND PROVIDE PROPER CONNECTION. PLENUM SHALL HAVE INTERIOR INSULATION AS REQUIRED BY CODE FOR DUCTS LOCATED OUTDOORS. PROVIDE PROPER DUCTWORK FINISH FOR DUCTS LOCATED OUTDOORS. DUCTWORK SHALL BE MOUNTED WITH MINIMUM 12" CLEARANCE ABOVE ROOF. COORDINATE DUCTWORK DESIGN WITH AIRFLOW MEASURING DEVICE INCLUDED AS PART OF PRE-PURCHASED UNIT. COORDINATE WITH REQUIRED CLEARANCE OF RTU OUTDOOR AIR INTAKE HOODS FOR PROPER AIRFLOW.
3. PROVIDE SUPPLY AIR DUCTWORK WITH CONNECTION TO EXISTING SUPPLY DUCT MAIN THROUGH ROOF. EXTEND AND CONNECT TO NEW ROOFTOP UNIT AND PROVIDE PROPER CONNECTION. PROVIDE INSULATION AND OUTDOOR-RATED DUCT PROTECTIVE COVERING ON ENTIRE SUPPLY DUCT SECTION. DUCTWORK SHALL BE MOUNTED WITH MINIMUM 12" CLEARANCE ABOVE ROOF. COORDINATE FINAL INSTALLATION LOCATIONS WITH RTU CLEARANCE REQUIREMENTS.
4. INSTALL RETURN AIR SMOKE DETECTOR (INCLUDED WITH PRE-PURCHASED UNIT) IN MANUFACTURER-APPROVED AND CODE-APPROVED LOCATION. PROVIDE REQUIRED COORDINATION AND CONNECTION TO EXISTING FIRE ALARM SYSTEM. PROVIDE OUTDOOR COVER IF INSTALLED OUTSIDE.
5. SEAL ALL NEW ROOF PENETRATIONS (PIPING, ELECTRICAL, ETC.) WEATHER-TIGHT.



1 MECHANICAL ROOF NEW WORK PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

25 W JEFFERSON ST
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PROJECT NUMBER:	2500105
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#	ISSUE	DATE
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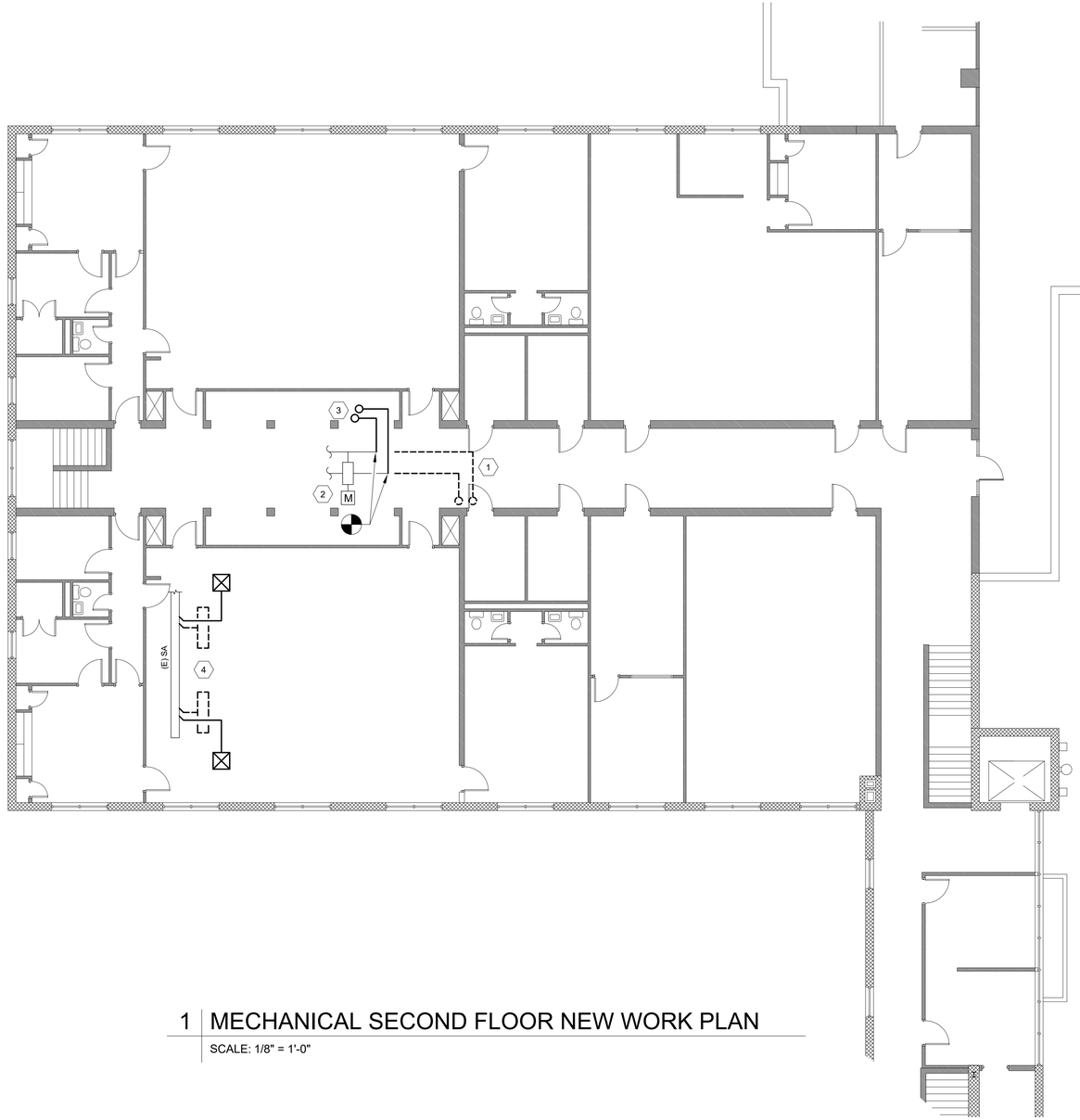
DRAWING TITLE:
MECHANICAL ROOF NEW WORK PLAN

DRAWING NUMBER:
M-03

CODED NOTES
MECHANICAL SECOND FLOOR NEW WORK PLAN

X

1. REMOVE EXISTING INSULATED HEATING WATER PIPING UP THROUGH ROOF TO DEMOLISHED REMOTE HEATING WATER COIL. EXISTING LINES BELOW ROOF SHALL REMAIN AS FEASIBLE FOR CONNECTION TO NEW UNIT.
2. EXISTING 3-WAY CONTROL VALVE AND ACTUATOR SHALL REMAIN AND BE CONNECTED TO NEW ROOFTOP UNIT HEATING WATER COIL PIPING. PROVIDE ASSOCIATED CONTROL WIRING AND PROGRAMING FOR CONTROL OF COIL WITHIN NEW RTU.
3. EXTEND EXISTING HEATING WATER COIL SUPPLY AND RETURN PIPING UP THROUGH ROOF CURB TO NEW RTU HEATING WATER COIL. PROVIDE ISOLATION VALVE FOR EACH LINE PRIOR TO PIPE RISE THROUGH ROOF. INSULATE LINES BELOW ROOF TO MATCH EXISTING HEATING WATER LINES. INSULATE LINES ABOVE ROOF APPROPRIATELY TO PROHIBIT FREEZING RISK.
4. EXISTING LINEAR DIFFUSER SETUP IN COURTROOM PROVIDES EXCESS NOISE TO SOUND AMPLIFIER/MICROPHONE AT JUDGE'S SEAT. REMOVE EXISTING LINEAR DIFFUSERS AND ASSOCIATED BRANCH DUCTWORK. PROVIDE NEW PLAQUE-STYLE 2x2' DIFFUSERS LOCATED APPROXIMATELY AS SHOWN ON PLAN WITH ASSOCIATED BRANCH DUCTWORK. INTENT IS TO REUSE TAKE-OFF LOCATIONS FOR NEW BRANCHES. BALANCE AIRFLOWS FOR NEW DIFFUSERS TO SAME AIRFLOW PREVIOUS SERVED BY LINEAR DIFFUSERS. MOUNT DUCTWORK AVOIDING EXCESSIVE TURNS AND BENDS TO ENSURE PROPER AIRFLOW AND TO MINIMIZE NOISE AT NEW DIFFUSERS. TARGETED AIRFLOW IS 400 CFM PER DIFFUSER.



1 MECHANICAL SECOND FLOOR NEW WORK PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM

FACILITY INVESTMENT RETROFIT MAINTENANCE

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DRAWING TITLE:

MECHANICAL SECOND FLOOR NEW WORK PLAN

DRAWING NUMBER:

M-04

MINI-SPLIT SYSTEMS SCHEDULE

OUTDOOR UNIT TAG	INDOOR UNIT TAG	TARGETED TONNAGE	SERVICE	TYPE	NOTES
CU-1	AC-1	2	TECH ROOM	WALL-MOUNTED INDOOR UNIT GRADE-MOUNTED OUTDOOR UNIT	ALL

NOTES:
1. COOLING-ONLY CAPABILITY (NOT HEAT PUMP)
2. OUTDOOR CONDENSING UNIT MOUNTED ON GRADE ON CONCRETE PAD
3. PROVIDE OUTDOOR UNIT WITH LOW AMBIENT WIND BAFFLES
4. PROVIDE DISCONNECT FOR INDOOR AND OUTDOOR UNITS
5. INDOOR UNIT MOUNTED APPROX 8'-0" AFF IN TECHNOLOGY ROOM
6. WALL-MOUNTED, WIRED THERMOSTAT
7. PROVIDE WITH CONDENSATE PUMP

CODED NOTES
MECHANICAL FIRST FLOOR NEW WORK PLAN

X

1. PROVIDE MINI SPLIT AC SYSTEM FOR TECHNOLOGY ROOM. REFER TO MINI-SPLIT SYSTEMS SCHEDULE FOR MORE INFORMATION. MOUNT INDOOR UNIT APPROXIMATELY 8'-0" ABOVE FLOOR, FIELD VERIFY BEST LOCATION WITH EXISTING EQUIPMENT. MOUNT OUTDOOR UNIT ON GRADE WITH NEW CONCRETE PAD. PROVIDE OUTDOOR RATED INSULATION ON ALL EXTERIOR PIPING. ROUTE CONDENSATE FROM INDOOR UNIT TO DISCHARGE OUTSIDE WITH SPLASHBLOCK. ROUTE REFRIGERANT PIPING TIGHT TO WALL IN WITH PROPER HANGERS, BRACKETS, ETC.
2. PROVIDE GLYCOL FILL STATION AND ASSOCIATED CONNECTION TO HEATING WATER LOOP. CONNECT VIA 1" PIPE TO EXISTING EXPANSION TANK BRANCH LINE. PROVIDE ISOLATION VALVE ON FILL STATION BRANCH. FIELD VERIFY BEST LOCATION IN MECHANICAL ROOM FOR FILL STATION.
3. EXISTING BOILER PLANT MAKE-UP WATER LINE DOES NOT HAVE A BACKFLOW PREVENTOR. PROVIDE NEW BACKFLOW PREVENTOR DEVICE AS REQUIRED BY LOCAL CODES ON EXISTING MAKE-UP WATER LINE. COORDINATE BEST LOCATION IN FIELD. PROVIDE MOUNTING SUPPORTS AND DRAIN PIPING AS REQUIRED FOR PROPER OPERATION.

1 MECHANICAL FIRST FLOOR NEW WORK PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

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DRAWING TITLE:
MECHANICAL FIRST FLOOR NEW WORK PLAN

DRAWING NUMBER:
M-05

CODED NOTES
MECHANICAL CONTROLS PLANS

X

1. ALT-2 SCOPE: PROVIDE NEW CONTROLS FOR EXISTING COOLING-ONLY VAV BOX. EXISTING VAV BOX SHALL REMAIN. REPLACE VAV BOX CONTROLLER, DISCHARGE AIR TEMPERATURE SENSOR, AND WALL-MOUNTED THERMOSTAT WITH NEW DEVICES. PROVIDE ASSOCIATED WIRING AND PROGRAMMING FOR A FULLY FUNCTIONING SYSTEM. COORDINATE INTEGRATION OF NEW EQUIPMENT WITH OWNER'S MSI. TARGETED WIRING SCOPE IS TO PROVIDE NEW WIRING FOR THERMOSTAT AND DISCHARGE AIR SENSOR BUT TO REUSE ALL OTHER POWER/LOW VOLTAGE WIRING. FINAL CHOICE TO REUSE ANY WIRING SHALL BE VERIFIED IN FILED WITH FINAL DESIGN DECISIONS FOR BEST LONG-TERM OUTCOME. LABEL THERMOSTAT WITH VAV TAG DESIGNATION. PROPOSER SHALL FIELD VERIFY THERMOSTAT TAGS SHOWN ON THESE DRAWINGS ARE ACCURATE WITH FIELD-INSTALLED SETUPS. ADDITIONALLY, PROPOSER SHALL VERIFY VAV BOX LOCATIONS IN FIELD AND PROVIDE LOCATIONS ON AS-BUILT DRAWING SET.
2. ALT-2 SCOPE: PROVIDE NEW THERMOSTAT FOR FINTUBE CONTROL. EXISTING CONTROL VALVE AND WIRING IS INTENDED TO REMAIN. LABEL THERMOSTAT ACCORDINGLY. FIELD VERIFY EXISTING CONTROLLER SERVING EACH FINTUBE ZONE AND UPGRADE APPROPRIATELY FOR PROPER OPERATION AFTER VAV CONTROLLER CHANGEOUT.

1 MECHANICAL SECOND FLOOR CONTROLS PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

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JEFFERSON, OH 44047

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DRAWING TITLE:

MECHANICAL SECOND FLOOR CONTROLS PLAN (ALT-2)

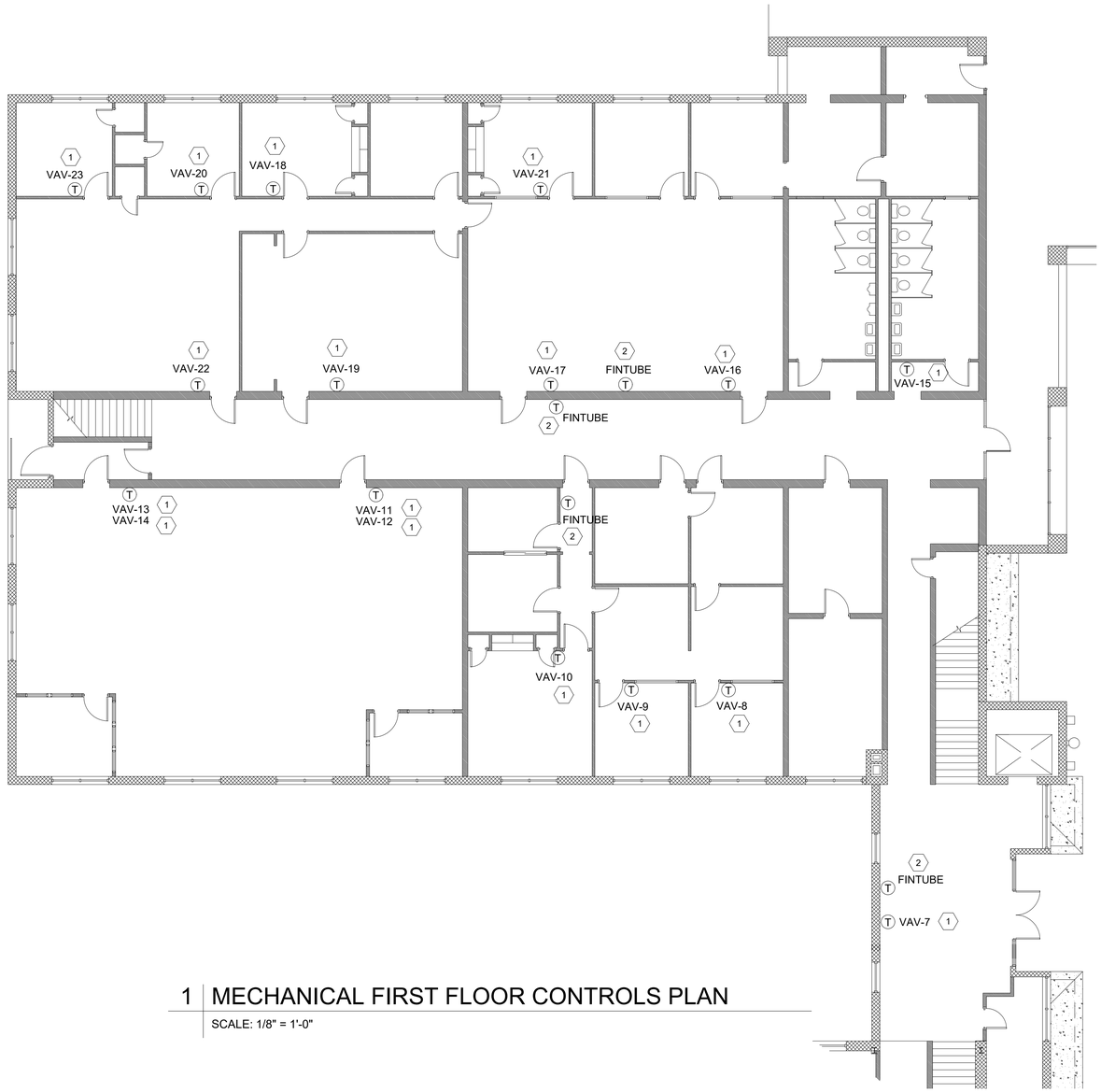
DRAWING NUMBER:

M-06

CODED NOTES
MECHANICAL CONTROLS PLANS

X

1. ALT-2 SCOPE: PROVIDE NEW CONTROLS FOR EXISTING COOLING-ONLY VAV BOX. EXISTING VAV BOX SHALL REMAIN. REPLACE VAV BOX CONTROLLER, DISCHARGE AIR TEMPERATURE SENSOR, AND WALL-MOUNTED THERMOSTAT WITH NEW DEVICES. PROVIDE ASSOCIATED WIRING AND PROGRAMMING FOR A FULLY FUNCTIONING SYSTEM. COORDINATE INTEGRATION OF NEW EQUIPMENT WITH OWNER'S MSI. TARGETED WIRING SCOPE IS TO PROVIDE NEW WIRING FOR THERMOSTAT AND DISCHARGE AIR SENSOR BUT TO REUSE ALL OTHER POWER/LOW VOLTAGE WIRING. FINAL CHOICE TO REUSE ANY WIRING SHALL BE VERIFIED IN FILED WITH FINAL DESIGN DECISIONS FOR BEST LONG-TERM OUTCOME. LABEL THERMOSTAT WITH VAV TAG DESIGNATION. PROPOSER SHALL FIELD VERIFY THERMOSTAT TAGS SHOWN ON THESE DRAWINGS ARE ACCURATE WITH FIELD-INSTALLED SETUPS. ADDITIONALLY, PROPOSER SHALL VERIFY VAV BOX LOCATIONS IN FIELD AND PROVIDE LOCATIONS ON AS-BUILT DRAWING SET.
2. ALT-2 SCOPE: PROVIDE NEW THERMOSTAT FOR FINTUBE CONTROL. EXISTING CONTROL VALVE AND WIRING IS INTENDED TO REMAIN. LABEL THERMOSTAT ACCORDINGLY. FIELD VERIFY EXISTING CONTROLLER SERVING EACH FINTUBE ZONE AND UPGRADE APPROPRIATELY FOR PROPER OPERATION AFTER VAV CONTROLLER CHANGEOUT.



1 MECHANICAL FIRST FLOOR CONTROLS PLAN

SCALE: 1/8" = 1'-0"

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

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DRAWING TITLE:

MECHANICAL FIRST FLOOR CONTROLS PLAN (ALT-2)

DRAWING NUMBER:

M-07

ELECTRICAL DEMO NOTES
(APPLIES TO ALL E-SERIES SHEETS)

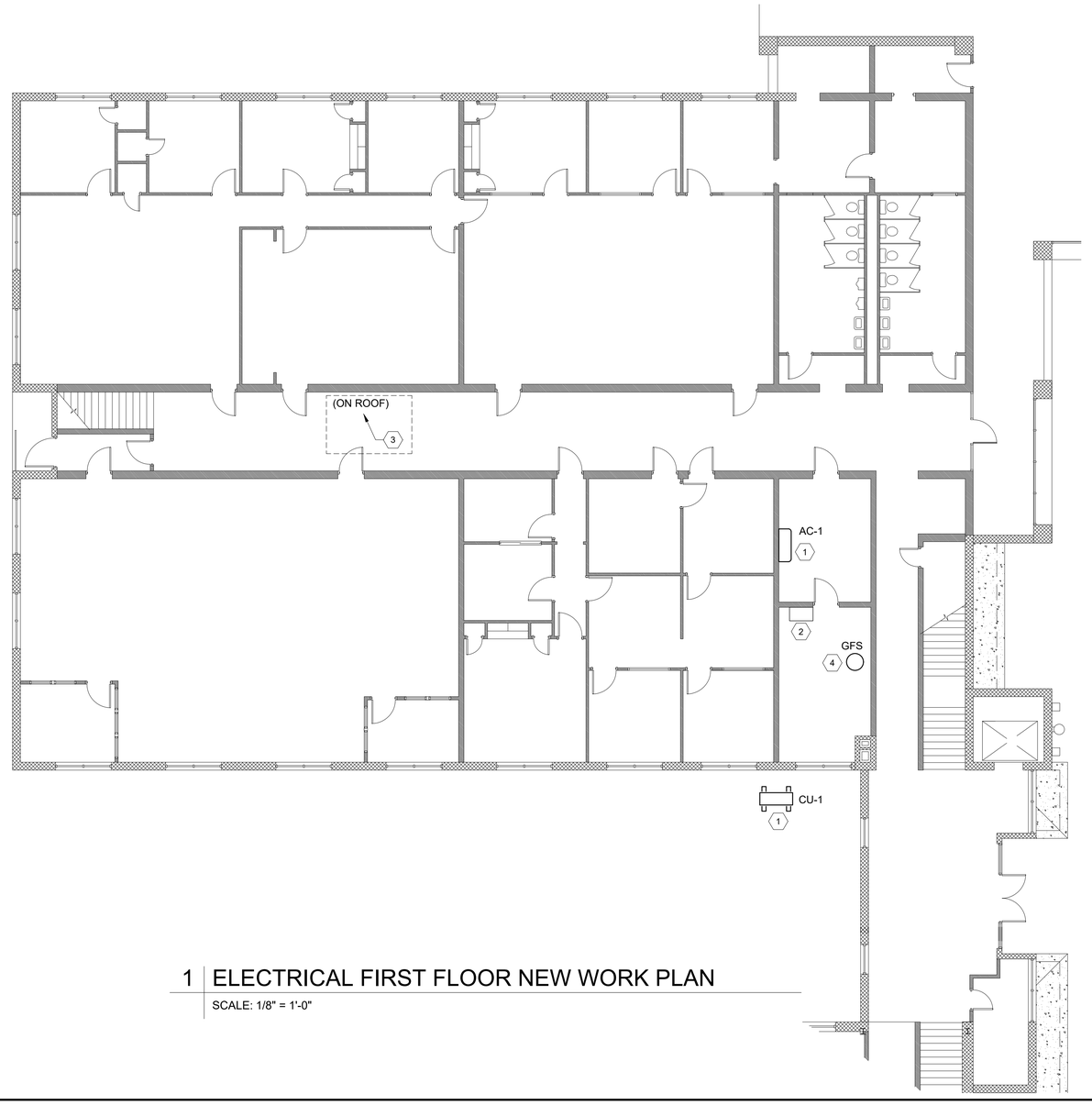
A. THESE DRAWINGS ARE TO BE USED AS A GUIDELINE FOR DEMOLITION AND NEW WORK. THE CONTRACTOR MUST VISIT THE SITE PRIOR TO PROPOSAL TO VERIFY ALL WORK REQUIRED FOR A COMPLETE PROJECT AND INCLUDE THE COST OF SUCH WORK IN THEIR PROPOSAL.
B. THE ELECTRICAL CONTRACTOR SHALL COORDINATE LOSS OF EXISTING SERVICES TO THE EXISTING AREAS AS REQUIRED, AND IF NECESSARY SHALL PROVIDE TEMPORARY SERVICES IN AFFECTED SPACES AS COORDINATED WITH ACCEPTED PROJECT SCHEDULES.
C. ANY SYSTEMS SHOWN AS BEING REMOVED SHALL BE REMOVED COMPLETELY AND MADE SAFE INCLUDING, BUT NOT LIMITED TO, CONDUIT, WIRING, SWITCHGEAR, LOW VOLTAGE CABLING, AND ANY ASSOCIATED INFRASTRUCTURE NOT REMAINING FOR USE, UNLESS NOTED OTHERWISE ON PLAN.
D. ANY ELECTRICAL CIRCUITS NOT BEING REUSED SHALL BE REMOVED BACK TO THE PANEL, SWITCHBOARD, OR OTHER SWITCHGEAR WHERE THEY ORIGINATE. OPENINGS IN ENCLOSURES SHALL BE PLUGGED BY INDUSTRY STANDARD MEANS, AND ALL WORK SHALL BE LEFT IN A CODE COMPLIANT CONDITION.
E. ALL WALLS, CEILING, FLOORS, ETC. BEING DISTURBED BY THE WORK SHALL BE RETURNED TO FINISHED CONDITIONS TO MATCH EXISTING. CUTTING, PATCHING, LABELING, AND PAINTING ARE TO BE INCLUDED, AS NECESSARY.
F. EXISTING PLAN BACKGROUNDS USED IN THIS DRAWING SET MAY NOT ACCURATELY REPRESENT FIELD CONDITIONS OR QUANTITIES. CONTRACTOR IS TO VERIFY EXISTING FIELD CONDITIONS, QUANTITIES, AND CONFIGURATIONS BEFORE SUBMITTING PROPOSALS OR COMMENCING WORK.
G. COORDINATE WITH OWNER THE RIGHT OF SALVAGED MATERIAL. PROPERLY DISPOSE OF MATERIAL NOT CLAIMED.

ELECTRICAL INSTALLATION NOTES
(APPLIES TO ALL E-SERIES SHEETS)

A. INSTALLATIONS ARE TO BE ACCOMPLISHED USING INDUSTRY STANDARD BEST PRACTICES, IN A NEAT AND ORDERLY MANNER AND ADHERING TO ALL APPLICABLE LOCAL, STATE, AND NATIONAL CODES. PROPOSER WILL CREATE FINAL DESIGN FOR NOTED ELECTRICAL SYSTEMS BASED ON PROJECT GOALS, OVERALL BENEFITS TO SYSTEM OPERATION, AND MAINTENANCE AND SITE LIMITATIONS.
B. NOTED AREAS OF NEW ELECTRICAL WORK MAY INVOLVE SELECT DEMOLITION OF EXISTING FIXTURES, CONDUIT, WALL SWITCHES, CONTROLS, ETC. AS REQUIRED AND COORDINATED WITH OTHER PROJECT DOCUMENTATION. ALL EQUIPMENT REMOVED IS TO BE COORDINATED WITH THE OWNER FOR SALVAGE RIGHTS. THAT MATERIAL WHICH IS NOT CLAIMED BY THE OWNER IS TO BE FULLY AND PROPERLY DISPOSED OF. CONDUIT, WIRING, MOUNTING ACCESSORIES NOT BEING REUSED ARE TO BE COMPLETELY REMOVED.
C. IT IS EXPECTED THAT A FINAL DESIGN/INSTALLATION DRAWING SET FOR NOTED UPDATES WILL BE PROVIDED BY THE PROPOSER DURING THE SUBMITTAL REVIEW PROCESS. PROPOSER WILL BE RESPONSIBLE FOR APPLICATION AND PAYMENT RELATED TO PERMITTING AND PLAN APPROVALS.
D. PROVIDE LIGHTING PROTECTION FOR UNITS MOUNTED ON ROOF, AS REQUIRED WITH FINAL COORDINATED DESIGNS AND LOCAL CODES.

CODED NOTES
ELECTRICAL FIRST FLOOR NEW WORK PLAN
X

1. PROVIDE REQUIRED ELECTRICAL UPGRADES FOR MINI-SPLIT SYSTEM PER LOCAL CODES AND STANDARD PRACTICES.
2. EXISTING ELECTRICAL POWER FOR ROOFTOP UNIT IS FED FROM PANEL IN BOILER ROOM. PROVIDE NECESSARY ELECTRICAL UPGRADES FOR NEW ROOFTOP UNIT PER LOCAL CODES AND STANDARD PRACTICES. REFER TO RECORD SUBMITTAL INFORMATION FOR NEW ROOFTOP UNIT PARAMETERS.
3. PROVIDE NECESSARY ELECTRICAL WIRING AND FIRE ALARM CONNECTIONS FOR NEW RETURN AIR DUCT SMOKE DETECTOR. COORDINATE ROOF INSTALLATION LOCATION WITH MECHANICAL CONTRACTOR.
4. PROVIDE LINE VOLTAGE AND LOW VOLTAGE WIRING FOR NEW GLYCOL FILL STATION IN ACCORDANCE WITH MANUFACTURER'S REQUIREMENTS. COORDINATE REQUIRED LOW LEVEL ALARM WITH OWNER'S MSI.



1 ELECTRICAL FIRST FLOOR NEW WORK PLAN
SCALE: 1/8" = 1'-0"

COUNTY FIRM
FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

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CHECKED BY:	SBH

#	ISSUE	DATE
-	FOR PROPOSAL	11/26/25

DRAWING TITLE:
ELECTRICAL NOTES AND FIRST FLOOR NEW WORK PLAN

DRAWING NUMBER:
E-01

INTEGRATION SUPERVISOR ENTERPRISE LEVEL

HEAD END INTEGRATION AND SYSTEMS METERING

CENTRAL EQUIPMENT AND LOCAL CONTROLLERS

TERMINAL EQUIPMENT AND SPACE DEVICES

1. NOTED CONTROL DEVICES AND ASSOCIATED PROGRAMMING FOR EQUIPMENT SHOWN ON THIS SYSTEMS ARCHITECTURE DIAGRAM ARE PROVIDED BY THE OWNER'S MASTER SYSTEMS INTEGRATOR (MSI). COORDINATE BREAKDOWN OF RESPONSIBILITIES WITH THE MSI FOR A COMPLETE AND FULLY OPERABLE SYSTEM ACCORDING TO PROJECT SPECIFICATIONS AND OWNER STANDARDS.

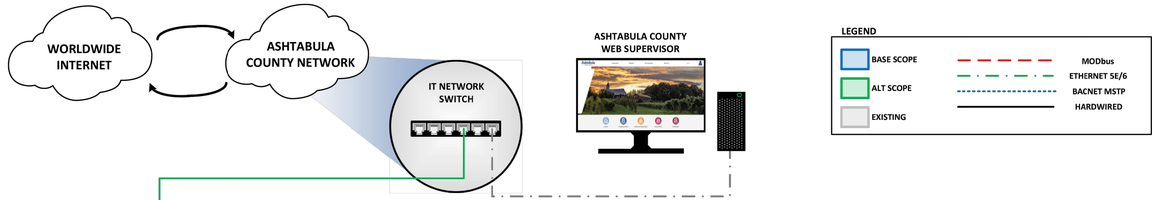
2. ALL DEVICE INSTALLATION AND WIRING IS PROVIDED BY THE PROPOSING CONTRACTOR. COORDINATE WITH MSI TO DETERMINE ROUTING OF SERIAL COMM NETWORK BASED ON FIELD CONDITIONS. ROUTING SHOWN IS SCHEMATIC. FINAL ROUTING TO BE NOTED ON AS-BUILT DRAWINGS.

3. FOR BACNET MSTP CABLE USE CONTROLLER MANUFACTURER RECOMMENDATION OR BELDEN 6G01FE IF NONE SPECIFIED. UTILIZE PLENUM-RATED CABLE IN EXISTING RETURN AIR PLENUM SPACES.

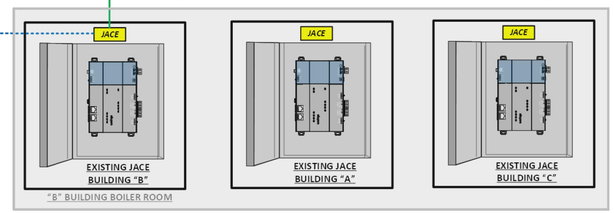
4. CONTROL MATERIALS AND SYSTEMS ARE TO CONFORM TO THE OPEN TEMPERATURE CONTROL SPECIFICATION 230900 INCLUDED AS PART OF THE OWNER'S PROJECT REQUIREMENTS.

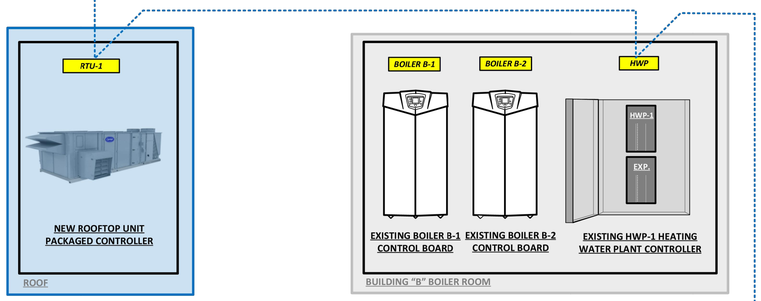
5. THE PROPOSING CONTRACTOR IS RESPONSIBLE FOR A COMPLETELY INSTALLED SYSTEM, INCLUDING COORDINATION WITH AND POSSIBLE INSTALLATION OF FIRE ALARM/DETECTION INTERFACE AND WIRING OF UNITARY CONTROLS, WHICH ARE SUPPLIED WITH EQUIPMENT. THIS MAY INCLUDE SMOKE DETECTORS, UNITARY CONTROLLERS, SENSORS, ACTUATORS, COMM MODULES OR OTHER DEVICES.

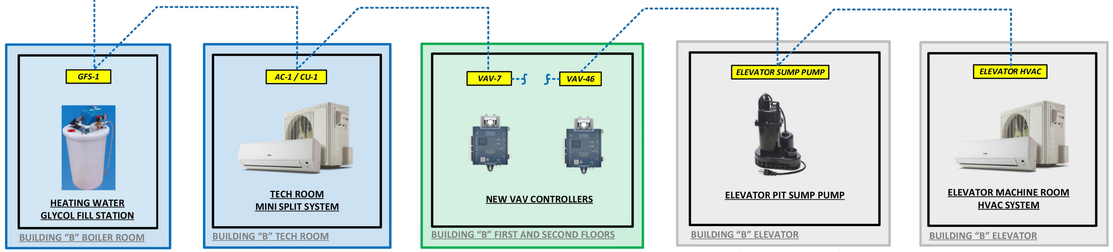
6. THIS DRAWING IS INTENDED FOR SCHEMATIC DESIGN ONLY. FINAL ROUTING AND EQUIPMENT TYPES/ DEVICES WILL BE COORDINATED WITH FINAL DESIGN IN FORTHCOMING INSTALLATION DRAWINGS.



GENERAL ELECTRICAL NOTE: All wiring shall be in accordance with the Project Electrical Specifications, the National Electrical Code and any applicable local codes. All wiring shall be installed in the conduit types specified in the Project Electrical Specifications unless otherwise allowed by the National Electrical Code or applicable local codes. Where plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.







1 SYSTEM ARCHITECTURE DIAGRAM

SCALE: N/A

COUNTY FIRM

FACILITY INVESTMENT RETROFIT MAINTENANCE

Ashtabula COUNTY, OHIO

COURTHOUSE HVAC RENOVATIONS 2025

25 W JEFFERSON ST
JEFFERSON, OH 44047

PROJECT NUMBER:	2500105
DRAWN BY:	AEU
CHECKED BY:	SBH

#	ISSUE	DATE
-	FOR PROPOSAL	11/26/25

DRAWING TITLE:

SYSTEM ARCHITECTURE DIAGRAM

DRAWING NUMBER:

SA-01