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# REQUEST FOR COMPETITIVE BIDS

<b>DATE ISSUED:</b>	3/12/2024
<b>TITLE:</b>	Loveland City Schools Middle/Intermediate School HVAC Controls Replacement
<b>CONTRACT ADMINISTRATOR NAME:</b>	John Ames
<b>EMAIL CONTACT:</b>	amesjo@lovelandschools.org
<b>METHOD OF AWARD:</b>	LOWEST RESPONSIBLE BIDDER PER R.C. 3313.46

Loveland City Schools will receive bids in sealed envelopes marked “2024 Loveland Middle/Intermediate School HVAC Control Replacement Bid” at the following addresses: Loveland City School District, 757 South Lebanon Road, Loveland, OH 45140, Attn: John Ames

**BIDS MUST BE RECEIVED NO LATER THAN: 04/05/2024 @ 12:00 PM, EST**

Bids will be opened and read publicly immediately after the deadline for submission of bids at the Administrative Office Building, 757 South Lebanon Road, Loveland, OH 45140. Bids and any subsequent negotiations shall be held confidential to the extent permitted by law until a final contract agreement is awarded, at which time the file shall be made a matter of public record and may be reviewed by any requesting party.

**AUTHENTICATION OF BID AND STATEMENT OF NON-COLLUSION AND NON-CONFLICT OF INTEREST**

I hereby swear (or affirm) under the penalty for false swearing as provided by Ohio revised code 2921.11:

- That I am the Offeror (if the Offeror is an individual), a partner in the Offeror (if the Offeror is a partnership), or an officer or employee of the bidding corporation having authority to sign on its behalf (if the Offeror is a corporation):
- That the attached Request for Competitive Bids covering Loveland City Schools Middle/Intermediate School HVAC Controls Replacement have been arrived at by the Offeror independently and have been submitted without collusion with, and without any agreement, understanding or planned common course of action with, any other vendor of materials, supplies, equipment, or services described in the Request for Competitive Bids, designed to limit independent bidding or competition:
- That the contents of the bid(s) have not been communicated by the Offeror or its employees or agents to any persons not an employee or agent of the Offeror or its surety; on any bond furnished with the bid(s) and will not be communicated to any such person prior to the official bid(s):
- That the Offeror is legally entitled to enter into the contracts with the State of Ohio and is not in violation of any prohibited conflict of interest.
- Offeror and its affiliates are duly registered with the Ohio Department of Taxation to collect and remit the sales and use tax imposed by Ohio Revised Code Title 57 to the extent required by Ohio law: and will remain registered for the duration of any contract awarded. Furthermore, Offeror is not delinquent on any state taxes or fees owed to the state of Ohio and will remain in good standing for the duration of any contract awarded.
- That I have fully informed myself regarding the accuracy of the statements made above.

**NOTICE**

- Any agreement of collusion among Offerors or prospective Offerors which restrains, tends to restrain, or is reasonably calculated to restrain competition by agreement to bid at a fixed price, or to refrain from bidding, or otherwise, is prohibited.
- Any firm/person who violates any provisions of Ohio Revised Code Chapter 13 shall be guilty of a felony.

<b>Name of Company:</b>		<b>Date:</b>
<b>Address:</b>		<b>Phone:</b>
<b>City:</b>	<b>State:</b>	<b>Zip:</b>
<b>Payment Terms:</b>	<b>This offer is valid for _____ calendar days from the date this proposal is received</b>	<b>E-Mail Address:</b>
<b>Shipping Terms:</b> FOB Destination, Freight Prepaid and Added to Invoice	<b>Print Name:</b>	<b>Web Address:</b>
<b>Federal Employer ID:</b>	<b>Signature:</b>	

**VENDOR IS TO COMPLETE THIS COVER SHEET AND SUBMIT WITH PROPOSAL**

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**NO BID RESPONSE**

Please be advised that our company does not wish to submit a bid in response to the above-mentioned project for the following reason(s):

Too busy at this time

Not engaged in this type of work

Project is too large or small

Cannot meet mandatory specifications (Please specify below)

Other (Please specify)

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Company Name

Name

---

Street Address

Authorized Signature and Date

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City, State, Zip

Title

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**LOVELAND CITY SCHOOLS MIDDLE/INTERMEDIATE SCHOOL HVAC CONTROLS REPLACEMENT**

Loveland City Schools will receive competitive bids for the replacement of the existing HVAC Controls System at Loveland Middle/Intermediate School. The HVAC Control Contractor will be the prime contractor for this project.

Bidders will need to furnish manufactures specifications, measurements, and submittal data sufficient to determine compliance with the criteria set forth in the plans and specifications.

**PURSUANT TO R.C. 153.12, THE ESTIMATED COST OF THIS PROJECT IS \$950,000.**

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## **INSTRUCTIONS TO BIDDERS**

### **PREPARATION OF OFFERS**

Each Offeror shall furnish the information required by the solicitation. The Offeror shall sign the solicitation and print or type their Name, Company Name, Address, Telephone Number and Date. Erasures or other changes must be initialed by the person signing the offer. Offers signed by an agent are to be accompanied by evidence of their authority unless such evidence has been previously furnished to the School District.

### **AUTHORITY TO CONTRACT**

Offeror and the Principal signing on its behalf, certify that it is validly organized with authority to do business and perform the terms hereunder, is qualified to do business in Ohio, if applicable, and is not prohibited from entering into or performing the terms of this agreement for any reason.

### **PRE-CONTRACTUAL EXPENSE**

The School District shall not, in any event, be liable for any pre-contractual expenses incurred by the Offeror in the preparation of their proposal. Offeror shall not include any such expenses as part of their bid.

Pre-Contractual expenses are defined as expenses incurred by the Offeror in:

- 1) Any and all expenses incurred in the preparation of the bid in response to this RFP;
- 2) Any and all expenses incurred with submitting that bid to the School District;
- 3) Any and all expenses incurred while negotiating with the School District any matter related to this bid (such as travel expenses, etc.);
- 4) Any other expenses incurred by the Offeror prior to effective date of the contract.

### **MULTIPLE REQUEST FOR PROPOSALS**

Only one response per company will be accepted.

### **AMENDMENTS TO REQUEST FOR PROPOSAL & ADDITIONAL INFORMATION**

Amendments to this Request for Competitive Bids may be necessary prior to the Bid Date. All requests for information must be received by the Business Manager, John Ames, at [amesjo@lovelandschools.org](mailto:amesjo@lovelandschools.org) on or before 4:00PM, March 29<sup>th</sup>. Any RFI received after this date will not be addressed. Written addenda shall be posted on the District Treasurer's webpage <https://www.lovelandschools.org/domain/23>, scroll down to the Public Bids section.

Oral communication with any person(s) will not be construed as an amendment to the specifications, unless converted to the form of written addenda and posted by the School District.

### **INTERPRETATION OF REQUEST FOR COMPETITIVE BIDS**

If any potential Offeror contemplating the submission of a Request for Competitive Bids has any doubt as to the true meaning of any part of the invitation, he/she should contact **John Ames** via e-mail at [amesjo@lovelandschools.org](mailto:amesjo@lovelandschools.org). Any interpretation of the specifications will be made by written addenda duly issued and posted by the School District.

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## **RESTRICTIONS ON COMMUNICATIONS**

From the issue date of this Request until the issuance of a Notification of Award, each Offeror's sole point of contact will be:

- **John Ames, Business Manager, [amesjo@lovelandschools.org](mailto:amesjo@lovelandschools.org)**

No Offeror should attempt to contact or meet with any district representatives. In order to insure fair and equal treatment, only questions submitted in writing by the date established within this Request for Competitive Bids will be considered responsive. Written responses will then be distributed via addendum.

It is understood that an Offeror may have an existing business relationship with a School District representative that must be maintained during the Request for Competitive Bid process. Normal business contact is permitted. This contact cannot include any discussion of an active Request for Competitive Bid process. Violation of this provision could result in the School District rejecting any bid(s) from the offending Offeror.

## **JOB-SITE TOURS**

Each Offeror, before submitting a bid, may visit the site, check the measurements and thoroughly familiarize himself/herself with all existing conditions likely to be encountered in the work to be done under the contract. Any technical errors or omissions in the technical specifications should be reported to the Owner whose name appears on the face of the Request for Competitive Bids so (within seven (7) days before bid opening) an official addendum can be issued.

The submission of a bid will be construed as evidence that a visit and examination of the site has been made. Later claims for labor, equipment, or materials required or difficulties encountered, which could have been foreseen had such an examination been made, will not be recognized.

## **COVID-19 SAFETY REQUIREMENTS**

Bidders, awardees, their subcontractors and all associated personnel, while on any Loveland School District property, must be in full compliance with all current state, local, and/or federal public health guidance for the prevention of spread of COVID-19.

## **MODIFICATION OR WITHDRAWAL OF OFFERS**

Bids may be withdrawn and modified by written notice received prior to the exact hour and date specified for receipt of offers. A bid may be withdrawn in person by an Offeror or his authorized representative, provided his identity is made known and he/she signs a receipt acknowledging the withdrawal, but only if the withdrawal is made prior to the exact hour and date set for receipt of bids. Bids received at the office designated in this Request after the exact hour and date specified for receipt will not be considered. Bids that have minor clerical errors or any minor irregularities are subject to correction only with concurrence of the School District.

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### **INTERVIEW AND NEGOTIATION SESSIONS**

Request for additional information and /or interviews may be required with any Offeror submitting a responsive bid. The School District does however reserve the right to limit any on-campus and /or teleconference interviews to the lowest two or three bidders

### **DISPOSITION OF PROPOSALS**

All bids become the property of the Loveland City School District. The successful bid will be incorporated into the resulting contract by reference.

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## **TERMS AND CONDITIONS**

Offeror shall not include any additional Terms and Conditions. Inclusion of any additional Terms and Conditions of the Offeror may be cause for rejection of a bid.

### **FIRM PRICING**

Unless otherwise provided, negotiated, or otherwise agreed upon, prices will be considered firm for the entire duration of the established contract period. Prices bid subject to qualifications such as: in effect on receipt of contract/order, escalation or other variables, may be rejected as non-responsive.

### **FOB DESTINATION**

All bids in response to this Request for Competitive Bids must be on the basis of F.O.B. to the School District, all freight prepaid and included in the Unit Price. No other terms are acceptable; any proposals that do not comply with the above will be rejected. The contractor will be fully responsible for all items while in transit, including returns. Any freight claims will be the responsibility of the contractor.

### **DELIVERIES**

Unless otherwise specified in the Request for Competitive Bids, delivery at the earliest possible date is desired.

Offeror must quote actual delivery time; estimates are not appropriate. If necessary, Offeror should contact manufacturer for delivery time on products not in stock.

As provided in this Request for Competitive Bids, the Offeror will clearly state in their bid the time required for the delivery upon receipt of contract, or purchase order. Delivery time must be specific and such phrases "as required", "as soon as possible" or "prompt" have no meaning and will cause for rejecting the proposal.

### **ALTERNATE BRANDS/SPECIFICATIONS**

Unless otherwise specified, brands referenced in this Request are meant to provide a historical account of purchases and to establish a minimum standard of quality only. Offerors may propose brand(s) that they consider to be equal or closely comparable.

Bids offering "equal" products will be considered for award if such products are clearly identified in the bid and are determined by the School District to meet or exceed fully the maximum essential and salient characteristics referenced in the Request. The burden of proof of equality shall be the responsibility of the Offeror. If the Owner judges the material or equipment is not equal to that named in the specifications, the bid shall be rejected. The Owner's decision shall be final.

Offerors proposing alternate brands, must enclose descriptive literature with their bid so that the equality can be verified. Failure to enclose sufficient literature may result in the rejection of the bid.

When specified brand names are not changed, it will be assumed that the Offerors are proposing to furnish those brands. The contracts will be written accordingly, and the successful firm will be required to deliver the brands named.

### **TAXES**

The Loveland City School District is tax exempt from the provision of the Ohio Sales and/or Use Tax on materials and equipment under this solicitation. All Offeror's or contractors shall take this into consideration when submitting their bid. Exemption certifications will be furnished to cover sales and excise tax exemption where applicable and when requested by the vendor.



Offerors are informed that material purchased by the contractor, for the performance of this contract for the Loveland City School District, are **not exempt** from the provisions of the Ohio Sales and/or Use Tax. All adjustments and allowances for the current sales and/or use tax shall be provided for in the bid amount as no adjustments will be permitted and/or made after the fact.

Federal Excise Tax

The Loveland City School District may be entitled to exemption from Federal Excise Tax. The Offeror shall take this into consideration when preparing their RFP response.

**SUSTAINABILITY**

The Loveland City School District is dedicated to acquiring products and services that are consistent with our commitment to sustainability. For the purpose of judging sustainability, the following considerations apply:

Sustainable Development is enhanced through sound Environmental, Social and Economic practices and technologies that minimize or eliminate waste and negative impacts on current resources.

The District seeks products and services that pose no significant risk to human health or environmental quality when compared with competing products or services that serve the same purpose. This comparison, where applicable, may consider raw materials and energy acquisition; production and manufacturing; packaging and distribution; and the operation, maintenance, reuse, recyclability or disposal of a product. Materials, products, and workers from the local region are preferred sources, along with companies/contractors that can demonstrate efforts to ensure worker protections and to restore or enhance the environment.

**INSPECTION**

All supplies and equipment shall be subject to inspection or test by the School District prior to acceptance. In the event supplies or equipment are defective in material or workmanship or otherwise not in conformity with specified requirement, the School District shall have the right to reject them or require acceptable correction at the vendor's expense.

**WARRANTY**

Offeror warrants that all materials and equipment furnished in connection with this bid will be new unless otherwise approved by the School District and shall be free from defects (including defects in design and fit) and suitable for the intended purposes. Offeror must include a statement of manufacturer's standard warranty with their response.

Offerors bidding on a commodity with a product warranty involved must be able to offer service by their company or through a servicing agency. A list of such agency or agencies must be included with the proposal.

Equipment will be serviced by:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(Include name and address)

A copy of the warranty will be furnished upon delivery of equipment to the School District. Warranties shall remain in effect for one (1) year following the School District's acceptance of the materials and equipment or for the duration of the manufacturer's standard warranty period if such period exceeds one year.

Payment to the vendor shall constitute acceptance by the School District. In the event of unacceptable/faulty equipment, the School District will contact the vendor for prompt replacement.

All warranties shall begin no earlier than upon delivery and acceptance by the School District. Warranties for product(s) procured on the District Credit Card shall be exempt from “acceptance” upon payment.

**BID PROPOSAL FORM**

DATE: \_\_\_\_\_, 2024

TO: **Loveland City School District**  
757 South Lebanon Road  
Loveland, Ohio 45140

FROM: \_\_\_\_\_  
(Name of Bidder)

\_\_\_\_\_  
\_\_\_\_\_  
(Official Address of Bidder)

Having carefully read and examined the Contract Documents for the: **2024 Loveland Middle/Intermediate School HVAC Controls Replacement Bid** and having inspected the premises and all the conditions affecting the work, the undersigned proposes to furnish all materials, equipment, and perform all of the labor necessary to complete such item or items as are enumerated below, all to be in full accordance with the documents named above.

The undersigned further agrees that if any, or all, of said bids be accepted they will enter into a contract within thirty (30) days for faithful performance of labor and furnishing of materials and will furnish a good and sufficient bond in an amount equal to 100 per cent of the contract price for the performance of such contract as required by law.

The undersigned further agrees to hold his bid in effect for sixty (60) calendar days.

ADDENDA # \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_

ADDENDA # \_\_\_\_\_ DATE RECEIVED: \_\_\_\_\_

Note: All deduct prices should be indicated in parenthesis and preceded by a "-" symbol. Amounts are assumed to be positive (additive) unless indicated otherwise. Alternates shall be listed on the bid proposal as the difference in cost between the cost of the base bid and the alternate.

**BASE BID - LABOR AND MATERIALS** in the sum of \$ \_\_\_\_\_

In submitting this Bid, we, the undersigned, hereby understand that Owner reserves unrestricted privilege of rejecting any or all bids, or parts of bids, and to waive any informalities in bidding.

A Bid Guaranty Bond is enclosed.

FIRM NAME: \_\_\_\_\_

BY: \_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Print Name)

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

State whether a Corporation ( ) Partnership ( ) Sole Proprietorship ( )

If a Corporation:  
Corporation is organized in \_\_\_\_\_ (State Location)

Corporation is authorized to do business in Ohio.  
Yes \_\_\_\_\_ No \_\_\_\_\_

Telephone No.: \_\_\_\_\_

E-mail Address \_\_\_\_\_

Fax No.: \_\_\_\_\_

Contact Person: \_\_\_\_\_

1.01 **SUBSTITUTION SHEET**

Refer to Substitutions and Standards, Paragraph 1.19 of the Instructions to Bidders regarding the use of materials or methods other than "Standards". All bids must be based on the standards specified.

The bidder is to list here any substitutions for which consideration is desired, showing the addition or reduction in price to be made for each if the substitution is accepted or stating "No Change in Price" if none is proposed.

BRAND OR MAKE SPECIFIED	PROPOSED SUBSTITUTIONS	ADD	DEDUCT

FIRM NAME: \_\_\_\_\_

BY: \_\_\_\_\_  
(Signature)

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

**1.02 LIST OF SUBCONTRACTORS AND SUPPLIERS**

If the Bidder intends to sub-contract any significant part of the work included in his Contract, the Bidder MUST list the firm name and address of each Subcontractor that is proposed for each of the various portions of the Work. This list shall be submitted to the Owner within three (3) business days of the Owner's receipt of the bids or such longer time as may be permitted in writing by the Owner.

After approval by the Owner and Architect of the list of proposed Subcontractors, suppliers, and manufacturers submitted by the successful Bidder, the list shall not be changed unless written approval of the change is authorized by the Owner, Architect, and Owner's Representative.

<u>TYPE OF WORK</u>	<u>NAME</u>	<u>ADDRESS</u>

FIRM NAME: \_\_\_\_\_

BY: \_\_\_\_\_  
(Signature)

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

### 1.03 **SUBMISSION OF BIDS**

- A. Bids shall be submitted IN DUPLICATE on Bid Proposal Forms furnished. Contractors may make copies of the forms bound in the project manual.
- B. The Bid Proposal Form furnished with these documents SHALL BE COMPLETED IN FULL; in writing in ink (or typewritten) and signed in ink. All blank spaces shall be filled in, in ink or typewritten, in words and figures, and in figures only where no space is provided for words, and signed by the Bidder. The wording on the Bid Form shall be used without change, alteration, or addition. Any change in the wording or omission of specified accompanying documents may cause the bid to be rejected. If both numbers and words are requested for any bid item, the amount in words shall prevail if there is an inconsistency between the numbers and words written.
- C. Bidders shall note receipt of Addenda on the Bid Form. If the Bidder fails to acknowledge receipt of each Addendum, the Bid shall be deemed non-responsive, unless the Bid amount reflects receipt of the Addendum or the Addendum involves only a matter of form and does not affect the price, quantity or quality of the Work to be performed.
- D. The Bid Proposal Form shall be submitted in sealed envelopes addressed to:  
**LOVELAND CITY SCHOOL DISTRICT**  
**757 South Lebanon road**  
**Lebanon, Ohio 45140**  
  
and shall be marked:  
**BID FOR: : 2024 Loveland Middle/Intermediate School HVAC Controls Replacement Bid**
- E. Bids are due at the location, time and date listed in the Notice to Bidders and will be publicly opened.
- F. List of Sub-Contractors and Suppliers shall be requested of apparent low bidder and shall be submitted within 48 hours of bid opening.

### 1.04 **PROJECT BIDDING**

- A. Lump Sum Bids from Contractors shall be submitted for the appropriate items as listed on the Bid Proposal Form.
- B. Bidder may withdraw bid, in person only, at any time prior to the scheduled time for closing the receipt of bids. Withdrawals after the scheduled time for closing the receipt of bids will not be permitted for a period of sixty (60) days.
- C. Bid may require the Bidder to submit alternate prices and unit prices. It is essential for a complete bid that the Bidder submit alternate prices and unit prices when such are listed in the Bid Proposal Form.
- D. Bidders shall use complete sets of Bid Documents in preparing bids. Neither the Owner or the Architect assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.
- E. The Owner and the Architect, in making the Bid Documents available to contractors, subcontractors, and material suppliers, do so only for the purpose of obtaining bids on the work and do not grant license for any other use.

### 1.05 **BONDS AND GUARANTEES**

- A. Bid Guaranty: Bidder shall furnish a Bid Guaranty, as prescribed in Sections 153.54, 153.57, and 153.571 of the Ohio Revised Code, in the form of either: (1) a bond for the full amount of the bid in the form of the Bid Guaranty and Contract Bond included in the Bid Documents; or (2) a certified check, cashier's check, or irrevocable letter of credit in an amount equal to 10% of the bid. Bid amount shall be the total of all sums bid, including all add alternatives, but excluding all deduct alternatives. The cost of the bond shall be included in the contractor's bid.

- B. Contract Bond: The successful Bidder who, as a Bid Guaranty, submits a certified check, cashier's check, or irrevocable letter of credit in an amount equal to 10% of the bid, shall furnish a Contract Bond in the form Contract Bond included in the Bid Documents in an amount equal to 100% of the Contract Sum.
- C. The bond must be issued by a surety company ("Surety") authorized by the Ohio Department of Insurance to transact business in the State of Ohio and acceptable to the Owner. The bond must be issued by a Surety capable of demonstrating a record of competent underwriting, efficient management, adequate reserves, and sound investments. These criteria will be deemed to be met if the Surety currently has an A.M. Best Company Policyholders Rating of "A-" or better and has or exceeds the Best Financial Size Category of Class VI. Other sureties may be acceptable to the Owner, in its sole discretion.
- D. All bonds shall be signed by an authorized agent of an acceptable Surety and by the Bidder.
- E. Bonds shall be supported by credentials showing the Power of Attorney of the agent, a certificate showing the legal right of the Surety to do business in the State of Ohio, and a financial statement of the Surety.
- F. The Bid Guaranty, as applicable, shall be in the name of or payable to the order of the Owner.
- G. The name and address of the Surety and the name and address of the Surety's Agent should be typed or printed on each bond.
- H. Checks will be returned to bidders upon execution of a contract with the successful bidder or rejection of bids.

#### 1.06 **PERSONAL PROPERTY TAX STATEMENT**

- A. In accordance with the requirements of Ohio Revised Code Section 5519.042, before the Contract between the Owner and the selected bidder can be entered into, the bidder shall submit an affidavit stating that it was not charged at the time the bid was submitted with any delinquent personal property taxes on the general tax list of personal property in the county which the school district is located or that it was charged with delinquent personal property taxes on such tax list. If the bidder was charged with such delinquent taxes, the affidavit must set forth the amount due plus unpaid penalties and interest thereon. If the affidavit indicates that the bidder was charged with any such taxes, a copy of the affidavit will be sent to the County Treasurer.
- B. Refer to Section 006200 for the Delinquent Property Tax Statement form.

#### 1.10 **REFERENCES**

- A. The vendor will provide at least five references showing similar projects of the similar size and scope as that being bid. The references must be schools (K-12) either public or private. The references must be projects that have been completed within the past 4 years.

#### 1.11 **EQUAL EMPLOYMENT OPPORTUNITY / NON-DISCRIMINATION**

- A. Minority, female, and disadvantaged businesses will be afforded full opportunity to submit bids, and bidders will not be discriminated against on the grounds of race, color, religion, sex, age, handicap, ancestry, or national origin in the consideration of an award.

#### 1.12 **PROJECT ALTERNATES**

- A. There are no Alternates in this project

#### 1.13 **UNIT PRICES**

- A. No Unit Prices

#### 1.14 **SALES TAX EXEMPTION**

- A. The Owner is a political subdivision of the State of Ohio and is exempt from taxation under the Ohio Sales Tax and Use Tax Laws. Building materials that the successful Prime Contactor purchases for incorporation into the Project, will be exempt from state sales and use taxes if the successful



Prime Contractor provides a properly completed sales tax exemption certificate to the vendors or suppliers when the materials are acquired. The Owner will execute properly completed certificates on request.

- B. A State of Ohio, Department of Taxation, Construction Contract Exemption Certificate is included in the Project Manual.

1.15 **WAGE SCALE**

- A. Prevailing Wage Rates do **NOT** apply to this contract. All Contractors to include in their bid over-time, weekend, premium, holiday, and/or night-shift pay required to complete the project according to the project schedule.”

1.16 **EXAMINATION OF DOCUMENTS**

- A. Each Bidder shall examine all Contract Documents, including the Plans and Specifications for all other divisions of the work as well as his own, noting particularly all requirements which will affect his work in any way. Failure of a Bidder to fully acquaint himself with the amount and nature of work required to complete his division of the work in conformity with all requirements for the project as a whole will not be considered subsequently as a basis for extra compensation.
- B. Should any requirements in the Plans and/or Specifications for the project, as a whole, appear to a Bidder to be in disagreement with those for the part of the work on which he proposed to bid, a request for clarification, in writing, should be addressed to the Project Architect as soon as discovered prior to the date set for opening bids. The Project Architect will reply to all such inquiries. Verbal interpretations will not be honored. In case of a discrepancy in the Plans and Specifications, an Addendum will be issued to clarify the matter. The Project Architect will forward copy of same to all individuals holding Plans and Specifications. If, in examining the Contract Documents, the Bidder discovers an apparent violation of the Ohio Building Code or other applicable statute or regulation, he shall report such apparent violation to the Project Architect promptly. However, this provision shall not be construed as imposing responsibility on the Contractor to insure conformity of the Plans and Specifications to the Ohio Building Code and other applicable regulation.
- C. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.
- D. If conflicting standards of material or product quality are discovered within the Contract Documents, the Bidder shall include in their bid the most stringent or highest standard of quality. If a difference between the drawings and specifications is discovered, the strictest requirements shall take precedence.
- E. Organization of the Specifications into divisions, sections and articles, and arrangement of the Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Each Contractor is responsible for the entire set of Contract Documents for establishing the scope of Work.
- F. All Bidders shall be familiar with the existing conditions in the material and labor markets, as well as the conditions related to the Work, and the fact that a bid is submitted will be construed by the Owner as an agreement by the bidder to carry out the improvements in full conformance with the Specifications and other Contract Documents, notwithstanding the existing conditions.
- G. Each Bidder shall be responsible for coordinating its Work with the Work of other bid packages that require integration of the Bidder's Work.
- H. Failure of a Bidder to visit the site to observe field conditions, which failure to attend results in the Bidder not fully being familiar with the existing conditions and Project Requirements, shall not be considered a basis for additional compensation to the successful Bidder for the Work.

#### 1.17 **ADDENDA TO DRAWINGS AND SPECIFICATIONS**

- A. The Owner reserves the right to issue Addenda changing, altering, or supplementing Contract Documents prior to the time set for receiving bids. The Architect will issue the Addenda to clarify bidders' questions, to change, alter, or supplement the Contract Documents.
- B. Any explanation, interpretation, correction or modification of the Bid Documents will be issued in writing in the form of an Addendum, which shall be the only means considered binding. Explanations or interpretations made by any other means shall NOT be legally binding. All Addenda shall become a part of the Contract Documents as if originally bound herein.
- C. Bidders must submit questions to the **owner** in sufficient time in advance of the bid opening to allow the Architect to respond. All Addenda will be issued, except as hereinafter provided, and mailed or otherwise issued to persons who have obtained Contract Documents for the Project, at least seventy-two (72) hours prior to the published time for the opening of bids, excluding Saturdays, Sundays and legal holidays. If any Addendum is issued within such seventy-two (72) hour period, then the time for opening of bids shall be extended one (1) week with no further advertising of bids required.
- D. Copies of each Addendum will be placed on the district Treasurer's web site in the same location as the original bid package. It is the responsibility of the bidder to confirm Addenda as found on the Treasurer's web page. Receipt of Addenda shall be indicated by Bidders in the space provided on the Bid Proposal Form. Bidders are responsible for acquiring issued Addenda in time to incorporate them into their bid.
- E. If a Bidder fails to indicate receipt of all Addenda issued by the Architect on its Bid Form, the bid of such Bidder will be deemed to be responsive only if:
  - 1. The bid received clearly indicates that the Bidder received the Addendum, such as where the Addendum added another item to be bid upon and the Bidder submitted a bid on that item; or
  - 2. The Addendum involves only a matter of form or is one that has either no effect or merely a trivial or negligible effect on price, quantity, quality, or delivery of the item bid upon.

#### 1.18 **PRE-BID MEETING / EXAMINATION OF SITE**

- A. There is a pre-bid meeting scheduled for March 29, 2024 at 11:00 at the Loveland Middle School, at the rear parking lot at Door 13.
- B. Each bidder is requested to visit each site and to inform himself of all conditions. Failure to visit the sites will in no way relieve the successful bidder from necessity of furnishing all material and labor necessary to complete work in accordance with plans and specifications.

#### 1.19 **SUBSTITUTIONS AND STANDARDS**

- A. Those articles, devices, materials, forms of construction fixtures, etc., named in the Specifications to denote the kind and quality required, whether or not the words "or equal" are used, shall be known as "Standards" and all Proposals shall be based on same.
- B. Bidders desiring consideration for the use of material, equipment, etc., not named in the Specifications may submit a Proposal for the substitution using the "Substitution Sheet" attached to the Proposal form, and listing, for each proposed change: (1) the "Standard" specified; (2) the substitution; and (3) the change in bid price (or "no change"). Complete Specifications and description of any proposed substitution being considered for acceptance shall be furnished to the Project Architect promptly upon request.
- C. Any substitution accepted will be incorporated in the Contract. No substitution shall be allowed after the award of the Contract.
- D. A substitution shall not affect determination of the lowest bid.
- E. Other than voluntary suggested substitutions listed on the substitution sheet at the time of bidding, substitutions will only be considered when a Product becomes unavailable through no fault of the Contractor.

## 1.20 **OWNER'S RESERVATIONS**

- A. The Owner reserves the unrestricted privilege to reject any, part of any, or all of the bids received and to waive any informalities in the bidding.
- B. The Owner reserves the right to accept Alternates in any order or combination and to determine which bid is the lowest best bid on the basis of the base bid and the Alternates accepted.
- C. No bid nor any obligation hereunder to be assumed by the Owner, shall be considered as accepted until such time as the Owner, or Owner's representative, may deposit in the U.S. Mail, or hand to the Bidder, personally, written notice addressed to Bidder at the address given on the bid, or acceptance of bid.
- D. By submitting its bid, the Bidder agrees that the Owner's determination of whether a defect or irregularity affects the amount of the bid in any material respect or otherwise gives the Bidder a competitive advantage will be final and conclusive; and the Bidder will pay the Owner's attorneys and consultants' fees related to any challenge to the bid procedure or process, brought directly or indirectly by the Bidder and/or any of its affiliates, which is unsuccessful.

## 1.21 **AWARD OF CONTRACT**

- A. All bids shall remain open for acceptance for sixty (60) days following the day of the bid opening, but the Owner may, in its sole discretion, release any bid and return the Bid Guaranty prior to that date. The Bid Guaranty shall be subject to forfeiture, as provided in the Ohio Revised Code, if a bid is withdrawn during the period the bids are being held.
- B. The Owner reserves the right to reject any, part of any, or all bids and to waive any informalities and irregularities. The Bidder expressly acknowledges this right of the Owner to reject any or all bids, or to reject any incomplete or irregular bid. The Owner will award a single contract for each of the Construction Contracts listed on the Bid Proposal Form or one or more combined contracts for combinations of the Construction Contracts. Bidders must furnish all information requested on or accompanying the Bid Proposal Form. Failure to do so may result in disqualification of the bid.
- C. **Determination of Lowest Best Bid.** Subject to the right of the Owner to reject any or all bids, the Owner will Award the Contract for the Work to the Bidder submitting the lowest best bid, taking into consideration accepted alternates. The Owner, in its sole discretion, will determine whether a bid or bidder is best. In evaluating Bids, the Owner shall consider the qualifications of the bidders, whether or not the bids comply with the prescribed requirements, and alternatives and unit prices, if requested, in the Bid Proposal Form. The Owner may also consider the qualifications and experience of suppliers and distributors. The Owner may conduct such investigations as are deemed necessary to establish the responsibility, qualifications and financial ability of the Bidders, proposed distributors and other persons and organizations to do the work in accordance with the Contract Documents to the Owner's satisfaction within the prescribed time. The Owner reserves the right to reject the bid of any Bidder that does not pass any such evaluation to the Owner's satisfaction. The factors to be considered by the Owner in making its determination as to whether a Bidder is the best bidder include the following as the Owner, in its discretion, deems appropriate; the Owner may give such weight to each factor as it deems appropriate:
  - 1. The Bidder's work history. The Bidder should have a record of consistent customer satisfaction and of consistent completion of projects, including projects which are comparable to or larger and more complex than the Owner's Project, on time and in accordance with the applicable Contract Documents. If the Bidder's management operates or has operated another construction company, the Owner may consider the work history of that company in determining responsibility of the Bidder.

The Owner will consider the Bidder's prior experience on other projects of the Owner, Architect, and Owner's Representative, including the Bidder's demonstrated ability to complete its work on these projects in accordance with the Contract Documents and on time, and its ability to work with the Owner, Owner's Representative and Architect.

- The Bidder authorizes the Owner and its representatives to contact the owners and design professionals (and construction managers, if applicable) on projects on which the Bidder has worked, and authorizes and requests such owners and design professionals (and construction managers) to provide the Owner with a candid evaluation of the bidder's performance. By submitting its bid, the Bidder agrees that if it or any person, directly or indirectly, brings an action against any of such owners or design professionals (or construction managers) or the employees of any of them as a result of or related to such candidate evaluation and such action is not successful, the Bidder will reimburse such owners, design professionals and construction managers, and the employees of each of them, for all legal fees and expenses incurred by them related to such legal action. This obligation is expressly intended for the benefit of such owners, design professionals, and construction managers, and the employees of each of them.
2. The Bidder's financial ability to complete the Contract successfully and on time, without resort to its Surety.
  3. The Bidder's prior experience with similar work on comparable or more complex projects;
  4. The Bidder's equipment and facilities;
  5. The adequacy, in numbers and experience, of the Bidder's work force to complete the Contract successfully and on time;
  6. The Bidder's compliance with federal, state, and local laws, and regulations, including but not limited to the Occupational Safety and Health Act; and
  7. The ability of the Subcontractors the Bidder intends to use on the Project to meet these same criteria.
  8. The Bidder's participation in a drug-free workplace program acceptable to the Owner, and the Bidder's record for both resolved and unresolved findings for recovery as defined in Ohio Revised Code Section 9.24; and/or
  9. Depending upon the type of the Work, other relevant factors, as the Owner may determine.
- D. Within three (3) business days after the Owner's receipt of the bids, the apparent low bidder will complete and submit to the Architect, AIA Document A305, Contractor Qualifications Statement for review. Additionally, upon request from the Architect, the apparent low bidder will provide additional information as requested regarding the Bidder's responsibility. A Bidder will submit any requested information within three (3) business days of the date of the request. The failure to submit requested information on a timely basis may result in the determination that the Bidder is not best.
- E. By submitting its bid, the Bidder agrees that the Owner's determination of responsibility shall be final and conclusive, and that if the Bidder or any person challenges such determination in any legal proceeding and such challenge is not successful, the Bidder will reimburse the Owner for all legal fees and expenses incurred by the Owner that are related to such challenge, including the cost of collection.
- F. Within three (3) business days of the Owner's receipt of the bids or such longer time as may be permitted in writing by the Owner, the apparent low bidder will submit the following:
1. A list of all proposed Subcontractors, suppliers, and manufacturers. After approval by the Owner, Architect, and Owner's Representative of the list of proposed Subcontractors, suppliers, and manufacturers submitted by the successful Bidder, the list shall not be changed unless written approval of the change is authorized by the Owner, Architect, and Owner's Representative.
  2. A breakdown of labor and material for the Project, including the sum of each.

3. Affidavit as to Property Taxes. The successful Bidder will be required to submit, prior to the time of the entry into the Contract for the Work, an affidavit in the form required by Section 5719.042, Ohio Revised Code, regarding the status of the Bidder's personal property taxes. A copy of the form of affidavit is included in the Contract Documents.
  4. Declaration of Material Assistance/ Nonassistance to a Terrorist Organization. In accordance with the requirements of Ohio Revised Code Section 2909.33 (C), before the Contract between the Owner and the selected bidder can be entered into, the bidder shall submit to the Owner a completed Declaration of Material Assistance/ Nonassistance to a Terrorist Organization (DMA) form. The DMA is a questionnaire to certify that the company has not provided material assistance to a terrorist organization as listed on the U.S. State Department's Terrorist Exclusion List (TEL). Any applicant under final consideration for employment with the State, any instrumentality of the State, or any political subdivision of the State must complete and submit a DMA. Current DMA applications and TEL are available from the Ohio Department of Public Safety. Failure to submit the completed DMA form, positive responses, or falsification, the contractor's consideration for the work shall be rejected. A copy of the DMA form is included in the Contract Documents.
  5. Insurance Certificates.
  6. Valid Worker's Compensation Certificate.
- G. The Owner reserves the right to disqualify bids, before or after opening, upon evidence of collusion with intent to defraud or other illegal practices on the part of the bidder.

#### 1.22 **MODIFICATION / WITHDRAWAL OF BIDS**

- A. Modification. A Bidder may modify its bid by written communication to the Owner addressed to the Owner, attention of the Treasurer, at any time prior to the scheduled closing time for receipt of bids, provided such written communication is received by the Treasurer prior to the bid deadline. The written communication shall not reveal the bid price but should provide the addition or subtraction or other modification so that the final prices or terms will not be known until the sealed bid is opened. If the Bidder's written instructions with the change in bid reveal the bid amount in any way prior to the bid opening, the bid may be rejected as non-responsive.
- B. Withdrawal Prior to Bid Deadline. A Bidder may withdraw its bid at any time for any reason prior to the bid deadline established in the Notice to Bidders. The request to withdraw shall be made in writing and submitted to the Owner, attention of the Treasurer. The request for withdrawal must be received by the Treasurer prior to the time of the bid opening.
- C. Withdrawal After Bid Deadline.
  1. All bids shall remain valid and open for acceptance for a period of at least sixty (60) days after the bid opening; provided, however, that a Bidder may request withdrawal its bid from consideration after the bid deadline when all of the following apply:
    - a. The price bid was substantially lower than the other bids;
    - b. The reason for the bid being substantially lower was a clerical mistake, rather than a mistake in judgment, and was due to an unintentional and substantial error in arithmetic or an unintentional omission of a substantial quantity of work, labor, or material;
    - c. The bid was submitted in good faith;
    - d. The Bidder provides written notice to the Owner, to the attention of the Treasurer, within two (2) business days after the bid opening for which the right to withdraw is claimed.
- D. No bid may be withdrawn under this provision if the result would be the awarding of the contract on another bid for the bid package from which the Bidder is withdrawing its bid to the same Bidder.
- E. If a bid is withdrawn under this provision, the Owner may award the Contract to another Bidder determined by the Owner to be the lowest best bidder or the Owner may reject all bids and advertise for other bids. In the event the Owner advertises for other bids, the withdrawing Bidder shall pay the costs incurred in connection with the rebidding by the Owner, including the cost of printing new Contract Documents, required advertising, and printing and mailing notices to

prospective bidders, if the Owner finds that such costs would not have been incurred but for such withdrawal.

1.23 **CONTRACT FORM**

- A. The Successful Bidder shall execute a Contract with the Owner on American Institute of Architects (AIA) Document A101, Standard Form of Agreement Between Owner and Contractor (Stipulated Sum), Latest Edition. A draft copy of the contract form is included in the Contract Documents.
- B. The Contract between the Owner and Contactor shall include the American Institute of Architects (AIA) Document A201, General Conditions of the Contract for Construction (Latest Edition).

END OF SECTION

**BID GUARANTY AND  
CONTRACT BOND**  
(O.R.C. § 153.571)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned \_\_\_\_\_  
\_\_\_\_\_ ("Contractor") as principal and  
\_\_\_\_\_ as surety are hereby held and  
firmly bound unto the Loveland City School District, located in Hamilton, Clermont and Warren Counties,  
Ohio, as obligee in the penal sum of the dollar amount of the bid submitted by the principal to the obligee  
on \_\_\_\_\_, 202\_\_, to undertake \_\_\_\_\_

\_\_\_\_\_ [INSERT BID PACKAGE  
NUMBER(S) AND DESCRIPTION(S)] in connection with the Security Camera Replacement and  
Expansion Project (the "Project"). The penal sum referred to herein shall be the dollar amount of the  
principal's bid to the obligee, incorporating any additive or deductive Alternates made by the principal on  
the date referred to above to the obligee, which are accepted by the obligee. In no case shall the penal  
sum exceed the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_). (If  
the foregoing blank is not filled in, the penal sum will be the full amount of the principal's bid, including  
add Alternates. Alternatively, if the blank is filled in the amount stated must not be less than the full  
amount of the bid including add Alternates, in dollars and cents. A percentage is not acceptable.) For the  
payment of the penal sum well and truly to be made, we hereby jointly and severally bind ourselves, our  
heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas the above named principal has  
submitted a bid for work on the Project.

Now, therefore, if the obligee accepts the bid of the principal and the principal fails to enter into a proper  
contract in accordance with the bid, plans, details, specifications, and bills of material; and in the event the  
principal pays to the obligee the difference not to exceed ten percent (10%) of the penalty hereof between  
the amount specified in the bid and such larger amount for which the obligee may in good faith contract  
with the next lowest bidder to perform the work covered by the bid; or in the event the obligee does not  
award the contract to the next lowest bidder and resubmits the project for bidding, the principal pays to the  
obligee the difference not to exceed ten percent (10%) of the penalty hereof between the amount specified  
in the bid, or the costs, in connection with the resubmission, of printing new contract documents, required  
advertising, and printing and mailing notices to prospective bidders, whichever is less, then this obligation  
shall be null and void, otherwise to remain in full force and effect; if the obligee accepts the bid of the  
principal and the principal within ten (10) days after the awarding of the contract enters into a proper contract  
in accordance with the bid, plans, details, specifications, and bills of material, which said contract is made  
a part of this bond the same as though set forth herein.

Now also, if the said principal shall well and faithfully do and perform the things agreed by said principal to  
be done and performed according to the terms of said contract; and shall pay all lawful claims of  
subcontractors, material men, and laborers, for labor performed and materials furnished in the carrying  
forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall  
be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then  
this obligation shall be void; otherwise the same shall remain in full force and effect; and surety shall  
indemnify the obligee against all damage suffered by failure of the principal to perform the contract  
according to its provisions and in accordance with the plans, details, specifications, and bills of material  
therefor and to pay all lawful claims of subcontractors, material men, and laborers for labor performed or  
material furnished in carrying forward, performing, or completing the contract and surety further agrees and  
assents that this undertaking is for the benefit of any subcontractor, materialman, or laborer having a just  
claim, as well as for the obligee; it being expressly understood and agreed that the liability of the surety for  
any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the  
terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the

obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 202\_\_.

\_\_\_\_\_  
(PRINCIPAL)

By: \_\_\_\_\_

Printed Name & Title: \_\_\_\_\_

\_\_\_\_\_  
(SURETY)

By: \_\_\_\_\_

Printed Name & Title: \_\_\_\_\_

Surety's Address: \_\_\_\_\_

\_\_\_\_\_  
Surety's Telephone Number: \_\_\_\_\_

Surety's Fax Number: \_\_\_\_\_

\_\_\_\_\_  
NAME OF SURETY'S AGENT

Surety's Agent's Address: \_\_\_\_\_

\_\_\_\_\_  
Surety's Agent's Telephone Number: \_\_\_\_\_

Surety's Agent's Fax Number: \_\_\_\_\_



**NOTE: The Contract Bond form that follows is to be used ONLY by a bidder that is determined to be the lowest responsible bidder and that submits a form of bid guaranty other than the combined Bid Guaranty and Contract Bond with its bid. If a bidder submits a combined Bid Guaranty and Contract Bond, then the bid guaranty becomes the contract bond when the contract is awarded.**

**CONTRACT BOND**  
(O.R.C. § 153.57)

KNOW ALL PERSONS BY THESE PRESENTS, that we, the undersigned ("Contractor") as principal and \_\_\_\_\_ as surety, are hereby held and firmly bound unto the Loveland City School District, located in Hamilton, Clermont and Warren Counties, Ohio (the "Board") as obligee, in the penal sum of \_\_\_\_\_ Dollars

(\$ \_\_\_\_\_), for the payment of which well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors, and assigns.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH that whereas, the above-named principal did on the \_\_\_\_ day of \_\_\_\_\_, 202\_\_, enter into a contract with the Board for \_\_\_\_\_ [INSERT AND DESCRIPTION(S)] in connection with the Security Camera Replacement and Expansion Project (the "Project"), which said contract is made a part of this bond the same as though set forth herein:

Now, if the said Contractor shall well and faithfully do and perform the things agreed by the Contractor to be done and performed according to the terms of said contract; and shall pay all lawful claims of subcontractors, material men, and laborers, for labor performed and materials furnished in the carrying forward, performing, or completing of said contract; we agreeing and assenting that this undertaking shall be for the benefit of any materialman or laborer having a just claim, as well as for the obligee herein; then this obligation shall be void; otherwise the same shall remain in full force and effect; it being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall in no event exceed the penal amount of this obligation as herein stated.

The said surety hereby stipulates and agrees that no modifications, omissions, or additions in or to the terms of the said contract or in or to the plans or specifications therefore shall in any wise affect the obligations of said surety on its bond, and does hereby waive notice of any such modifications, omissions or additions to the terms of the contract or to the work or to the specifications.

Signed and sealed this \_\_\_\_ day of \_\_\_\_\_, 202\_\_.

\_\_\_\_\_  
(PRINCIPAL)  
By: \_\_\_\_\_  
Printed Name & Title: \_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
(SURETY)  
By: \_\_\_\_\_  
Printed Name & Title: \_\_\_\_\_  
\_\_\_\_\_

Surety's Address: \_\_\_\_\_  
\_\_\_\_\_

Surety's Agent's Tel. & Fax Numbers: \_\_\_\_\_

\_\_\_\_\_  
NAME OF SURETY'S AGENT

Surety's Agent's Address: \_\_\_\_\_  
\_\_\_\_\_

Surety's Agent's Tel. & Fax Numbers: \_\_\_\_\_

Surety's Agent's Fax Number \_\_\_\_\_

SECTION 00 6002

CONTRACTOR'S PERSONAL PROPERTY TAX AFFIDAVIT

(O.R.C. § 5719.042)

State of \_\_\_\_\_,

County of \_\_\_\_\_, ss:

\_\_\_\_\_, being first duly sworn, deposes and says that he is the  
(Name)

\_\_\_\_\_ of \_\_\_\_\_ with offices located at  
(Title) (Contractor)

\_\_\_\_\_, and as its duly  
(Address of Contractor)

authorized representative, states that effective this \_\_\_\_ day of \_\_\_\_\_, 20 \_\_,

\_\_\_\_\_  
(Name of Contractor)

( ) is charged with delinquent personal property taxes on the general list of personal property as set forth below:

<u>County</u>	<u>Amount</u> (includes total amount penalties and interest thereon)
_____ County	\$ _____
_____ County	\$ _____
_____ County	\$ _____

( ) is not charged with delinquent personal property taxes on the general list of personal property in any Ohio county.

\_\_\_\_\_  
(Affiant)

Sworn to and subscribed before me by the above-named affiant this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

\_\_\_\_\_  
(Notary Public)

My commission expires  
\_\_\_\_\_

2024 HVAC CONTROLS REPLACEMENT  
LOVELAND CITY SCHOOLS  
LOVELAND, OH

OLMS23  
MARCH 2024  
BID DOCUMENTS

INDEX

**DIVISION 23 – MECHANICAL**

230501 – COMMON REQUIREMENTS FOR HVAC  
230505 – EXISTING CONDITIONS AND DEMOLITION  
230566 – AIR TREATMENT SYSTEMS FOR HVAC  
230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

ELECTRICAL INDEX

## SECTION 230501 - COMMON REQUIREMENTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 SUBMITTAL REQUIREMENTS

##### A. Shop Drawings

1. Coordination Drawings: This contractor shall provide necessary coordination drawings required to make sure all disciplines are coordinated and fit into specified spaces (i.e. ceilings, chases, and all others). It is the work of the contractor to prepare complete coordination drawings indicating exact location, clearances and penetrations of all items of all trades.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to all sections.

#### 1.3 GENERAL DIRECTION

- A. Submittal of a bid indicates that the contractor has examined the drawings, specifications, and had an opportunity to visit the site to be able to provide a comprehensive complete bid.
- B. The intent of these specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes. Interpret these specifications in conjunction with the drawings and provide all work described. If work is shown on drawings and not mentioned in the specifications, or vice versa, it is to be included in the work the same as though clearly set forth by both. Should there be a conflict between the specifications and drawings, provide the greater quantity or better quality. Immediately notify owner's representative and design professional of such conflicts.
- C. The drawings that accompany these specifications are diagrammatic and although size and location of equipment is drawn to scale wherever possible make use of submittal data and verify all dimensions on site. They do not show every offset, bend, tee, or elbow which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical and install additional bends, offsets and elbows where required by site conditions and codes at no additional cost. Install all new work in such manner as to conform to the structure, avoid obstructions, provide required service clearances and preserve headroom. Do not scale from drawings, all measurements should be taken in the field.
- A. Coordinate all work with all other contractors and installers in addition to existing building obstructions and install accordingly. Comply with requirements of architectural drawings including but not limited to mounting height and locations. Fully research peculiarities and limitations of space available for installation of work with materials being provided. Work around material lead times to not extend project schedule.

- B. Complete work, or part(s) thereof, at times as may be designated by the Owner's Representative, so that it can be used for temporary or permanent use. Do not construe such use of the system as an acceptance of it by Owner.
- C. During mobilization or construction, if an abnormal condition is uncovered either with existing conditions, equipment loads, submittal data, etc. bring these to the attention of the Design Professional for review.
- D. Owner's Representative or Design Professional may relocate devices prior to installation within a 20-foot limit at no additional charge.
- E. All ducts shall be run as straight as possible and symmetrical with architectural items. Ductwork fabricated before coordination with the other trades will be done at the contractor's risk.
- F. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Bidder/Proposer's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation from the Owner.
- G. Each Bidder/Proposer shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.

#### 1.4 GENERAL STANDARDS

- A. Provide materials, installation methods, workmanship, testing, etc., in strict accordance with the latest edition of applicable standards and adopted codes, including (but not limited to) the following.
  - 1. State Building Code and applicable local amendments.
  - 2. Local Building Code (if applicable)
  - 3. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE).
  - 4. American Society of Test Materials (ASTM)
  - 5. National Fire Protection Association (NFPA)
  - 6. Underwriters Laboratories (UL)
  - 7. National Sanitation Foundation (NSF)
  - 8. Sheet Metal & Air Conditioning Contractors National Association (SMACNA)
  - 9. American National Standards Institute (ANSI)
  - 10. Building Code Seismic Relative Displacement Requirements

#### 1.5 PERMITS AND REGULATIONS

- A. Obtain and pay for permits, fees, certificates of inspection and approval, etc. required for this branch of the work. Furnish Owner with certificates of final inspection and approval prior to final acceptance of this branch of the work.
- B. Laws and regulations which bear upon or affect the various branches of this work shall be complied with by this contractor and are hereby made a part of this contract.

## 1.6 DEFINITIONS

- A. Contractor - Any Contractor whether bidding, proposing or working independently or under the supervision of a General Contractor, Prime Contractor, Construction Manager and who installs any type of Mechanical Work as specified in the Contract Documents or, the General Contractor.
- B. Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
- C. Architect - The Architect of Record for the project.
- D. Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owner, etc.
- E. Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency or entity for any part of the work required under this contract.
- F. The Project - All of the work required under this Contract.
- G. Furnish - Procure, supply and deliver to project site, ready for installation, install and warrant (unless indicated otherwise on documents). Include warranty expenses.
- H. Install - To supply labor, tools and incidental materials necessary to handle, store, mount, terminate, program, configure and adjust a product in order render the respective product and system fully operational and usable to the Owner for the intended purpose.
- I. Provide - Furnish and Install. Similar Terms: "include", "shall", "equip with", "consisting of".
- J. Equal or Equivalent - Determination of equivalency to be made by design professional for all products not listed as basis-of-design.
- K. Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto.
- L. Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- M. Substantial Completion - Where frontend documentation does not define, products and systems must be fully installed as designed, tested, adjusted, labeled, and functionally demonstrated to owner.

## 1.7 REQUESTS FOR INFORMATION

- A. Submit all questions, requests for information (RFIs) and similar queries through the formally-established RFI process for the project that has been accepted by the Owner's Representative, Design Professionals, Prime Contractor and subcontractors. Submit as a PDF file. Do not submit as text in an email.

1.8 AVAILABILITY OF ELECTRONIC DRAWINGS

- A. If expressly permitted by the Owner and the terms of the Contract, editable electronic drawings may be made available for the creation of shop and as-built drawings upon request. Drawings will be made available at the discretion of the Engineer.
- B. "Drawing Release" form can be obtained from the CMTA project manager upon request.

1.9 QUALITY ASSURANCE

- A. Contractor shall have a minimum five (5) years' experience in the installation of systems similar to the systems specified. Contractor, if requested, shall demonstrate his ability to perform all work to be included under the contract. Assurance if requested, shall be in the form of a list of past projects of similar size and complexity and a list of six (6) references pertaining to those projects. Failure to demonstrate these quality assurances shall be taken as a statement of the contractor's inability to perform.

1.10 INTENT AND INTERPRETATION

- A. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc as necessary for trouble free operation; tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.
- B. All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer's installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer's installation requirements whether specifically detailed or not within the Plans and Specifications.
- C. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- D. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.
- E. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten (10) days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.



1.11 CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

- A. The Contractor shall give all necessary notices, obtain and pay for all permits, government sales taxes, fees, inspections and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with their work. They shall also file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.
- B. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.
- C. The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus and Plans in order to comply with all applicable laws, ordinances, rules and regulations, whether or not indicated or specified.
- D. All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.
- E. All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of, or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.
- F. All plumbing work is to be constructed and installed in accordance with applicable codes, Plans and Specifications which have been approved in their entirety and/or reflect any changes requested by the Authority Having Jurisdiction. Plumbing work shall not commence until such Plans are in the possession of the Plumbing Contractor.
- G. All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Building Code and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.
- H. The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.
- I. Where minimum code requirements are exceeded in the Design, the Design shall govern.
- J. The Contractor shall ensure that their work is accomplished in accord with the OSHA Standards and that they conduct their work and the work of their personnel in accord with same.
- K. All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction and the American Disabilities Act.
- L. Discharge of any toxic, odorous or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air

pollution control commission. If in doubt, contact the State Department for Environmental Protection.

- M. Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense.

#### 1.12 PLANS AND SPECIFICATIONS:

- A. The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their Bid accordingly.
- B. The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.
- C. The Plans and Specifications shall be considered to be cooperative and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
- D. Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.
- E. The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.
- F. Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.
- G. Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to insure no conflict with other work.
- H. Each Bidder/Proposer shall review all Plans in the Contract Documents to ensure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur, it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in

particular ensure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to insure adequate spaces.

- I. Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.
- J. Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.
- K. Where within the Contract Documents the word "typical" or "typ." is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.
- L. Each Contractor shall evaluate ceiling heights specified on Architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

#### 1.13 COOPERATION AND COORDINATION WITH OTHER TRADES:

- A. The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.
- B. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than  $\frac{1}{4}'' = 1'-0''$ , clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.
- C. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

#### 1.14 COST BREAKDOWNS (SCHEDULE OF VALUES):

- A. Within thirty (30) days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost

breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

1.15 HAZARDOUS MATERIALS:

- A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building or site.
- B. Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, ensure that their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.
- C. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling or disposal of such material.
- D. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner and so advise them immediately.
- E. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents or consultants. Also, the Contractor further agrees to defend, indemnify and hold CMTA, its principals, employees, agents and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.
- F. No asbestos or mercury containing materials shall be installed in this project.

1.16 INDEMNIFICATION:

- A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

1.17 TEMPORARY SERVICES:

- A. The Contractor shall arrange any temporary water, electrical and other services which may be required to accomplish the work. Refer also to General and Special Conditions.
- B. All temporary services shall be removed by Contractor prior to completion of work.

1.18 WARRANTY / GUARANTEE

- A. Provide a warranty/guarantee in written form as part of O&M manual stating that all work, materials, equipment and parts are warranted to be free of defect for a minimum period of one year from the date of Substantial Completion. Warranty period and requirements may be expanded in drawings or subsequent specification sections. Repair or replace (owner's option) any defects or failures at no cost to the owner within the warranty period. Issues arising within warranty period must be attended to in a timely manner and in no case exceed four (4) working days. State this in writing as part of O&M manual. Replace defective items to the satisfaction of the Owner's Representative and the Design Professional.

1.19 SURVEY, MEASUREMENTS AND GRADE:

- A. The Contractor shall lay out their work and be responsible for all necessary lines, levels, inverts, elevations and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.
- B. The Contractor shall base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.
- C. Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Provide materials that are new, full weight, of the best quality. Obtain equipment, components and materials from single manufacturer for products of the same kind or category. Provide materials that are listed and labeled and marked for intended location and application.
- B. Provide basis of design products or listed products equivalent in quality, performance, aesthetics, and product support (factory and local) to that specified as basis of design. Products not basis of design are subject to review by the Design Professional and possible rejection. Listing of a product manufacturer by name alone as an equivalent manufacturer shall not equate all products offered by that manufacturer to the basis of design.

- C. Bear all costs incurred from deviation from basis-of-design materials, methods, labor, services, etc. Use of materials, methods, labor, services, etc. that deviate from the basis-of-design will be considered a statement that capacities, requirements, clearances, arrangements, performance, etc. have been checked, verified, found satisfactory, and align with intent of specified work and applicable codes and regulations.
- D. Should deviation from basis of design equipment impact other contractor's scope of work it shall be the responsibility of this contractor to coordinate with and cover these costs in addition to their own. This specifically includes electrical deviations from basis of design.
- E. All manufacturer or contractor provided electrical disconnect switches shall comply with current National Electric Code requirements and rated to meet or exceed the overcurrent device serving the equipment.

### PART 3 - EXECUTION

#### 3.1 GENERAL DIRECTION

- A. Unless specifically indicated, provide all specified and drawn work as required to render all equipment and systems fully operational, including all ancillary, accessory, and support work. Install equipment and materials in strict accordance with manufacturer's written instructions.
- B. In cases where products / materials are furnished by Owner or others, provide the following services: receive, transport and securely store materials on site; remove materials and components from packaging; assemble all materials and components per factory instructions; install, wire and connect materials and components as recommended by manufacturer for a fully operational installation.
- C. Remove and replace items that impede new work installation including but not limited to fencing, doors, gypsum, lift-out panels, and structures to provide pathway for moving equipment into place.
- D. Examine surfaces to receive products for suitable mounting conditions and verify compliance with installation tolerances and other conditions affecting performance of the work. Proceed with installation only after unsatisfactory conditions have been corrected.
- E. Equipment shall be installed in accordance with manufactures installation recommendations. Provide and maintain service, maintenance and operating clearances as required by the manufacturer.

#### 3.2 SUPERVISION AND WORKMANSHIP

- A. Workmanship throughout shall conform to the standards of best practice and all labor employed must be competent and qualified to do all the work required.
- B. Contractor shall furnish the services of an experienced superintendent to be in constant charge of the work at all times. The superintendent's qualifications are subject to the review and acceptance

by the Owner's Representative. Utilize the same mechanical superintendent throughout the duration of the project.

- C. Provisions shall be made for owner's representative or design professional to make rough-in and open ceiling inspections prior to covering up work.

### 3.3 CHANGE OF WORK

- A. In the event of revised scope or work formally issued through Change of Work order, contractor shall provide an itemized breakdown of pricing and receive approval prior to commencing work.
- B. All pricing shall be in alignment with industry standard labor rates and estimated hours (based on RSMeans data). Any additional material or equipment shall be passed through with the standard industry excepted mark-up. All labor hours, labor rates, material costs, and equipment costs are subject to further questioning and approval from the Engineer.
- C. All work commencing prior to approval will be at the risk of the contractor.

### 3.4 ARCHITECTURAL COORDINATION ITEMS

- A. Cutting and Patching:
  - 1. Cut and drill all openings in roofs, walls, and floors required for the installation. Neatly patch all openings cut. Hold cutting and patching to a minimum by arranging with other contractors for all sleeves and openings before construction is started.
- B. Fire Caulking:
  - 1. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Patch shall be equal to rockwool, firestop, caulk or approved "rated" patch.
  - 2. Provide products equivalent to the following:
    - a. For Floor Openings: 3M; Fire Barrier Sealant CP 25WB+
    - b. For Wall Openings: 3M; Fire Barrier Sealant CP 25WB+
    - c. Mineral Felt: Rockwool; Firepro Firestop Compound
    - d. For Insulated Pipes: 3M; Fire Sealant System CAJ5211
    - e. For Fill Areas: 3M; Fire Barrier Packing Material PM 4
  - 3. For larger openings where pipes penetrate fire rated enclosures that cannot be sealed with products described above, utilize approved UL products equal to 3M FireDam Spray 200.
- C. Access Panels:
  - 1. Provide all access panels required for proper servicing of equipment. Provide fire rated access panels at fire rated assembly penetrations rated at or above the fire rating of the assembly. Provide frame as required for finish. Coordinate installation with General Contractor as they may elect to install access panel. Exact location(s) must be approved by the Architect. Minimum size to be 12" x 12", units to be 16-gauge steel, primed for paint, and locking device shall be screwdriver cam locks.

2. For equipment above gypsum board or “hard ceilings”, provide equipment access panels sized to permit complete holistic removal of the unit in its entirety. Access panel shall also be sized to accommodate removal of the largest piece of equipment in the case where such access panel is used as a removal pathway for multiple pieces of equipment.

D. Piping Sleeves:

1. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, walls or masonry construction. Cut flush with both faces of wall. Floor sleeves shall extend one inch above floor top elevation. Roof penetrations shall be within a pipe curb assembly equal to Pate Co. Curb and flashing per roofing manufacturer’s requirements to maintain warranty.
2. Install rockwool and/or caulk between pipe and sleeve. Material must meet all applicable fire ratings.

E. Piping Escutcheon plates:

1. Install manufactured chromium plated escutcheon plates wherever uninsulated exposed pipes pass through walls, floors, or ceilings. Escutcheon inside diameter to closely fit around pipe and outside diameter to completely cover opening.

F. Expansion Joints:

1. Provide flexible connectors where all pipes or ducts cross building expansion joints. Coordinate exact quantity & location with Architectural plans prior to installation of piping or ductwork.

### 3.5 PROTECTION OF EQUIPMENT AND SURFACES

- A. Make every effort to protect roofs, walls and floors from foot traffic, equipment, carts, lifts, etc.
- B. Make roof penetrations and install insulated roof curbs and flashing in accordance with roofing manufacturer’s recommendations. Obtain written certification from roofing manufacturer that work has been performed properly and that roof warranty is intact.
- C. The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense. All ductwork with open ends shall be covered with plastic during construction.

### 3.6 REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT

- A. The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any



appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost. Coordinate with the Electrical Contractor prior to any work.

### 3.7 EQUIPMENT SUPPORT

- A. Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Do not support items from roof/floor deck or bridging.

### 3.8 UTILITY VERIFICATION REQUIREMENTS

- A. Field verify locations of underground and aboveground utilities, or those otherwise obscured from view, in the vicinity of work prior to commencing work. Utilize "811" call before you dig and hire locating service to identify, locate and mark remaining utilities and private lines.
- B. Camera scope and dye testing existing piping, ductwork and pathways to confirm existing conditions and use including, but not limited to, voltage, natural gas pressure, sanitary, storm, chilled water, steam, etc.)
- C. Obtain on-site approval from local utility prior to connecting to existing services.
- D. Failure to perform the above shall result in contractor proceeding at their risk and accepting full responsibility for incorrect connections.

### 3.9 ACCESSIBILITY:

- A. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.
- B. The Contractor shall locate and install all equipment so that it may be serviced, and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, controls, coils, etc.
- C. Whether shown on the Plans or not, the Contractor shall provide in the Bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. Change orders for access panels will not be accepted.

3.10 SCAFFOLDING, RIGGING AND HOISTING:

- A. The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

3.11 DELIVERY, STORAGE, HANDLING, AND PROTECTION

- A. Receive, inspect, store and protect all materials required for new work. Do not accept or install any product damaged in any way.
- B. Comply with all manufacturer guidelines and requirements for movement, storage, and protection of new work. All new work must be stored in a clean, dry place protected from weather and construction traffic. Maintain acceptable temperature and humidity per manufacturer recommendations. When stored inside or during transport through building, do not exceed structural capacity of the floor.
- C. Coordinate and account for sizes of all new work included shipping materials with available openings. Account for rigging of all new work as required and as intended by manufacturer.
- D. Do not install work until work area is sufficiently weathertight, all wet work in area is complete and all work above is complete.
- E. Prior to installation, all products shall have the ability to be returned to the supplier or manufacturer after purchase and charged a reasonable restocking fee equal to a small portion of the cost.
- F. Protect all new work through construction from damage. Take safeguards necessary to protect from damage. Items damaged during construction will not be accepted and shall be replaced with new.
- G. Remove and replace all materials that have been installed improperly, physically damaged, moisture or water damaged, or mold damaged.
- H. Fully remove all packaging materials inside and out prior to startup.

3.12 LOW VOLTAGE CONTROL WIRING FOR MECHANICAL EQUIPMENT

- A. 120VAC Temperature Control Circuits
  1. Electrical Contractor shall provide all 120 Volt power wiring as required for temperature control panels and transformers to low voltage. Electrical Contractor shall connect to existing spare at electrical panel board and provide proper circuit breaker per NEC and label panel board accordingly. Mechanical contractor and temperature controls contractor shall coordinate with the electrical contractor accordingly.
  2. All other required 120VAC raceway and wiring related work shall be provided by the Electrical Contractor.
  3. The Electrical Contractor shall coordinate with the General Contractor to ensure thermal envelope is maintained at these locations.

3.13 FIRE ALARM RELATED WORK FOR MECHANICAL SYSTEMS

- A. The drawings and specifications for this project require specific fire alarm devices, connections, wiring and programming associated with this division of work.
- B. The electrical contractor will be installing a new fire alarm system or making modifications to an existing fire alarm control panel. Coordinate all fire alarm connections and programming that will be required with the electrical contractor to fulfil this division of work. This coordination shall take place at the start of the project so that all devices may be shown on fire alarm shop drawings.
- C. Fire alarm devices to satisfy the requirements of this division of work will be furnished by the electrical contractor, installed by the mechanical contractor, wired and programmed by the electrical contractor. Mechanical and electrical contractor shall perform and be present for all tests of the system.
- D. All required mechanical shutdowns of equipment shall be coordinated with the electrical contractor and with submitted equipment and performed in a controlled and safe manner in the presence of smoke. This shall be done via hardwired contacts and not via Building Automation System.
  - 1. Whether shown on the drawings or not, all air handling units over 2000 CFM that serve more than one space shall have duct smoke detectors located in the return duct of each unit in accordance with the current State Mechanical Code, and NFPA 90A. The duct smoke detector shall be equipped with an auxiliary relay that immediately cuts power to the fan motor and notifies the fire alarm panel. All related work shall be coordinated accordingly with the electrical contractor. The duct detectors shall be installed downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 2,000 cfm. Where the duct detector cannot be located ahead of branch connections, multiple duct detectors shall be used to satisfy the intent of the code. Return system smoke detectors are not required when the entire space served by the air distribution system is protected by a system of area smoke detectors

3.14 CLEANING:

- A. The Contractor shall, at all times, keep the area of their work presentable to the public and clear from rubbish and debris caused by their operations; and at the completion of the work, they shall remove all rubbish, debris, all of their tools, equipment, temporary work and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.
- B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.
- C. Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4" above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork or insulation (pipe or duct) if the building is not "dried-in". If this is required, the entire lengths of duct shall be covered in

plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

3.15 INSPECTION, APPROVALS AND TESTS:

- A. Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installations to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.
- B. The Contractor shall provide as a part of this Contract any required Agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.
- C. The Contractor shall advise each Inspecting Agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing the work. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all rough-in without fail. Failure of the Inspecting Agency to inspect the work in a timely manner and submit the related reports may result in the Contractor having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.
- D. Approval by an Agency Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
- E. Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the Agency Inspector to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

3.16 OPERATING INSTRUCTIONS

- A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Refer to Section HVAC EQUIPMENT for additional requirements. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7) days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.
- B. Each Contractor shall furnish three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions

shall be submitted in draft form, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions. Refer to Specification Section SHOP DRAWINGS for additional detail.

- C. Each Contractor, in the above-mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

3.17 RECORD DRAWINGS:

- A. The Contractor shall insure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

END OF SECTION 230501

SECTION 230505 - EXISTING CONDITIONS AND DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Prior to submitting a bid, the Mechanical Contractor shall perform a detailed walk-through field inspection, to review the existing structures and premises, to determine all existing conditions, equipment/ductwork/piping locations, etc. and shall make all necessary allowances for all required mechanically related demolition and relocation work. This pre-bid inspection by the Mechanical Contractor shall include inspection of all applicable accessible ceiling cavity, areas, etc.
- B. Should the Mechanical Contractor take any exceptions to providing any related demolition or relocation work, such exceptions shall be stated in detail within the Prime Contractor's bid. No subsequent allowance to the contract cost shall be made for any insufficient allowances made by the Mechanical Contractor during bidding which may result from the Mechanical Contractor's failure to visit job site and review drawings.
- C. The Mechanical Contractor shall confirm the working operation and condition of existing systems to remain. The Mechanical Contractor shall note any malfunctioning systems, system deficiencies or any other noteworthy system items prior to commencement of work. The Mechanical Contractor shall provide a written systems condition assessment report to the owner prior to commencement of work. The owner shall sign the assessment report acknowledging the condition of the existing systems. The Mechanical Contractor shall protect these existing systems and shall be responsible for these systems during demolition and construction. The Mechanical Contractor shall be responsible for turning these existing systems back over to the owner in the same operating condition as the contractor received it. The mechanical contractor shall be responsible for repairing or replacing any malfunctioning systems, components or deficient systems to the satisfaction of the owner that have not been noted on the written systems condition assessment report. The mechanical contractor shall be responsible for all existing system components and operation in the absence of an owner-signed systems condition assessment report.
- D. Demolition related work may not be specifically indicated on drawings, but shall be included under base bid. All mechanically related demolition, relocation, etc. work, including work described herein, shall be under base bid.
- E. It is not the intent of these contract documents that existing conditions be accurately shown. Existing mechanical work is shown to a limited extent on drawings and is shown for general planning reference only. Such locations, etc. have been located from portions of contract documents which were prepared for previously installed work (not from "as-builts"). These locations are not guaranteed. The successful Mechanical Contractor shall have access to all available existing building/system plans and specifications.
- F. The existing ductwork and piping systems may be utilized only to the extent indicated herein or on drawings and/or as directed by Owner's representative in field.

- G. Routing of all new ductwork and piping work in existing buildings shall be approved by Owner's representative prior to installation.

## PART 2 - PRODUCTS

### 2.1 NOT USED

## PART 3 - EXECUTION

### 3.1 EFFECT ON ADJACENT OCCUPIED AREAS

- A. Locate, identify, and protect existing mechanical services passing through demolition areas and serving other areas outside the demolition limits. Maintain services to areas outside demolition limits. When services must be interrupted, install temporary services (including proper filtration) for affected areas.
- B. It is recognized that there may be some ductwork and/or piping systems rendered inactive by demolition, causing disconnection of "downstream" terminals, equipment, etc. which serve occupied areas. It shall be the responsibility of the Mechanical Contractor to investigate these types of conditions (for all systems) prior to demolition. Provide all necessary corrective mechanical work prior to demolition to ensure that such "downstream" work remain permanently active throughout demolition, new construction and after project completion.
- C. All work and system shutdowns shall be carefully coordinated in advance with owner's representative and all affected trades so that normal building activities and other construction trades are minimally affected. All required mechanical related demolition and/or new construction work, which will affect any and all occupied areas (including those which are located outside the immediate area of project work) shall be performed at special times if/as directed by Owner's representative in field.
- D. All existing systems and components shall remain fully operational in all occupied spaces during all occupied periods.
- E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent finished areas and/or other system components. During cutting and patching operations, protect adjacent installations. Remove protection and barriers after demolition operations are complete.

### 3.2 WORK IN EXISTING SPACES

- A. General: Care shall be taken when working in existing spaces so as not to damage existing walls and ceilings where work is being performed.

- B. Existing Ceilings: Where work is being performed above existing ceilings, and the architectural drawings do not indicate ceiling modifications by the General Contractor, it shall be the responsibility of this contractor to remove and replace existing ceilings where work is being performed. In those instances, all repair and installation of new grid, ceiling panels, etc shall be the responsibility of this contractor. Match existing finishes.
- C. New Ceilings: Where existing air outlets are to remain, and the architectural drawings indicate replacement of the ceilings, this contractor shall temporarily remove air outlets, clean and store temporarily. This contractor shall support existing run outs to structure to facilitate replacement of ceiling. This contractor shall re-install existing air outlets at previous locations and extend run outs to air outlets after new ceiling is installed. Refer to architectural drawings for all required ceiling replacements. Coordinate with all trades prior to re-installation.
- D. Walls & Floors: It shall be the responsibility of this contractor to patch existing walls and floors and match existing finishes where work is being removed or installed and patching is being performed, unless noted otherwise on the architectural drawings.
- E. HVAC Units: Replace all air filters in all HVAC equipment serving renovated space prior to turning space over to owner.
- F. If asbestos, PCB's, or other hazardous materials are encountered in the course of the work, stop work in the vicinity of such materials and report their presence to the Owner. Owner will arrange for proper removal and disposal of hazardous materials.

### 3.3 GENERAL DEMOLITION

- A. Provide complete mechanical demolition as required for all systems throughout all project areas not indicated to be salvaged or saved. Unless specifically noted otherwise on plans or determined otherwise during this contractor's pre-demolition survey, all abandoned existing mechanical work in the project areas shall be disconnected and removed in its entirety by the Mechanical Contractor. All related work shall comply with the notes specified herein.
- B. Provide demolition work as required to clear and remove all existing mechanical work to be abandoned and as required to accommodate all new work of all trades. In general, remove existing related ductwork, piping, control media, etc. back to nearest concealed accessible terminal or take-off "upstream". Extend ductwork, piping, etc. as required to accommodate new or relocated mechanical work.
- C. Remove abandoned, inactive and obsolete equipment, ductwork, piping, etc. Abandoned work embedded in floors, walls, and ceilings may remain if such materials do not interfere with new installations. Remove all abandoned materials above accessible ceilings.
- D. Perform cutting and patching required for demolition in accordance with the contract documents.
- E. All abandoned ductwork and piping shall be removed and capped back to respective sources, even if sources are outside of the confines of the project area. Coordinate all work carefully with Owner prior to beginning any mechanical demolition work.



- F. All ductwork, piping, etc. conflicting with construction related work of any and all trades shall be removed and/or relocated by the Mechanical Contractor as necessary and/or as directed by Owner's representative in the field. Mechanical disconnections (and/or reconnections) for equipment to be removed (and/or relocated) shall be by the Mechanical Contractor. This shall apply to all existing mechanical work whether shown on drawings or not.
- G. All refrigerant evacuations and reclaim shall be required for demolished or relocated equipment.
- H. Disposal and Cleanup: Remove from the site and legally dispose of demolished materials and equipment not indicated to be salvaged.
- I. Provide new work as required to accommodate relocations, etc. Routing of all new ductwork and piping in existing buildings shall be held tight to structure above wherever possible and shall be approved by owner's representative prior to installation.

### 3.4 DISPOSITION OF REMOVED EQUIPMENT & MATERIALS

- A. If required to accommodate construction related activities, remove and reinstall any conflicting fixtures, devices or equipment that are to remain.
- B. All abandoned materials removed during demolition and thereafter shall be referred to the Owner's representative for disposal instructions. All materials which the Owner elects to retain shall be neatly stored at the site by the Mechanical Contractor as designated by the Owner's representative. All materials which the Owner elects not to retain shall be disposed of by the Mechanical Contractor in a lawful manner.
- C. All fixtures, devices or equipment designated for salvage (removal and reuse, or for turning over to Owner) shall be disconnected and removed undamaged. Disconnect all pigtails, etc. from equipment terminal points and carefully transport and neatly store same to a protected on-site storage location as directed in field.
- D. Components to be reused shall be cleaned (inside and out) and reinstalled where indicated on drawings. Modify and/or extend related existing ductwork and/or piping as required.
- E. Components turned over to Owner shall be neatly stored as groups by system type.

### 3.5 PRE-EXISTING CODE VIOLATIONS

- A. All existing work which is accessed and/or used under this project shall be inspected and brought into compliance with current codes and standards by the Mechanical Contractor. This shall apply only to the extent that such work is uncovered in the immediate project areas affected by demolition and/or new construction and only to the limited extent that it applies to pre-existing general installation methods (i.e. a missing hanger/support, a missing seal and other minor incidental work).
- B. If more extensive code or safety violations are discovered by the Mechanical Contractor, they shall be immediately brought to the attention (detailed in writing) of the Owner's representative along with the contractors proposed cost for corrections.

3.6 INTERIM LIFE SAFETY WORK

- A. Provide interim fire protection (sprinkler) work in all demolition and construction areas for full code coverage. Further definition will be provided in field if required.

3.7 INTERIM INDOOR AIR QUALITY (IAQ) WORK

- A. All requirements of this IAQ subsection shall be implemented prior to commencement of any demolition/construction activities.
- B. No airborne dust or particulate matter shall be permitted to enter any occupied spaces or any air intakes to existing systems.
- C. Become familiar with all affected HVAC systems to ensure that positive pressure can be maintained, relative to construction areas, in all areas adjacent to construction areas. This shall include all possible operational sequences of all systems such, including operation of smoke control, fire dampers, etc.
- D. All return air and exhaust air terminals within all demolition/construction spaces shall be covered and properly sealed until construction is complete.
- E. All air filters shall be checked at the beginning and end of each work shift and shall be changed in-kind as required to permit free airflow at all times.
- F. Provide temporary exhaust throughout all demolition/construction spaces to ensure proper negative pressure is maintained relative to adjacent areas, including allowances for normal construction traffic through all access doors. Ensure that no windows or doors are left open which could upset the desired negative pressure.
- G. Designate a dedicated qualified person to be on site to monitor all IAQ requirements, including checking filters three to four times per shift, checking for any breeches (by any contractor) such as drilled/cut openings in walls/floors, open windows, etc. Ensure that openings through walls and floors (by any contractor) are made immediately prior to installation of work and properly/permanently sealed immediately thereafter.

END OF SECTION 230505

## SECTION 230566 – AIR TREATMENT SYSTEMS FOR HVAC

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.
- B. All other Suppliers of comparable products requesting prior approval shall:
  - 1. Manufacturers submitting for approval for Bi-Polar Ionization must, as part of the prior approval request, provide their ASHRAE 62.1-2019 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values.
  - 2. Submit independent test data from UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.
  - 3. Submit UL 2998 Environmental Claim Certificate proving no ozone output.
  - 4. Submit pathogen testing per section 2.2.
  - 5. Ionization bars manufactured using ion modules not having epoxy coating all circuit boards and internal components shall not be acceptable.
  - 6. Manufacturers submitting as an alternate shall include their DO-160 test results.

#### 1.2 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. Contractor to purchase and furnish extra materials as suggested by the original equipment manufacturer in the previous section. Contractor to purchase and furnish extra materials for all non-equipment supporting systems at their discretion.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Product description with complete technical data, performance data, and product specification sheets.
  - 2. Operating characteristics; electrical characteristics; and furnished accessories indicating process operating power, distribution range, control signal over range, default control signal with loss of power, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
  - 3. Installation instructions, including factors affecting performance.
  - 4. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
  - 5. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.

6. Performance data for each type of plasma device furnished.
7. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
8. Product drawings detailing all physical, electrical and control requirements.
9. Copy of UL 867 independent ozone test.
10. Copy of UL 2998 conformance certificate.
11. Statement on the manufacturer's letterhead stating that the technology contains no titanium dioxide (TiO<sub>2</sub>).

B. Shop Drawings: For each system.

1. Include plans, elevations, sections, mounting, and attachment details.
2. Include details of system assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

#### 1.4 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
1. Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of 36 months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

### PART 2 - PRODUCTS

#### 2.1 BI-POLAR IONIZATION DESIGN & PERFORMANCE CRITERIA

- A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described here within.
- B. The Bi-polar Ionization system shall be capable of:
1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
  2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
  3. Capable of reducing static space charges.
  4. Effectively reducing space particle counts.
  5. When mounted to the air entering side of a cooling coil, keep the cooling coil free from pathogen and mold growth.
  6. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:

- a. MRSA - >96% in 30 minutes or less
  - b. E.coli - > 99% in 15 minutes or less
  - c. TB - > 69% in 60 minutes or less
  - d. C. diff - >86% in 30 minutes or less
  - e. Noro Virus -> 93.5% in 30 minutes or less
  - f. Legionella -> 99.7% in 30 minutes or less
  - g. Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELAP accredited independent lab confirming kill rates and time meeting the minimum requirements stated in section 2.2 B, points 6A, 6B and 6C. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.
- C. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive and negative output shall not be acceptable.
1. Air exchange rates may vary through the full operating range of a constant Volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
  2. Velocity Profile: The air purification device shall not have maximum velocity profile.
- D. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.
- E. Equipment Requirements:
1. The Air Purification System shall be a product of an established manufacturer within the USA and shall be an integral part of the HVAC Equipment, completely installed, started, commissioned, warranted, and supported by a local factory authorized technician.
  2. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not be acceptable. "Plasma" particulate filters shall not be acceptable. Technologies that produce bi-products or inject other substances (such as hydrogen peroxide) are not acceptable.
  3. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations.
  4. The Air Purification System shall have been tested by UL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers shall submit their independent UL 867 test data with ozone results to the engineer during the submittal process. All manufacturers shall

submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

5. Per ASHRAE 62.1 2019, all air purification products must meet UL 2998 which states that the maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.001 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner's output shall be no more than 0.001 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.
6. Each Plasma Generator shall be provided with a self-cleaning system. Systems without a no-maintenance, self-cleaning system shall not be acceptable.
7. The ionization output shall be a minimum of 400 million ions/cc as measured 1 inch from the cold plasma needles.

F. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC, 115 VAC or 208-230VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

G. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset. Systems requiring fuses shall not be acceptable.
2. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS as well as a local "Plasma On" indication light.
3. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown on the plans. The contractor shall follow all manufacturer IOM instructions during installation.

## 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Global Plasma Solutions.
  2. Plasma Air
  3. ActiveAir

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

3.3 ELECTRIC CONNECTIONS

- A. Provide electrical power and service disconnects to products requiring electrical connections.
- B. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- C. Comply with requirements for service disconnects in Section 262816 "Enclosed Switches and Circuit Breakers."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- E. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.

3.6 DEMONSTRATION

- A. A manufacturer's authorized representative shall provide start-up supervision and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION 230566

SECTION 230923 - DIRECT DIGITAL CONTROL (DDC) SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL REQUIREMENTS

- A. District Supervisor is a Siemens Talon / Tridium Niagara 4 server furnished, installed, programmed and supported by ASA Controls. The Loveland Middle School is to be seamlessly implemented onto the existing district supervisor incorporating all existing programming, graphics, etc. as developed by ASA Controls / Loveland City Schools.
  - a. All new programming and graphics to conform to standards implemented by ASA Controls and approved by Loveland City Schools.
    - 1) The Owner, Engineer and Commissioning Agent shall make a final determination as to whether all new programming and graphics is consistent with and conform to standards developed for existing controls.
    - 2) The Contractor shall perform, at their expense, any and all programming/graphic rework deemed necessary by Owner, Engineer and/or Commissioning Agent so that new programming and graphics are consistent with and conform to standards developed for existing school controls.
  - b. Contractor to develop detailed sequences of operation for each piece of existing HVAC equipment being provided with upgraded controls under this scope of work. All new sequences to provide level of detail consistent with existing control sequences.
  - c. Owner, Engineer and Commissioning Agent to make final determination as to whether contractor developed sequences, both content and level of detail, are consistent with existing control sequences.
  - d. Contractor will need to perform, at his expense, any and all sequence rework deemed necessary by Owner, Engineer and/or Commissioning Agent so that new sequences are consistent with existing sequences with regards to content and level of detail.
  - e. This scope of work is for control upgrades to existing equipment at the Loveland Middle School.
  - f. This contractor shall furnish and install all incidental controls needed for fully functional controls for the different HVAC equipment listed including but not limited to:
    - 1) Furnishing new control panels, with dedicated 120V power circuits for the new system. Refer to specifications and drawings.
      - a) Refer to sequences of operations.
    - 2) Cat6 cabling between all new Tridium Niagara 4 Jace controllers.
    - 3) Programming, graphics, alarms, schedules and historical trend information for the BAS.



- B. This Building Automation System (BAS) Contractor shall supply and install a complete Siemens Talon / Tridium Niagara 4 BAS with Open License Requirements to accomplish the specified sequences of operation for control of heating, ventilating, air-conditioning and other building equipment and systems as described herein. This BAS shall be fully integrated with the existing ASA Controls District Supervisor. All work in this Section shall be coordinated and provided by a single BAS Contractor. This system in its entirety shall comply with all the networking requirements of a BACnet® system as defined by the latest ASHRAE Standard 135-2016. This includes but is not limited to the following:
  - B. BAS Contractor to provide detailed sequences of operation for each piece of existing HVAC equipment at the Loveland Elementary, Primary and Early Childhood Schools. All new sequences to provide level of detail consistent with existing control sequences.
  - C. Include all power wiring and cabling for the operation of the controls system. Refer to Electrical Division Specifications for additional requirements.

#### 1.1 GENERAL SCOPE OF WORK

- A. Contractor shall implement the Niagara 4 Framework based open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The owner shall be the named license holder of all software associated with any and all incremental work on the project. Only Niagara 4 Framework (with Open License Requirements) are acceptable.
- A. The owner shall receive ownership of all job specific configuration documentation, data files and application-level software developed for the project. This shall include all custom, job specific software code, databases and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for admin and programming level access to any component or software program shall be provided to the owner.
- B. It is the owner's intent to purchase an open system capable of being serviced and expanded by any acceptable system integrator that has and maintains certification (TCP) to work on Niagara Framework systems. The Niagara Compatibility Statement (NICS) for all Niagara Software shall allow open access and be set as follows: accept.station.in="\*" accept.station.out="\*" accept.wb.out="\*" accept.wb.in="\*". In any case, the owner shall maintain the right to direct contractor to modify any software license, regardless of supplier, as desired by the owner. The Contractor shall not install any "brand specific" software, applications or utilities on Niagara Framework based devices.
- C. All hardware and field level devices installed, (i.e.; ASCs, PDUs), for the project shall not be limited in their ability to communicate with a specific brand of Niagara Framework device. They shall also be constructed in a modular fashion to permit the next generation and support components to be installed in replace of or in parallel with existing components.

- D. Provide and install all wiring required for a complete system, including communication bus, analog points, digital points, low voltage power, emergency power, and spare communication bus. Splices are not permitted within the IAS FAC LAN or DLN communication cables. Only continuous bus topologies, MS/TP or continuous homeruns are allowed for these networks. Capacity of any bus shall be limited to 80% of the allowable device count to allow for future minor modifications or expansions to the network.
- E. Provision of all documentation called out in these specifications including, but not limited to, submittals, O&M manuals, commissioning submittals, CAD based as-built documentation, and training manuals. Provide both hard copies and electronic files on electronic media.
- F. Training of facility personnel, and or maintenance contractor, on the operation and maintenance of the system.
- G. The repair of all finished surfaces effected as a result of IAS related installation work. This includes but is not limited to carpet, drywall, paint, ceiling tiles, furniture, and the like.
- H. System point to point check out, verification and documentation. Assist the Owner/CxA, and/or TAB Firm in verification and functional performance testing and GUI acceptance testing.
- I. Graphical User Interface Development. The Contractor shall develop the graphics, tools, features, and network integration as required

## 1.2 ACTION SUBMITTALS

- A. The TCC shall not start the project installation until the shop drawing submittals have been reviewed by the Engineer.
- B. Submittals shall include hardware, end devices, ancillary control components, a written operating sequence, unitary control wiring, building floor plans showing communication cabling and labels as well as logic flow diagrams. All submittals shall be provided on paper and electronically in PDF format.
- C. Submittals shall contain one control drawing per specified system and equipment. Drawing shall include point descriptors (DI, DO, AI, AO), addressing, and point names. Each point names shall be unique (within a system and between systems). For example, the point named for the mixed air temperature for AHU #1, AHU #2, and AHU #3 shall not be MAT but should be named AHU#1MAT, AHU#2MAT, and AHU#3MAT. The point names should be logical and consistent between systems and AHU's. The abbreviation or short hand notation (e.g., MAT) shall be clearly defined in writing by the TCC.
- D. Control diagrams shall identify: System being controlled (attach abbreviated control logic text, all digital points, analog points, virtual points, all functions (logic, math, and control) within control loop, legend for graphical icons or symbols, definition of variables or point names and detailed electric connections to all control devices and sensors.
- E. Points list shall include all physical input/output. Points list shall be provided in both hard copy and in electronic format and shall include: Name, address, engineering units, high and low alarm values and alarm differentials for return to normal condition, default value to be used

when the normal controlling value is not reporting, message and alarm reporting as specified, identification of all adjustable points and description of all points.

- F. Submittals shall contain floor plans depicting DDC control devices (control units, network devices, LAN interface devices, and power transformers as well as static pressure sensor in duct and temperature sensors in rooms) in relation to mechanical rooms, HVAC equipment, and building footprint.
- G. Submittals shall contain DDC system architecture diagram indicating schematic location of all control units, workstations, LAN Interface devices, gateways, etc. Indicate address and type for each control unit, Indicate protocol, baud rate, and type of LAN per control unit.
- H. Electrical wiring diagrams shall include motor start, control, and safety circuits and detailed digital interface panel control point termination diagrams with all wire numbers and terminal block numbers identified. Indicate all required electrical wiring. Provide panel termination drawings on separate drawings. Clearly differentiate between portions of wiring that are existing, factory-installed and portions to be field-installed.
- I. Show all electric connections of the controls system to equipment furnished by others complete to terminal points identified with manufacturer's terminal recommendations.
- J. TCC shall provide one complete drawing that shows the control-wiring interface with equipment provided by others.
- K. Submittals shall include project specific graphic screens for each system including a picture of the screen with a list of the variables to be placed on the screen.
- L. Submittals shall include TCC's hardware checkout sheets and test reports.
- M. Submittals shall include the agenda for approval by the engineer and owner of the specified training periods. See training section for requirements.
- N. Provide complete panel drawings that are:
  - 1. Clearly labeled and schematic or drawn to scale.
  - 2. Show the internal and external component arrangement so that the operators can identify the components by their position if the labels come off.
  - 3. Wiring access routes shall also be identified so that Class 1 wiring is separated from Class 2 and 3 and so high voltage wiring is segregated from low voltage wiring.
  - 4. Complete identification of all control devices (manufacturer's type, number, and function).
  - 5. Provide details for labeling all wiring, control devices, and controllers.
  - 6. Material and equipment descriptive material such as catalog cuts, diagrams, performance curves, and other data to demonstrate conformance with specifications shall be provided.
- O. Include room schedule including a separate line for each terminal unit, heat pump, etc. indicating location and address.
- P. Include control valve schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: code number, configuration, fail position,

pipe size, valve size, body configuration, close-off pressure, capacity, valve Cv, design pressure, and actuator type.

- Q. Include control damper schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: code number, fail position, damper type, damper operator, duct size, damper size, mounting, and actuator type.

### 1.3 O&M MANUALS AND CLOSEOUT DOCUMENTS

- A. Operating instructions, maintenance procedures, parts and repair manuals shall be supplied. Repair manuals shall include detailed instructions in the setup, calibration, repair and maintenance of all equipment furnished. Also supplied with these manuals will be a complete parts listing of all devices supplied which is to include part numbers and model numbers of all parts and component parts along with exploded views of devices.
- B. All as built drawings (wiring diagrams, flowcharts, floor plans, etc.) shall also be supplied to the owner electronically in PDF format.
- C. System specific wiring, control diagrams, sequence of operation and points lists shall be as installed in each control panel. This means as-built drawings, not design (submittal) drawings.
- D. Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving.
- E. Supply one copy of the software programming manual (hard copy and PDF format). The manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.
- F. Provide a Bill of Materials with each schematic drawing. List all devices/equipment and match to schematic and actual field labeling. Provide quantity, manufacturer, actual product ordering number, description, size, accuracy, operating ranges (voltage, temperature, pressure, etc.), input/output parameters, etc.
- G. Maintenance manual shall include copies of signed-off acceptance test forms, commissioning reports, start-up reports, etc.
- H. The TCC shall turn over to owner two (2) sets of digital back-ups of the complete temperature control system.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials and parts that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

- B. Include product manufacturers' recommended parts lists for proper product operation over four year period following warranty period. Parts list shall be indicated for each year.

## 1.5 QUALITY ASSURANCE

### A. DDC System Provider Qualifications:

1. Authorized representative of, and trained by, DDC system manufacturer.
2. In-place facility located within 50 miles of Project.
3. Demonstrated past experience with installation of DDC system products being installed for period within five consecutive years before time of bid.
4. Demonstrated past experience on 10 projects of similar complexity, scope, and value.
5. Each person assigned to Project shall have demonstrated past experience.
6. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
7. Service and maintenance staff assigned to support Project during warranty period.
8. Product parts inventory to support on-going DDC system operation for a period of not less than 5 years after Substantial Completion.
9. DDC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

## 1.6 WARRANTY & SOFTWARE LICENSES

- A. Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after substantial completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner.
- B. The TCC shall respond to the Owner's request for warranty service within 24 hours during normal business hours. The TCC shall respond to the Owner's request for Emergency service (defined as life-threatening or creating the potential to cause property damage) during the warranty period within 4 hours.
- C. The TCC shall provide technical phone support to the owner during the warranty period for warranty related issues and for two years after the warranty period. If the technical support location of the TCC is outside of the toll free calling area for the customer, the TCC shall have a toll free number or accept collect calls for the purpose of providing technical support.
- D. During the warranty period, standard parts for the DDC system shall arrive at the facility within 48 hours of placing an order. Non-standard parts (requiring re-manufacturing or ordering from another supplier) shall be shipped within 96 hours.
- E. Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the TCC shall be provided and correctly installed at no charge during the warranty period.

- F. Provide licensed electronic copies of all software for each workstation, laptop, server. This includes, but is not limited to: project graphic images (editing/modifying/creating), project database, trouble-shooting and debugging programs, project-specific programming code and all other software required to operate and modify the programming code (including software at system level, primary control units, secondary control units, and all communication software). Any hardware devices (cables, protection devices) required to operate the software/hardware shall also be provided.
- G. All additional licensing needed for this project shall be supplied by TCC. Software license shall not expire or utilize any sort of protection hardware device for its use. In any case owner shall be free to direct the modification of any software license, regardless of supplier to allow open access to all controllers. Owner shall hold the software and firmware licensing. Software license shall not expire or utilize any sort of protection hardware device for its use.
- H. System software shall be the latest version available with upgrades provided at the end of the warranty period, and shall be fully licensed to the Owner for the entire system. Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and down-loading the entire unitary data base or any part of the automated system for backup or archiving.

#### 1.7 TRAINING

- A. A formal on-site "Hands On" training session shall be conducted for the owner's maintenance personnel. This session shall be a minimum of one (1) eight (8) hour days to train the staff on setup, operation, and maintenance of all system(s) and/or devices. This will be at a time and location selected by the owner. One (1) additional eight (8) hour session shall be provided as "opposite season" training – generally 6 months into the warranty period. One (1) additional eight (8) hour session shall be provided at a later date. (This may be requested any time during the warranty period.) All training materials and books shall be provided. Both sessions shall be given by the manufacturers "factory" technical representative. (This is defined as someone other than the installing contractor's representative.) All expenses are to be provided by the TCC. All training sessions shall be scheduled at owner's request.
- B. TCC shall conduct training courses for designated personnel in operation and maintenance of system. Training shall be oriented to specific system being installed under his contract and shall be digitally recorded and submitted on DVD or flash drive by the TCC.
- C. Training shall be a mix of, test exercises, and actual keyboard entry and screen viewing at the operator's terminal. A curriculum shall be discussed and implemented based on the level of expertise of the employees. Hands-on experience and problem solving shall be emphasized.
- D. If during any training session, the trainer/owner finds more than three (3) items that need repair, the training session will be immediately terminated. The session will be rescheduled for another date. The re-scheduled training session will be carried out at no additional cost to the Owner.
- E. The training shall be oriented to making the owner self-sufficient in the day-to-day use and operation of the DDC system.

- F. Additionally, the training shall include:
1. System start-up, shutdowns, power outage and restart routines, alarms, security levels, changing setpoints, changing schedules and other parameters, overrides, freeze protection, manual operation, return to automatic operation, and resetting equipment.
  2. All screens shall be discussed, allowing time for questions.
  3. Information specifically focused on showing the owner methods of troubleshooting the mechanical systems using the DDC.
  4. Use of laptop and hand-held operator interface device, if applicable.
  5. Creating, modifying, viewing, downloading, and reloading, trend logs.
  6. Remote access to the system.
  7. The other training sessions shall be oriented toward answering specific questions from Owner's staff.
  8. The trainer must be well grounded in both DDC system operation and in mechanical systems service and shall be the programmer.
- G. This documentation and process shall be complete, approved and accepted by Engineer and Owner prior to acceptance. This information shall be documented as completed. A copy shall be delivered to the Engineer and Owner and included in the O&M manuals.

## 1.8 COMMISSIONING & VERIFICATION, FUNCTIONAL PERFORMANCE TESTING & CHECKLISTS

- A. 100% compliance with the requirements of this section is a condition of the Owner's acceptance and start of the warranty period.
- B. The TCC shall be responsible for completion of (1) their hardware checkout sheets and test reports, (2) Point-by-point confirmations of ALL points – this includes visual inspection of installed components, and (3) sequence of operation confirmation.
- C. This documentation and process shall be complete, approved and accepted by Engineer and Owner prior to acceptance. This information shall be documented as completed. A copy shall be delivered to the Engineer and Owner and included in the O&M manuals. Each subcontractor shall be responsible for completion of their own System Verification Checklists/Manufacturer's Checklists. Sample checklists shall be submitted to the Engineer and Testing Agent for approval.
- D. Air and water balancing shall be completed (and discrepancies resolved) before the TCC's final system check and before the acceptance test to be conducted in the presence of the Engineer.

## PART 2 - PRODUCTS

### 2.1 DDC SYSTEM MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (Branch Office is not acceptable):
- B. The following are approved BAS installers:

- a. ASA Controls (Basis of Design)
- b. Thomas Control Service
- c. CCG

- C. The following are approved BAS component manufacturers:
- a. Siemens Talon (Siemens Talon Value Added Partner (VAP))

## 2.2 DDC SYSTEM DESCRIPTION

- A. Microprocessor-based monitoring and control including analog/digital conversion and program logic. A control loop or subsystem in which digital and analog information is received and processed by a microprocessor, and digital control signals are generated based on control algorithms and transmitted to field devices to achieve a set of predefined conditions.
1. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.3 WEB ACCESS

- A. Remote Data Access: The system shall support the Internet Browser-based remote access to the building data. The IAS contractor shall coordinate with the Owner's IT department to insure all remote browser access (if desired by the owner) is protected with the latest Niagara Software updates and a VPN (Virtual Private Network) must be installed to protect the owner's network from cyber-attacks.
- B. Browser-based access: A remote/local user using a standard browser will be able access all control system facilities and graphics via the WAN or direct connection, with proper username and password. Only native Internet browser-based user interfaces (HTML5, Java, XML, CCS3 JAVA Script, etc.) that do not require plug-ins (thin clients) are acceptable. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Firefox™ or Chrome™.

## 2.4 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Products installed in ducts, equipment, and return-air paths shall comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
  2. Smoke-Developed Index: 50 or less.
- B. DDC System Speed:
1. Response Time of Connected I/O:



- a. AI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
  - b. BI point values connected to DDC system shall be updated at least every five seconds for use by DDC controllers. Points used globally shall also comply with this requirement.
  - c. AO points connected to DDC system shall begin to respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
  - d. BO point values connected to DDC system shall respond to controller output commands within two second(s). Global commands shall also comply with this requirement.
2. Display of Connected I/O:
- a. Analog point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
  - b. Binary point COV connected to DDC system shall be updated and displayed at least every 10 seconds for use by operator.
  - c. Alarms of analog and digital points connected to DDC system shall be displayed within 45 seconds of activation or change of state.
  - d. Graphic display refresh shall update within eight seconds.
  - e. Point change of values and alarms displayed from workstation to workstation when multiple operators are viewing from multiple workstations shall not exceed graphic refresh rate indicated.
- C. Network Bandwidth: Design each network of DDC system to include at least 30 percent available spare bandwidth with DDC system operating under normal and heavy load conditions indicated. Calculate bandwidth usage, and apply a safety factor to ensure that requirement is satisfied when subjected to testing under worst case conditions.
- D. DDC System Data Storage:
1. Include capability to archive not less than 24 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
  2. Local Storage:
    - a. Provide server workstation with data storage indicated. Server(s) shall use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.
  3. Cloud Storage:
    - a. Provide application-based and web browser interfaces to configure, upload, download, and manage data, and service plan with storage adequate to store all data for term indicated. Cloud storage shall use IT industry standard database platforms and be capable of functions described in "DDC Data Access" Paragraph.
- E. DDC Data Access:

1. When logged into the system, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
  2. System(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
- F. Future Expandability:
1. DDC system size shall be expandable to an ultimate capacity of at least two times total I/O points indicated.
  2. Additional DDC controllers, I/O and associated wiring shall be all that is needed to achieve ultimate capacity. Initial network infrastructure shall be designed and installed to support ultimate capacity.
  3. Operator interfaces installed initially shall not require hardware and software additions and revisions for ultimate capacity.
- G. Input Point Displayed Accuracy: Input point displayed values shall meet the industry standard end-to-end overall system accuracy, including errors associated with meter, sensor, transmitter, lead wire or cable, and analog to digital conversion.
- H. Control Stability: Control variables indicated shall be within the industry standard.
- I. Environmental Conditions for Controllers, Gateways, and Routers:
1. Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location.
    - a. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application.
  2. Products shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Products not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures.
- J. Environmental Conditions for Instruments and Actuators:
1. Instruments and actuators shall operate without performance degradation under the ambient environmental temperature, pressure, humidity, and vibration conditions specified and encountered for installed location.
    - a. If instruments and actuators alone cannot comply with requirement, install instruments and actuators in protective enclosures that are isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by instrument and application.

2. Instruments, actuators and accessories shall be protected with enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Instruments and actuators not available with integral enclosures complying with requirements indicated shall be housed in protective secondary enclosures.

K. DDC System Reliability:

1. Design, install and configure DDC controllers, gateways, routers, to yield a MTBF of at least 40,000 hours, based on a confidence level of at least 90 percent. MTBF value shall include any failure for any reason to any part of products indicated.
2. If required to comply with MTBF indicated, include DDC system and product redundancy to maintain DCC system, and associated systems and equipment that are being controlled, operational and under automatic control.
3. Critical systems and equipment that require a higher degree of DDC system redundancy than MTBF indicated shall be indicated on Drawings.

L. Electric Power Quality:

1. Power-Line Surges:

- a. Protect DDC system products connected to ac power circuits from power-line surges to comply with requirements of IEEE C62.41.
- b. Do not use fuses for surge protection.
- c. Test protection in the normal mode and in the common mode, using the following two waveforms:

2. Power Conditioning:

- a. Protect DDC system products connected to ac power circuits from irregularities and noise rejection. Characteristics of power-line conditioner shall be as follows:
  - 1) At 85 percent load, output voltage shall not deviate by more than plus or minus 1 percent of nominal when input voltage fluctuates between minus 20 percent to plus 10 percent of nominal.
  - 2) During load changes from zero to full load, output voltage shall not deviate by more than plus or minus 3 percent of nominal.
  - 3) Accomplish full correction of load switching disturbances within five cycles, and 95 percent correction within two cycles of onset of disturbance.
  - 4) Total harmonic distortion shall not exceed 3-1/2 percent at full load.

3. Ground Fault: Protect products from ground fault by providing suitable grounding. Products shall not fail due to ground fault condition.

M. Backup Power Source:

1. HVAC systems and equipment served by a backup power source shall have associated DDC system products that control such systems and equipment also served from a backup power source.

N. UPS:

1. DDC system products powered by UPS units shall include the following:
  - a. Desktop workstations.
  - b. Printers.
  - c. Servers.
  - d. Gateways.
  - e. DDC controllers, except application-specific controllers.

O. Continuity of Operation after Electric Power Interruption:

1. Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

## 2.5 SYSTEM ARCHITECTURE

- A. The system provided shall incorporate hardware and software resources sufficient to meet the functional requirements of these Specifications. The Facility Local Area Network (FAC LAN) and Device Level Network (DLN) shall be based on industry standard open platforms as specified herein and utilize commonly available operation, management and application software. All software packages and databases shall be licensed to the Owner to allow unrestricted maintenance and operation of the BAS. Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.
- B. The system architecture shall implement a new building BAS which is based on the Niagara Framework and consists of an Ethernet-based, wide area network (WAN), a single Local Area Network (LAN) that supports NCs, PCUs, ASCs, Operator Workstations (OWS), Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable.
  1. WAN: Internet-based network connecting multiple facilities with a central data warehouse and server, accessible via standard web-browser.
  2. Facility Local Area Network (FAC LAN): The FAC LAN shall be an Ethernet-based, 10/100/1000 Ethernet LAN connecting Local NCs, IAS Server and OWSs. The FAC LAN serves as the backbone for the NCs communications path and as the connection point to the WAN. Contractor shall provide a FAC LAN as a dedicated LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 6 cable with switches and routers that support 1000base-T gigabit Ethernet throughput.
  3. Device Level Network (DLN): Network used to connect PCUs and ASCs. These shall be Peer to Peer devices as defined in the BTL standard.
  4. ARCnet and/or Token-Ring based FAC LANs and DLNs shall not be acceptable.
- C. The communication speed between the controllers, LAN interface devices, CSS, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition.

- D. Niagara Framework Control Systems Server (CSS): A server that maintains the systems configuration and programming database. It shall allow secure multiple-access to the control information.
- E. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on a server that resides on the FAC LAN. User tools for DLN and FAC LAN management shall be provided and licensed to the Owner and shall allow unrestricted configuring, updating, maintaining, and expanding of all current devices, configurations and settings.
- F. Database Schema shall be published and provided to the Owner to facilitate easy access to DLN and FAC LAN data.

## 2.6 DDC SYSTEM OPERATOR INTERFACES

- A. Operator Means of System Access: Operator shall be able to access entire DDC system through any of multiple means, including, but not limited to, the following:
  - 1. Desktop and portable workstation with hardwired connection through LAN port.
  - 2. Portable operator workstation with wireless connection through LAN router.
  - 3. Mobile device and application with secured wireless connection through LAN router or cellular data service.
  - 4. Remote connection through web access.
- B. Access to system, regardless of operator means used, shall be transparent to operator.
- C. Desktop Workstations:
  - 1. Connect to DDC system Level one LAN through a communications port directly on LAN or through a communications port on a DDC controller.
  - 2. Able to communicate with any device located on any DDC system LAN.
- D. Mobile Device:
  - 1. Connect to system through a wireless router connected to LAN and cellular data service.
  - 2. Able to communicate with any DDC controller connected to DDC system using a dedicated application and secure web access.
- E. Critical Alarm Reporting:
  - 1. Operator-selected critical alarms shall be sent by DDC system to notify operator of critical alarms that require immediate attention.
  - 2. DDC system shall send alarm notification to multiple recipients that are assigned for each alarm.
  - 3. DDC system shall notify recipients by any or all means, including e-mail, text message and prerecorded phone message to mobile and landline phone numbers.
- F. Simultaneous Operator Use: Capable of accommodating up to five simultaneous operators that are accessing DDC system through any one of operator interfaces indicated.

## 2.7 NETWORK COMMUNICATION PROTOCOL

- A. Network communication protocol(s) used throughout entire DDC system shall be open to Owner and available to other companies for use in making future modifications to DDC system.
- B. ASHRAE 135 Protocol:
  - 1. ASHRAE 135 communication protocol shall be sole and native protocol used throughout entire DDC system.
  - 2. DDC system shall not require use of gateways except to integrate HVAC equipment and other building systems and equipment, not required to use ASHRAE 135 communication protocol.
  - 3. If used, gateways shall connect to DDC system using ASHRAE 135 communication protocol and Project object properties and read/write services indicated by interoperability schedule.
  - 4. Operator workstations, controllers and other network devices shall be tested and listed by BACnet Testing Laboratories.

## 2.8 DESKTOP WORKSTATIONS

- A. Description: A tower or all-in-one computer designed for normal use at a single, semi-permanent location.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Dell Inc.
  - 2. HP.
  - 3. Lenovo.
- C. Performance Requirements:
  - 1. Performance requirements may dictate equipment exceeding minimum requirements indicated.
  - 2. Energy Star compliant.
- D. Personal Computer:
  - 1. Operating System: Windows 10 Professional, 64 bit
  - 2. Minimum Processor Speed: 4 GHz.
  - 3. RAM: 8 GB SDRAM @ 1333MHz
  - 4. 1 TB, solid state hard drive
  - 5. 24", 4K LED widescreen, HDMI
  - 6. Video Card: 4K HD Graphics: HDMI
  - 7. Optical Drive: 16X DVD+/-RW with double-layer DVD+/-R write
  - 8. Network Support: Ethernet adapter (10/100 Mb with RJ-45 connector)
  - 9. Wireless Network Support: wireless 802.11 a/b/g/n protocols must be supported
  - 10. Wireless USB Mouse and keyboard
  - 11. Inkjet Printer
  - 12. Surge Protection

## 2.9 SERVERS

1. Processor: Intel® Xeon® CPU E5-2640 x64 (or better), compatible with dual- and quad-core processors
2. Operating System: Windows 10 64 bit, Windows Server 2016, Red Hat Enterprise
3. Memory: 16 GB minimum
4. Hard Drive: 100 GB minimum, more recommended depending on archiving requirements
5. Display: Video card and monitor capable of displaying 1024 x 768 pixel resolution or greater
6. Network Support: Ethernet adapter (10/100 Mb with RJ-45 connector)
7. Connectivity: Full-time high-speed ISP connection recommended for remote site access (i.e., T1, ADSL, cable modem) and IPv6 compliant.

## 2.10 WIRE MANAGEMENT, ELECTRICAL POWER, ETC:

- A. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.
- B. All wiring and cabling in mechanical and electrical rooms shall be in conduit. No wiring or conduit can be exposed to view in any other area. Conceal all wiring and cabling in conduit in wall from thermostats or other controls devices to above ceiling. Install conduit in wall from wall thermostats to above ceiling for cabling. Route wiring directly to cable tray from control points above the ceiling. Rough-in for control devices shall be in compliance with the requirements of the ELECTRICAL SPECIFICATIONS.
- C. If new devices are installed on existing solid walls (i.e. filled block), provide wire mold to hide all surface mounted wiring from view.
- D. Any power for controls shall be fed from dedicated circuits in emergency electrical panels, when provided for a project, and shall not be obtained from receptacles, lighting, or equipment circuits. Unitary control power may be obtained from the equipment served. If power is obtained from the equipment served, the power may not be interrupted to the electronics if the equipment is off for any reason.
- E. The TCC shall be responsible for the power source to any control panels, unitary controllers, etc. on any controlled equipment and all other control power requirements. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.
- F. Prior to installation, insure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, heat pumps, etc.
- G. The TCC shall provide all CAT6 cabling network cabling for a complete system. This shall include cabling to the Owner's data drop. The main system data drop will be provided by others.
- H. All control circuits within the electrical panels shall be marked to indicate equipment served.

- I. The TCC shall perform all temperature control interlock wiring. This shall include control valves, dampers, thermostats, indoor/outdoor HVAC systems, etc. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.
  - J. The TCC shall be responsible for any power required for the unitary controls or control panels. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.
  - K. Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic control components. This receptacle may be served from the control panel 120 VAC power source.
  - L. All wiring shall be continuous runs. Any junctions must be made in metal enclosure.
  - M. Grounding terminals shall be color coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip. Terminals shall be Entrelec M 4/5.3A.PI or equivalent by Weidmuller, Phoenix, or Allen Bradley.
  - N. The Department of Housing, Building and Construction's Electrical Division requires that all new lighting control panels, new Building Automation Systems control panels, and new conventional HVAC control panels be certified as being constructed and wired in accordance with NFPA 70 110.3 (a) (1) and article 409.
  - O. Contractor shall ensure control panels have an identification label stating the "Certification Agency" such as UL, CSA, CE, etc. or a label of certification for each control panel by a Professional Engineer (P.E.) registered in the State of Kentucky, stating that the design of the control panel was under their direct supervisory control. Include with shop drawings.
  - P. The Electrical Advisory Council for the State of Kentucky requires that only an electrical contractor licensed by the State of Kentucky with a licensed Master Electrician and a licensed on-site electrician can install the electrical wiring for lighting controls systems or Building Automation Systems (BAS).
- 2.11 CABLING:
- A. All control wiring shall be installed in a wire management system to include cable trays, bridle rings, & conduits. No exceptions! Coordinate with electrical contractor to ensure a complete wire management system.
  - B. A complete cabling system shall be furnished and installed, which shall adhere to the highest workmanlike standard of quality and appearance. Cabling shall be installed square with building lines and contained within a wire management system.



- C. All sizing of cabling shall be according to manufacturer's recommendations, but shall be a minimum of 18 AWG.
- D. Furnish a floor plan of the building indicating communication cable labeling and routing as well as addresses and branch wiring from the unitary devices. All cabling shall be labeled on both ends. The type, size and label of all cabling shall be indicated on submittal floor plan drawings.
- E. Wall space temperature sensor cabling (from the sensor to the unitary controller) shall have a minimum of four (4) conductors.
- F. All cabling shall be stranded. "NO" solid conductors will be accepted. All cabling shall be 100% shielded with appropriate drain wire and insulation. System specific, proprietary controls wiring, i.e. VRF/VRV controls wiring, is the only exception.
- G. All cable connections shall be continuous run (including shield). Any junctions must be made in a metal enclosure, connections must be soldered, taped and the metal enclosure must be mechanically attached to the nearest ground. No wire nuts or crimped connections will be accepted. Note location of junction boxes on the as built floor plans. All cabling networking unitary controllers, and other networked equipment, shall be in soldered.
- H. All shields must be terminated as per manufacturer's recommendation. Shield termination requirements by the manufacturer must be provided with submittals.
- I. Wireless controllers are not approved unless specifically mentioned in the sequence of operations or noted on plans.

## 2.12 SYSTEM SOFTWARE

- A. System software will be the latest version available with upgrades provided for full warranty period, and shall be fully licensed to the owner for all network controllers and servers.
- B. The BAS shall include trend logging screens accessible from tabs on the home page for building utilities usage.
- C. System software shall, at a minimum, provide:
- D. Monitor and supervise all control points.
- E. Add new points and edit system database.
- F. Change control setpoints, timing parameters and loop tuning of PID coefficients in all control loops in all control units.
- G. Enter programmed start/stop schedules.
- H. View alarm and messages.
- I. Modify existing control logic (or sequence of operation) in all control units.

- J. Upload/Download programs, databases, control parameters, etc.
- K. Modify graphic screens.
- L. Sequence of operation programming methodology - The application software shall be user programmable. Application programming shall be (1) Line type programming that uses text programming in a language similar to BASIC or FORTRAN, or (2) graphical block programming - The method of programming shall be by manipulation of graphic icon "blocks." Each block represents a subroutine containing the programming necessary to execute the function of the device that the block represents.
- M. Unitary Control Unit Database Archiving - The host software shall provide capability to upload sequence of operation, database, and other control parameters from each controller. Uploaded programs shall be retained on hard disk for system backup. Programs may be modified using Editor functions, and downloaded to individual controllers as desired. Downloading of databases shall not interrupt other multi-tasked functions that are ongoing.
- N. THIRD PARTY SOFTWARE PACKAGES: The host software shall provide the capacity to run third party software packages for word processing, spreadsheets, or database management programs. Use of third party software shall not suspend operation of background tasks of multi-tasking operating system, such as alarm logging, and report generation.

2.13 NETWORK CONTROLLER (Siemens Talon / Tridium N4 Jace)

- A. Install the Network Controller in a surface mounted panel, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. All control panels must be painted the same color and identified. The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.
- B. Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.
- C. The Network Controller shall be web-based and communicate BACnet IP. It shall issue all time schedules, summer/winter commands, customized trending, holiday scheduling, alarm handling, clock or other shared commands to all unitary controllers within the building network. If for any reason communications between the unitary(s) and the Network Controller is lost, the unitary(s) shall operate in a stand-alone manner (in day operation) until communications is restored. It shall also operate in the "summer" or "winter" mode as last commanded.
- D. The Network Controller shall be integrated and interoperable with the facility infrastructure and include user access to all system data locally over the Local Area Network (LAN) / Wide Area Network (WAN) within the building and remotely by a standard Web Browser over the Internet. Any computer connected to the network, utilizing a web browser and having the proper password.
- E. The Network Controller shall be a fully user-programmable, supervisory controller. It shall monitor the network of distributed unitary controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers.

- F. The Network Controller shall have battery back-up to allow a minimum of seven days of operation. The Network Controller shall be composed of one or more independent, stand-alone, microprocessor to manage the network strategies described in Application software section. The network controller shall have ample memory to support its operating system, database and programming requirements. The operating system of the Network Controller shall manage the input and output communications signals to allow distributed unitary controllers to share real and virtual point information and allow central monitoring and alarms. The database and custom programming routines of the Network Controller shall be editable from a single operator station.
- G. The Network Controller shall be remotely monitored via the internet. Additionally, it shall include automatic emailing and texting out alarms, gathering alarms, reports and logs, programming and downloading database.
- H. The Network Controller shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:
  - 1. Assume a predetermined failure mode.
  - 2. Emit an alarm.
  - 3. Display card failure identification.
- I. Under no circumstance shall more than 80% of the total number of sensor and control points be connected through a single Network Controller. Each DDC system component shall provide for the future addition of at least 20% of each type of the number of sensor and control points connected to that component including a minimum of one universal input and one universal output.

#### 2.14 PROGRAMMABLE EQUIPMENT CONTROLLER (Siemens Talon / Tridium N4 Jace)

- A. Unless otherwise specified, the following pieces of equipment shall have their own Siemens Talon / Tridium N4 Jace (i.e., Hot Water System, Chilled Water System, Modular Air Handlers, etc.). The Programmable Equipment Controller shall be mounted in a panel and properly labeled.

#### 2.15 UNITARY CONTROLLER (Siemens Talon DXR)

- A. Unless otherwise specified, each piece of equipment shall have its own Unitary Controller (i.e., rooftop unit, VAV Box, Fan coil unit, unit ventilator, terminal unit, etc.). The Unitary Controller for each piece of equipment shall be mounted on the side of the unit. The Unitary Controller for all other equipment shall be mounted in a panel and properly labeled.
- B. Unitary Controllers used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F. All Unitary Controllers shall have an RJ-11 or similar type connection for monitoring or programming access by room or local equipment level with access to any unitary within the network without modification.
- C. Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.

- D. Unitary Controllers utilized in the network shall have full standalone capability including time of day and holiday scheduling as well as all energy management functions such as optimal start/stop, duty cycling, etc. The terminal unit Unitary Controllers may be pre-programmed with the project specific sequence of operation as specified for the application. Any re-programming of the electronics shall be performed on location using a portable personal computer with appropriate software or through the Network Controller. The entire unitary data base shall have the capability of being backed up and or downloaded locally.
- E. All points to have a unique digital input to the BAS system. The use of digital point count expanders is not an acceptable replacement to digital inputs to the unitary controller. The conversion of a single universal input channel to accept up to multiple voltage free contacts such as relay contacts, auxiliary starter contacts, differential pressure switches, etc. IS NOT ACCEPTABLE.
- F. Unitary Controllers shall communicate via BACnet MSTP communication protocol. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each Unitary Controller that will communicate on the BACnet MS/TP Bus.
- G. All Unitary Controllers shall be fully application programmable. All control sequences within or programmed into the unitary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery shall be retained.
- H. Unitary Controllers shall have a 20% spare point capacity to be provided for all applications.
- I. The Unitary Controller for each VAV box shall be mounted on the side of the unit. The unitary controller for all other equipment shall be mounted in a panel and properly labeled. Prior to installation, ensure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, etc.
- J. After a power failure, the Unitary Controller shall operate the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

## 2.16 GRAPHICS SCREENS AND TRENDS

- A. All graphics screens shall be submitted for review by Engineer. Provide the following animated, color graphics screens at a minimum.
  - 1. Entire floor plan home screen with OAT, Time and Date displays.
    - a. Floor plan showing major zones.
    - b. Click major zone displays enlarged floor plan of the zone showing individual system zones & numbers. Include link to respective mechanical room.
    - c. Click individual zone shows system graphic. Display all data points from points list, occ/unocc schedule and setpoints, VAV cfm and setpoint, OAT, Time and Date.
  - 2. Color Graphic Screens shall be designed for all mechanical systems and shall include the following:

- a. A graphic shall be the starting page with the building graphically indicated. Break up the floor plan into zones to match Contract Documents. The building shall be the point of reference to enter into the respective building control system.
  - b. All system units including pumps, filters, humidifiers, associated VAV boxes, etc.
  - c. All terminal equipment including but not limited to VAV boxes, reheat coils, zone dampers, etc.
  - d. All OA units.
  - e. Domestic hot water heaters and pumps.
  - f. The summation of all supply OA for each unit shall be displayed on the AHU graphic pages.
  - g. All floor plans indicating all actual room numbers, thermostats and mechanical equipment. Operator shall be capable of clicking on any equipment and pull up the respective graphic screen.
- B. Graphics to include floor plans with room numbers (as-built room numbers) and thermostat locations, links to flow diagrams for all equipment, domestic hot water, and lighting controls.
- C. All new graphics shall match the existing system graphics, unless noted otherwise.
- D. The graphical programming software shall allow for interactive mouse-driven placement of block icons on the graphic screen and connection of block inputs to block outputs by means of drawing lines to form a graphic logic diagram. The user shall not have to manually input text to assign block input/output interconnections. Blocks shall allow entry of adjustable settings and parameters via pop-up windows.
- E. The clarity of sequence shall be such that the user has the ability to verify that the system programming meets the specs without having to learn or interpret a manufacturer's unique programming language. Provide a means for testing and/or debugging the control programs off-line (not communicating with control units) using operator entered values for physical inputs and time. Provide a means for testing and/or debugging the control programs on-line (communicating with control units), showing actual physical inputs and all block outputs in real time.
- F. Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs. Logic diagrams shall be viewable either off-line, or on-line with real-time output values.
- G. All graphic software shall be in the HTML web browser format and support multiple simultaneous screens to be opened and resizable in a "Windows" type environment. All functions, except text entry, shall be executable with a mouse. Graphic software shall provide for multitasking such that third party programs can be used while the Operator Workstation Software is on-line. Provide the ability to alarm graphically even when operator is in another software package. The software shall allow for Owner to create user defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics.
- H. The contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, coils, filters, dampers, etc.), mechanical system

components (e.g., pumps, heat pumps, etc.), complete mechanical systems (e.g. VAV, etc.) and electrical symbols.

- I. The graphic development package shall use a mouse or similar pointing device to allow the user to perform the following:
  - 1. Define symbols
  - 2. Position items on graphic screens
  - 3. Attach physical or virtual points to a graphic
  - 4. Define background screens
  - 5. Define connecting lines and curves
  - 6. Locate, orient and size descriptive text
  - 7. Define and display colors for all elements
  - 8. Establish correlation between symbols or text and associated system points or other displays.
  - 9. Create hot spots or link triggers to other graphic displays or other functions in the software
  
- J. The TCC shall including programming of 25-point trends as directed by the Engineer. These can be requested at any time during the project including the warranty period. Trend “change of state” for digital inputs. Trend analog points in 30-minute increments. Maintain trend history for 30 days. Include the following:
  - 1. Outside air temperature
  - 2. OA unit leaving air temperatures for each unit
  - 3. Summation of all VAV boxes connected to a unit
  - 4. VFD speeds (OA & EA)
  - 5. Freezer/Cooler temperatures
  - 6. Makeup water flow rate
  - 7. Electrical power kW and kWh
  - 8. Others as directed in the field

## 2.17 ASHRAE 135 GATEWAYS

- A. Include BACnet communication ports, whenever available as an equipment OEM standard option, for integration via a single communication cable.
  
- B. Include gateways to connect BACnet to legacy systems, existing non-BACnet devices, and existing non-BACnet DDC-controlled equipment, only when specifically requested and approved by Owner.
  
- C. Include with each gateway an interoperability schedule showing each point or event on legacy side that BACnet "client" will read, and each parameter that BACnet network will write to. Describe this interoperability of BACnet services, or BIBBs, defined in ASHRAE 135, Annex K.
  
- D. Gateway Minimum Requirements:
  - 1. Read and view all readable object properties on non-BACnet network to BACnet network and vice versa where applicable.

2. Write to all writeable object properties on non-BACnet network from BACnet network and vice versa where applicable.
3. Include single-pass (only one protocol to BACnet without intermediary protocols) translation from non-BACnet protocol to BACnet and vice versa.
4. Comply with requirements of Data Sharing Read Property, Data Sharing Write Property, Device Management Dynamic Device Binding-B, and Device Management Communication Control BIBBs according to ASHRAE 135.
5. Hardware, software, software licenses, and configuration tools for operator-to-gateway communications.
6. Backup programming and parameters on digital media and the ability to modify, download, backup, and restore gateway configuration.

#### 2.18 SENSORS AND MISCELLANEOUS DEVICES:

- A. WEATHER STATION HOUSING: Provide Kele Model A21 Outdoor Aspirated Humidity/Temperature housing. NEMA 3R enclosure is painted white to reduce the effect of radiation, and the enclosure has a lockable latch for security. The outdoor air sensor will be installed on the north wall in the shade as not to be effected by sunlight, building ventilation or weather. This location shall be indicated on the control drawings. Installation in outside air ductwork or louvers is not acceptable. If not installed to provide "accurate" temperature readings, it shall be relocated (at the TCC's expense) until a suitable location is found.
- B. SENSOR RESOLUTION: All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. Outside air, water and duct sensors shall be tested and accurate to within 2.0 degrees F.
- C. SPACE SENSORS AND THERMOSTATS:
  1. Refer to the drawings for proper type and location.
  2. All thermostat and sensors shall be provided with temperature indication, unless otherwise noted.
  3. Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point for supervised areas.
  4. Unsupervised areas shall have non-adjustable set-point.
  5. Generally, thermostats/sensors shall be installed 5'-0" above the finished floor.
  6. Where thermostats/sensors are to be mounted next to a light switch, install at the same height as the light switch.
  7. Sensors in hallways, vestibules, stairways, restrooms and locker rooms shall utilize a stainless steel surface mount temperature sensor installed on an interior wall or partition (2"x4" blank plate). Care must be taken in the installation of these sensors to ensure proper insulation from the wall temperatures in order to properly sense space temperature.
  8. If there is a question consult engineer prior to rough-in.
- D. WATER SENSORS: Temperature sensors for water lines are to be the well type. Wells are to be threaded brass (same manufacturer as the temperature sensor) with the sensor coated with a heat transfer compound. Strap on sensors will not be acceptable.

- E. **MIXED AIR SENSORS:** These sensors shall be bendable averaging, type made of copper or aluminum elements. In unit ventilators, these sensors shall be at least five (5) feet in length and installed in the discharge air of the unit. For Air Handling Units, Outside Air Units, etc. the sensors shall be at least 20 feet in length.
- F. **DISCHARGE AIR AND DUCT ROOM RETURN AIR SENSORS:** Shall be rigid insertion type. In all applications, care shall be taken to ensure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.
- G. **FREEZE/LOW-LIMIT THERMOSTAT:** Provide a freeze/low-limit thermostat in each Air Handling Unit, Outside Air Unit, etc with a water coil for freeze protection. These devices shall be the manual reset type. This device shall be wired by using a normally closed contact in series with the motor starting circuit and a normally open set of contacts as an input to the unitary controller. The element shall be constructed of copper and be at least 20 feet in length. It shall be installed serpentine across the air entering the coil. In some cases it may require being installed after the coil. Each application should be closely evaluated before installation. The device shall sense the lowest temperature by any one foot section of its element.
- H. **HUMIDITY SENSORS:** These devices shall be 100% solid state, linear and temperature compensated with scaling 0-100% RH range with LED or LCD Display. Accuracy at 25°C from 10-80% RH\*  $\pm 2\%$ , operating Humidity Range 0 to 100% RH (non-condensing), Stability  $\pm 1\%$  @ 20°C (68°F) annually, for two years, Hysteresis 1.5% typical, Temperature Effect  $\pm 0.1\%$  RH/°C above or below 25°C (typical), 1% accuracy between 0% - 90% RH, Operating Temperature Range -40° to 50°C (-40° to 122°F)  $\pm 1\%$ .-Do not submit products that do not meet this range. The output of the device shall utilize an analog output 4-20 mA, 2-wire, polarity insensitive, (clipped and capped), The device shall use a power supply of 24 VAC or VDC. Duct mounted sensors shall have at least 4" insertion probe with a 16 gauge steel enclosure. NIST traceable certification shall be provided to the Engineer as part of the shop drawings. For wall mounted sensors the enclosure shall be polystyrene plastic mounted next to and at the same height as the temperature sensor in that area. Both shall have the same appearance. Provide protective cages in fitness and common areas.
- I. **COMBINATION TEMPERATURE/HUMIDITY SENSORS:** All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. The humidity sensing device shall be 100% solid state, linear and temperature compensated with a 0-100% RH range. The response time shall be a minimum of 30 seconds for a 60% change. They shall have a minimum of 2% accuracy minimum accuracy of  $\pm 2\%$  RH minimum rangeability 5 to 95% RH non-condensing and maximum hysteresis  $\pm 1.5\%$  RH.-Do not submit products that do not meet this range. The output of the device must utilize a 0-10 VDC or 4-20mA signal as required. The device must use a power supply of 24 VAC or VDC. Duct mounted sensors shall have at least 4" insertion probe with a 16 gauge steel enclosure. NIST traceable certification shall be provided to the Engineer as part of the shop drawings. For wall mounted sensors the enclosure shall be polystyrene plastic mounted next to and at the same height as the temperature sensor in that area. Both shall have the same appearance. Provide protective cages in fitness and common areas.
- J. **LOW PRESSURE TRANSDUCERS:** These devices shall be 100% solid state, linear and temperature compensated. Accuracy shall be no less than plus or minus 1% of its full range.



Linearity, repeatability and hysteresis shall be no less than plus or minus 0.1%. All pressure sensors shall utilize output averaging/output clipping to adjust and stabilize any fluctuations in the output. The output of the device shall utilize a 0 - 10 VDC signal. The device shall use a power supply of 24 VAC or VDC. The enclosure 16 gauge steel. For sensing internal static pressure of air handling ducts utilize sensors with a range of 0 to 5 inches water column. For sensing building static pressures (building compared to atmospheric) utilize a sensor with a range of -0.25 to +0.25 inches water column.

- K. RELAYS: Relays for starting and stopping fractional horsepower motors shall be rated as follows:
1. 1/4 horsepower motors or less use 15 ampere rated relays,
  2. 1/3 horsepower motors use 20 ampere rated relays,
  3. 1/2 horsepower motors use 30 ampere rated relays,
  4. Relays used for pilot duty service shall be rated at a minimum of 10 amperes.
  5. Provide auxiliary pilot duty relays on motor starters as required for control function.
  6. Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.
- L. CENTRAL STATION AIR HANDLERS: All Central Station Air Handlers, Outside Air Units, etc shall be provided with a D.A.P. (differential air pressure) switch across each the supply fan to provide fan status for each air handler.
- M. SMOKE SHUTDOWN: All AHUs, OA units, Heat Pump Units, etc with fans of greater than 2,000 CFM are required to have smoke shutdown safeties as required by the Building Code. These smoke detectors shall have a set of auxiliary contacts wired to a dedicated input of the Unitary to provide status of the smoke detector. All units must be provided with a current sensor to provide fan status for each air handler. For projects with Outside Air (OA) units, any system fire alarm activation shall shutdown all OA units. Coordinate with the Fire Alarm Contractor to ensure a complete, code compliant installation.
- N. CURRENT SENSING DEVICES: Veris Industries model Hx08 Series and H701 or equal. All current sensors shall be capable of alarming to the BAS for belt losses, pump coupling shear or other mechanical failure on loads.
- O. DIFFERENTIAL PRESSURE TRANSMITTERS: Provide Rosemount (ITT Bell & Gossett ST-102R) or Johnson Controls Setra DPT 2302-050-V field mounted differential pressure sensor transmitters as indicated on the plans. Range shall be 0-25 psig. Accuracy shall be .025% full span.
- P. CARBON DIOXIDE SENSORS: This sensor shall have a range of 0-2000 ppm +/-5% and +/- 50 ppm. Analog output of 0-10 or 2-10 VDC. Power shall be 24VAC. Calibration interval rated for 5 years. Sensor shall not be provided with a digital display. Honeywell Model C7232 or equal. A replacement CO2 sensor shall be installed annually for 5 years after substantial completion by the controls contractor. Provide with LED display.

## 2.19 VALVES

- A. Unless otherwise specified, valves shall be furnished and sized by the TCC. The valves are to provide the required capacity and the close off rating shall be in excess of the system pressures

encountered (minimum 40 psi differential). Proportioning-type valve bodies shall be packed type with throttling type inner valve (quick close plug shall not be acceptable). Proportional type valves to be rated at 125 psi static pressure. Two position control valves (open/close) shall be line size.

1. Fail positions unless otherwise indicated:
  - a. Chilled Water: Close
  - b. Heating Hot Water: Open
- B. Control valve shutoff classifications shall be FCI 70-2, Class IV or better unless otherwise indicated.
- C. Valve pattern, three-way or straight through, shall be as indicated on Drawings.
- D. Modulating straight-through pattern control valves shall have equal percentage flow-throttling characteristics unless otherwise indicated.
- E. Modulating three-way pattern water valves shall have linear flow-throttling characteristics. The total flow through the valve shall remain constant regardless of the valve's position.
- F. Modulating butterfly valves shall have linear flow-throttling characteristics.
- G. Globe-type control valves shall pass the design flow required with not more than 95 percent of stem lift unless otherwise indicated.
- H. Rotary-type control valves, such as ball and butterfly valves, shall have Cv falling between 65 and 75 degrees of valve full open position and minimum valve Cv between 15 and 25 percent of open position.
- I. Selection shall consider viscosity, flashing, and cavitation corrections.
- J. Valves shall have stable operation throughout full range of operation, from design to minimum Cv.
- K. Minimum Cv shall be calculated at 10 percent of design flow, with a coincident pressure differential equal to the system design pump head.
- L. In water systems, select modulating control valves at terminal equipment for a design Cv based on a pressure drop of 5 psig at design flow unless otherwise indicated.
- M. Modulating valve sizes for steam service shall provide a pressure drop at design flow equal to lesser of the following:
  1. 50 percent of the valve inlet pressure.
  2. 50 percent of the absolute steam pressure at the valve inlet.
- N. In water systems, use ball- or globe-style control valves for two-position control for valves NPS 2 and smaller and butterfly style for valves larger than NPS 2.
- O. "ALL" Actuators shall be of the same manufacturer and have internal feedback circuitry to provide a positive action to ensure proper positioning of the valve through the entire sequence.

Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 0-010V, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application. Analog actuation is 6-9 VDC, 0-010V, 2-10 VDC or 4-20 MA, floating point control with 2 digital outputs is NOT approved as analog actuation.

- P. Actuators may be factory installed. If not factory installed they shall be installed as per instructions by the terminal equipment manufacturer.
- Q. Locations mounted above ceiling shall be marked on ceiling grid.

## 2.20 DAMPERS

- A. Dampers for various units requiring field mounting shall be tight closing, "ultra-low leakage", opposed blade with side and edge seals. They shall be sized and furnished under this section. Installation of dampers shall be by the sheet metal contractor, coordinated by the TCC. Frames shall be no less than 16 gauge galvanized steel and furnished with mounting holes for duct mounting. Damper blades shall be no less than 14 gauge galvanized steel with maximum blade width of 8 inches. Blades shall be secured to 1/2 inch zinc plated axles and hardware with nylon bearings. Provide thrust bearings at the end of each blade. All dampers shall have end switches to positively prove damper position. No Exceptions!
- B. All damper actuators shall be fail safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They shall return to the normally open position upon a loss of power.
- C. "ALL" Actuators shall be of the same manufacturer and have internal feedback circuitry to provide a positive action to ensure proper positioning of the damper through the entire sequence. Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 0-010V, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application. Analog actuation is 6-9 VDC, 0-010V, 2-10 VDC or 4-20 MA, floating point control with 2 digital outputs is NOT approved as analog actuation.
- D. Actuators may be factory installed. If not factory installed they shall be installed as per instructions by the equipment manufacturer.
- E. Locations mounted above ceiling shall be marked on ceiling grid.
- F. Install damper motors on the outside of the duct in warm areas where possible, not in air stream or locations exposed to outdoor conditions.

## AIRFLOW MEASURING DEVICE (AMD)

### G. GENERAL REQUIREMENTS

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

- b. Ruskin
  - c. Greenheck
2. Provide one thermal airflow measuring device for each location indicated on plans, schedules and/or control diagrams. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
  3. Each AMD shall use the principle of thermal dispersion to determine the actual or mass airflow rate of the airstream. Differential pressure-based devices, including pitot tubes, pitot arrays, piezo-rings and devices measuring the pressure drop across a louver, damper or obstruction are not acceptable.
  4. Each AMD shall be provided with one or more sensor probes having one or more sensor nodes per probe.
  5. Each sensor node shall consist of two hermetically sealed bead-in-glass thermistors. The airflow of each sensor node shall be determined using one self-heated and ambient temperature sensing thermistor. Devices using indirectly heated thermistors to determine the airflow rate are not acceptable. Devices using chip thermistors of any type or packaging are not acceptable. Devices using platinum wire RTDs or similar "hot wire" devices are not acceptable.
  6. Thermistors shall be potted in an engineering thermoplastic assembly using water-proof, marine epoxy and shall not be damaged by moisture, direct contact with water or exposure to atmospheric acids. Provide a copy of an independent laboratory report to verify compliance with this requirement.
  7. All internal wiring in the probe tube shall be chemical and abrasion resistant Kynar® coated copper.
  8. All connections to internal wires in the probe tube shall be solder joints or welds. Connectors of any type in the probe tube are not acceptable.
  9. Each thermistor shall be independently calibrated to NIST traceable temperature standards to establish the resistance-temperature characteristics for the determination of airflow and temperature. Devices using interchangeable, curve-matched, thermistors are not acceptable.
  10. The airflow sensing thermistor of each sensor node shall be self-heated. Devices using indirectly heated thermistors are not acceptable.
  11. Each sensor node shall be independently processed by the transmitter prior to averaging and output.
  12. The specified sensor accuracy shall include the combined uncertainty of the sensor nodes and transmitter. Devices whose overall accuracy is based on individual accuracy specifications of the sensor probes and transmitter shall demonstrate compliance with the specified sensor accuracy over the entire operating range.
  13. Installed accuracy shall include the uncertainty of the AMD and the additional uncertainty that results from the placement of the AMD in the airstream. The specified installed accuracy is based on the AMD being installed in accordance with manufacturer's published placement and installation guidelines.
  14. Transmitters shall be microprocessor-based and operate automatically after brownouts and/or transient power interruptions.
  15. All printed circuit boards shall have gold plated interconnects, edge fingers, and test points.
  16. Remote transmitters shall have an LCD and four-button user interface.
  17. Remote transmitters shall be mounted in a location protected from moisture, rain and snow with an ambient temperature between -20 and 120 °F and a humidity range between 5 and 95% RH (non-condensing). Provide a weatherproof enclosure and mount away from direct sunlight when outdoor mounting is required.

18. Probes with remote transmitters shall be “plug and play”, not require matching to the transmitter, and be provided with a UL listed, FEP jacketed, plenum rated cable and connector plug. Devices using PVC jacketed cables to connect sensor probes to the transmitter are not acceptable.
19. All components of each AMD shall be RoHS2 compliant.
20. Each AMD shall be UL/cUL listed as a final assembly.
21. Each AMD shall be FCC-Part 15 compliant. Compliance shall be demonstrated by an independent test laboratory.
22. European shipments shall be CE marked. Compliance shall be demonstrated by an independent test laboratory.
23. Devices with a BACnet network connection shall be BTL tested and listed.

H. DUCT AND PLENUM AMD WITH TEMPERATURE AND HUMIDITY MEASUREMENT AND REMOTE TRANSMITTER

1. Each AMD shall be suitable for installation in ducts and plenums; including air handling equipment cabinets and outdoor air intakes to determine the airflow rate, velocity weighted temperature and humidity of the airstream. Enthalpy and dewpoint shall be calculated using the velocity weighted temperature, humidity and on-board pressure sensor.
2. Provide one to four gold anodized 6063 aluminum probes and one remote transmitter. Probes shall have integral 304 stainless steel mounting brackets for insertion, internal or standoff mounting. Probe connector plug and receptacle pins shall be gold plated.
3. Each sensor node shall be individually wind-tunnel calibrated at 16 points to NIST traceable airflow standards and have an accuracy of  $\pm 2\%$  of reading over the entire operating range. Provide a copy of the NIST calibration report for the reference standard used to calibrate the production tunnels used to calibrate individual sensor nodes. Reference standards calibrated to third-party NIST traceable labs are not acceptable. Devices claiming AMCA certification are not acceptable.
4. Provide up to 16 sensing nodes per measurement location as required for the opening size and published sensor density tables to achieve an installed airflow accuracy of  $\pm 3\%$  of reading ( $\pm 5\%$  of reading on close coupled outdoor air intakes) between 0 and 5,000 fpm over a temperature range of -20 to 160 °F and a humidity range between 0 and 100% RH (non-condensing). Provide the velocity weighted temperature of the airstream with an accuracy of  $\pm 0.15$  °F.
5. This product may be used to for temperature measurement when the required measurement location for temperature is satisfied by the measurement location of the AMD.
6. Provide humidity measurement of the airstream with the following accuracy at 77 °F:
  - a.  $\pm 2\%$  of reading between 20 and 80% RH.
  - b. Better than  $\pm 4\%$  of reading at all other % RH at 77 °F.
7. The humidity sensor shall have a temperature coefficient of 0.07% RH/ °F and the annual drift shall not exceed 0.5% RH/year.
8. This product may be used for humidity, enthalpy or dewpoint when the required measurement location for humidity, enthalpy or dewpoint can be satisfied by the measurement location of the AMD.
9. Provide low and high airflow alarms with a user defined setpoint and tolerance. The airflow rate, temperature, humidity, enthalpy or dewpoint, airflow alarm and system status alarm shall be visible on the transmitters display.
10. Transmitters with analog output signals shall provide:
  - a. One linear output signal for airflow.

- b. One linear output signal for velocity weighted temperature or one binary signal for the airflow alarm or system status alarm.
- 11. Transmitters with network capability shall provide the airflow, velocity weighted temperature, humidity, enthalpy, dewpoint, airflow alarm status, individual sensor node airflow and temperature data and device fault status.

#### 2.21 DC POWER SUPPLY

- 1. Plug-in style suitable for mating with a standard eight-pin octal socket. Include the power supply with a mating mounting socket.
- 2. Enclose circuitry in a housing.
- 3. Include both line and load regulation to ensure a stable output. To protect both the power supply and the load, power supply shall have an automatic current limiting circuit.
- 4. Performance:
  - a. Output voltage nominally 25-V dc within 5 percent.
  - b. Output current up to 100 mA.
  - c. Input voltage nominally 120-V ac, 60 Hz.
  - d. Load regulation within 0.5 percent from zero- to 100-mA load.
  - e. Line regulation within 0.5 percent at a 100-mA load for a 10 percent line change.
  - f. Stability within 0.1 percent of rated volts for 24 hours after a 20-minute warmup.

#### 2.22 UNINTERRUPTABLE POWER SUPPLY (UPS) UNITS FOR WORKSTATIONS

- A. UPS units shall provide continuous, regulated output power without using their batteries during brown-out, surge, and spike conditions.
- B. Load served shall not exceed 75 percent of UPS rated capacity, including power factor of connected loads.
  - 1. Larger-capacity units shall be provided for systems with larger connected loads.
  - 2. UPS shall provide 20 minutes of battery power.
- C. Performance:
  - 1. Input Voltage: Single phase, 120- or 230-V ac, compatible with field power source.
  - 2. Load Power Factor Range (Crest Factor): 0.65 to 1.0.
  - 3. Output Voltage: 101- to 132-V ac, while input voltage varies between 89 and 152-V ac.
  - 4. On Battery Output Voltage: Sine wave.
  - 5. Inverter overload capacity shall be minimum 150 percent for 30 seconds.
  - 6. Recharge time shall be a maximum of six hours to 90 percent capacity after full discharge to cutoff.
  - 7. Transfer Time: 6 ms.
  - 8. Surge Voltage Withstand Capacity: IEEE C62.41, Categories A and B; 6 kV/200 and 500 A; 100-kHz ringwave.
- D. UPS shall be automatic during fault or overload conditions.
- E. Unit with integral line-interactive, power condition topology to eliminate all power contaminants.

- F. Include front panel with power switch and visual indication of power, battery, fault and temperature.
- G. Unit shall include an audible alarm of faults and front panel silence feature.
- H. Unit with four NEMA WD 1, NEMA WD 6 Configuration 5-15R receptacles.
- I. UPS shall include dry contacts (digital output points) for low battery condition and battery-on (primary utility power failure) and connect the points to the DDC system.
- J. Batteries shall be sealed lead-acid type and be maintenance free. Battery replacement shall be front accessible by user without dropping load.
- K. Include tower models installed in ventilated cabinets to the particular installation location.

## 2.23 ACCESSORIES

### A. Pressure Electric Switches:

- 1. Diaphragm-operated snap acting switch.
- 2. Set point adjustable from 3 to 20 psig.
- 3. Differential adjustable from 2 to 6 psig.
- 4. Rated for resistance loads at 120-V ac.
- 5. Body and switch housing shall be metal.

### B. Damper Blade Limit Switches:

- 1. Sense positive open and/or closed position of the damper blades.
- 2. NEMA 250, Type 13, oil-tight construction.
- 3. Arrange for the mounting application.
- 4. Additional waterproof enclosure when required by its environment.
- 5. Arrange to prevent "over-center" operation.

### C. Instrument Enclosures:

- 1. Include instrument enclosure for secondary protection to comply with requirements indicated in "Performance Requirements" Article.
- 2. NRTL listed and labeled to UL 50.
- 3. Sized to include at least 25 percent spare area on subpanel.
- 4. Instrument(s) mounted within enclosure on internal subpanel(s).
- 5. Enclosure face with engraved, laminated phenolic nameplate for each instrument within enclosure.
- 6. Enclosures housing pneumatic instruments shall include main pressure gauge and a branch pressure gauge for each pneumatic device, installed inside.
- 7. Enclosures housing multiple instruments shall route tubing and wiring within enclosure in a raceway having a continuous removable cover.
- 8. Enclosures larger than 12 inches shall have a hinged full-size face cover.
- 9. Equip enclosure with lock and common key.

### D. Manual Valves:

1. Ball Type:
  - a. Body: Bronze ASTM B62 or ASTM B61.
  - b. Ball: Type 316 stainless steel.
  - c. Stem: Type 316 stainless steel.
  - d. Seats: Reinforced PTFE.
  - e. Packing Ring: Reinforced PTFE.
  - f. Lever: Stainless steel with a vinyl grip.
  - g. 600 WOG.
  - h. Threaded end connections.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  1. Verify compatibility with and suitability of substrates.
- B. Examine roughing-in for products to verify actual locations of connections before installation.
  1. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
  2. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where product will be installed.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 CONTROL DEVICES FOR INSTALLATION BY INSTALLERS

- A. Deliver selected control devices, specified in indicated HVAC instrumentation and control device Sections, to identified equipment and systems manufacturers for factory installation and to identified installers for field installation.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install products to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.



- C. Support products, tubing, piping wiring and raceways. Brace products to prevent lateral movement and sway.
- D. If codes and referenced standards are more stringent than requirements indicated, comply with requirements in codes and referenced standards.
- E. Fabricate openings and install sleeves in ceilings, floors, roof, and walls required by installation of products. Before proceeding with drilling, punching, and cutting, check for concealed work to avoid damage. Patch, flash, grout, seal, and refinish openings to match adjacent condition.
- F. Firestop Penetrations Made in Fire-Rated Assemblies: Comply with requirements in Section 078413 "Penetration Firestopping."
- G. Seal penetrations made in acoustically rated assemblies. Comply with requirements in Section 079200 "Joint Sealants."
- H. Welding Requirements:
  - 1. Restrict welding and burning to supports and bracing.
  - 2. No equipment shall be cut or welded without approval. Welding or cutting will not be approved if there is risk of damage to adjacent Work.
  - 3. Welding, where approved, shall be by inert-gas electric arc process and shall be performed by qualified welders according to applicable welding codes.
  - 4. If requested on-site, show satisfactory evidence of welder certificates indicating ability to perform welding work intended.
- I. Fastening Hardware:
  - 1. Stillson wrenches, pliers, and other tools that damage surfaces of rods, nuts, and other parts are prohibited for work of assembling and tightening fasteners.
  - 2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
  - 3. Lubricate threads of bolts, nuts and screws with graphite and oil before assembly.
- J. If product locations are not indicated, install products in locations that are accessible and that will permit service and maintenance from floor, equipment platforms, or catwalks without removal of permanently installed furniture and equipment.

### 3.4 DDC SYSTEM I/O CHECKOUT PROCEDURES

- A. Check installed products before continuity tests, leak tests and calibration.
- B. Check instruments for proper location and accessibility.
- C. Check instruments for proper installation on direction of flow, elevation, orientation, insertion depth, or other applicable considerations that will impact performance.
- D. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material and support.

E. Control Damper Checkout:

1. For pneumatic dampers, verify that pressure gauges are provided in each air line to damper actuator and positioner.
2. Verify that control dampers are installed correctly for flow direction.
3. Verify that proper blade alignment, either parallel or opposed, has been provided.
4. Verify that damper frame attachment is properly secured and sealed.
5. Verify that damper actuator and linkage attachment is secure.
6. Verify that actuator wiring is complete, enclosed and connected to correct power source.
7. Verify that damper blade travel is unobstructed.

F. Control Valve Checkout:

1. For pneumatic valves, verify that pressure gauges are provided in each air line to valve actuator and positioner.
2. Verify that control valves are installed correctly for flow direction.
3. Verify that valve body attachment is properly secured and sealed.
4. Verify that valve actuator and linkage attachment is secure.
5. Verify that actuator wiring is complete, enclosed and connected to correct power source.
6. Verify that valve ball, disc or plug travel is unobstructed.
7. After piping systems have been tested and put into service, but before insulating and balancing, inspect each valve for leaks. Adjust or replace packing to stop leaks. Replace the valve if leaks persist.

G. Instrument Checkout:

1. Verify that instrument is correctly installed for location, orientation, direction and operating clearances.
2. Verify that attachment is properly secured and sealed.
3. Verify that conduit connections are properly secured and sealed.
4. Verify that wiring is properly labeled with unique identification, correct type and size and is securely attached to proper terminals.
5. Inspect instrument tag against approved submittal.
6. For instruments with tubing connections, verify that tubing attachment is secure and isolation valves have been provided.
7. For flow instruments, verify that recommended upstream and downstream distances have been maintained.
8. For temperature instruments:
  - a. Verify sensing element type and proper material.
  - b. Verify length and insertion.

3.5 DDC SYSTEM I/O ADJUSTMENT, CALIBRATION AND TESTING:

- A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.
- B. Provide a written description of proposed field procedures and equipment for calibrating each type of instrument. Submit procedures before calibration and adjustment.

- C. For each analog instrument, make a three-point test of calibration for both linearity and accuracy.
- D. Equipment and procedures used for calibration shall comply with instrument manufacturer's written instructions.
- E. Provide diagnostic and test equipment for calibration and adjustment.
- F. Field instruments and equipment used to test and calibrate installed instruments shall have accuracy at least twice the instrument accuracy being calibrated. An installed instrument with an accuracy of 1 percent shall be checked by an instrument with an accuracy of 0.5 percent.
- G. Calibrate each instrument according to instrument instruction manual supplied by manufacturer.
- H. If after calibration indicated performance cannot be achieved, replace out-of-tolerance instruments.
- I. Comply with field testing requirements and procedures indicated by ASHRAE's Guideline 11, "Field Testing of HVAC Control Components," in the absence of specific requirements, and to supplement requirements indicated.
- J. Analog Signals:
  - 1. Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
  - 2. Check analog current signals using a precision current meter at zero, 50, and 100 percent.
  - 3. Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
- K. Digital Signals:
  - 1. Check digital signals using a jumper wire.
  - 2. Check digital signals using an ohmmeter to test for contact making or breaking.
- L. Control Dampers:
  - 1. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.
  - 2. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed and 100 percent open at proper air pressure.
  - 3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
  - 4. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
- M. Control Valves:
  - 1. Stroke and adjust control valves following manufacturer's recommended procedure, from 100 percent open to 100 percent closed and back to 100 percent open.

2. Stroke control valves with pilot positioners. Adjust valve and positioner following manufacturer's recommended procedure, so valve is 100 percent closed, 50 percent closed and 100 percent open at proper air pressures.
  3. Check and document open and close cycle times for applications with a cycle time less than 30 seconds.
  4. For control valves equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.
- N. Meters: Check sensors at zero, 50, and 100 percent of Project design values.
- O. Sensors: Check sensors at zero, 50, and 100 percent of Project design values.
- P. Switches: Calibrate switches to make or break contact at set points indicated.
- Q. Transmitters:
1. Check and calibrate transmitters at zero, 50, and 100 percent of Project design values.
  2. Calibrate resistance temperature transmitters at zero, 50, and 100 percent of span using a precision-resistant source.

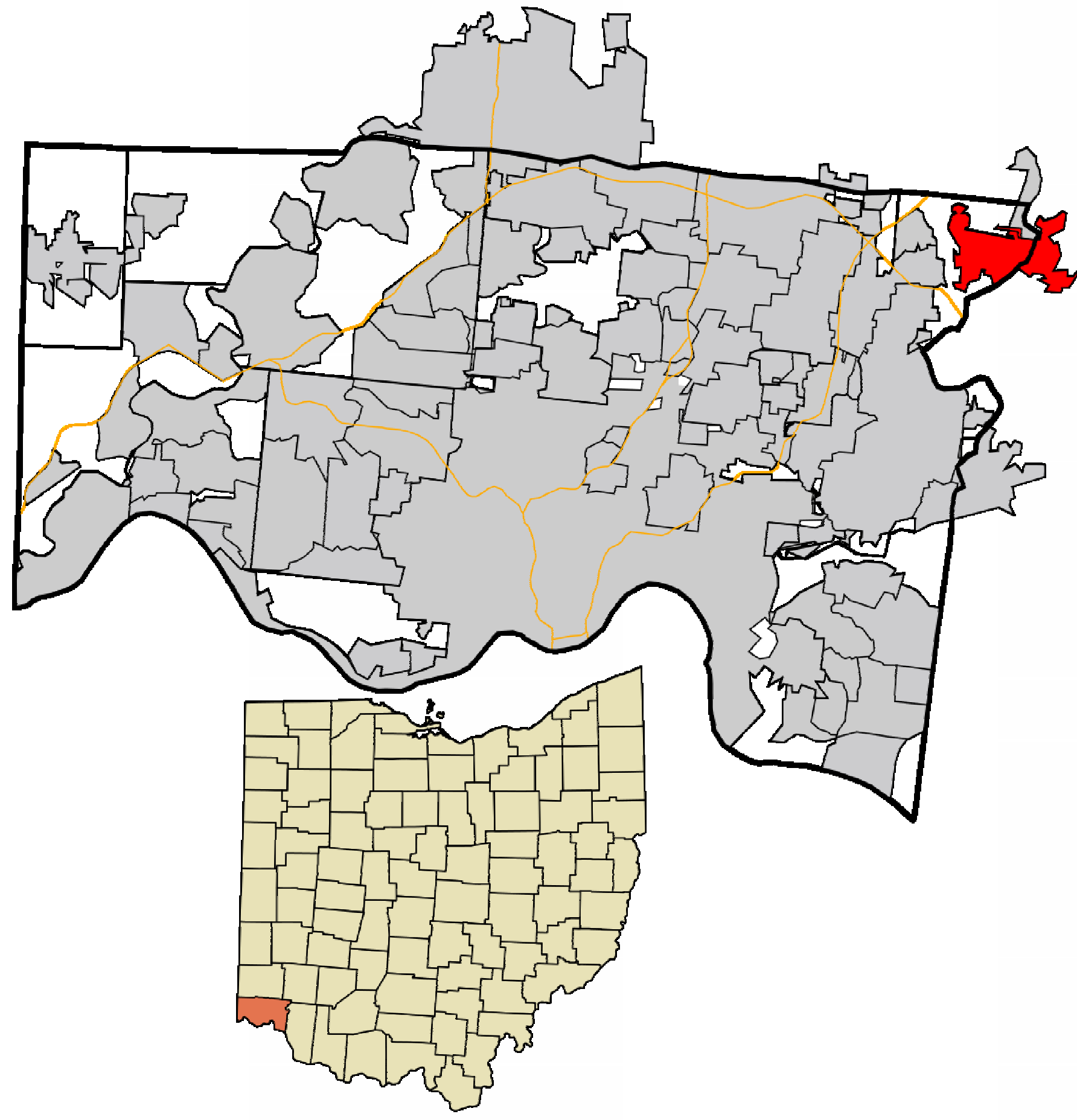
### 3.6 DDC SYSTEM CONTROLLER CHECKOUT

- A. Verify power supply.
1. Verify voltage, phase and hertz.
  2. Verify that protection from power surges is installed and functioning.
  3. Verify that ground fault protection is installed.
  4. If applicable, verify if connected to UPS unit.
  5. If applicable, verify if connected to a backup power source.
  6. If applicable, verify that power conditioning units, transient voltage suppression and high-frequency noise filter units are installed.
- B. Verify that wire and cabling is properly secured to terminals and labeled with unique identification.
- C. Verify that spare I/O capacity is provided.

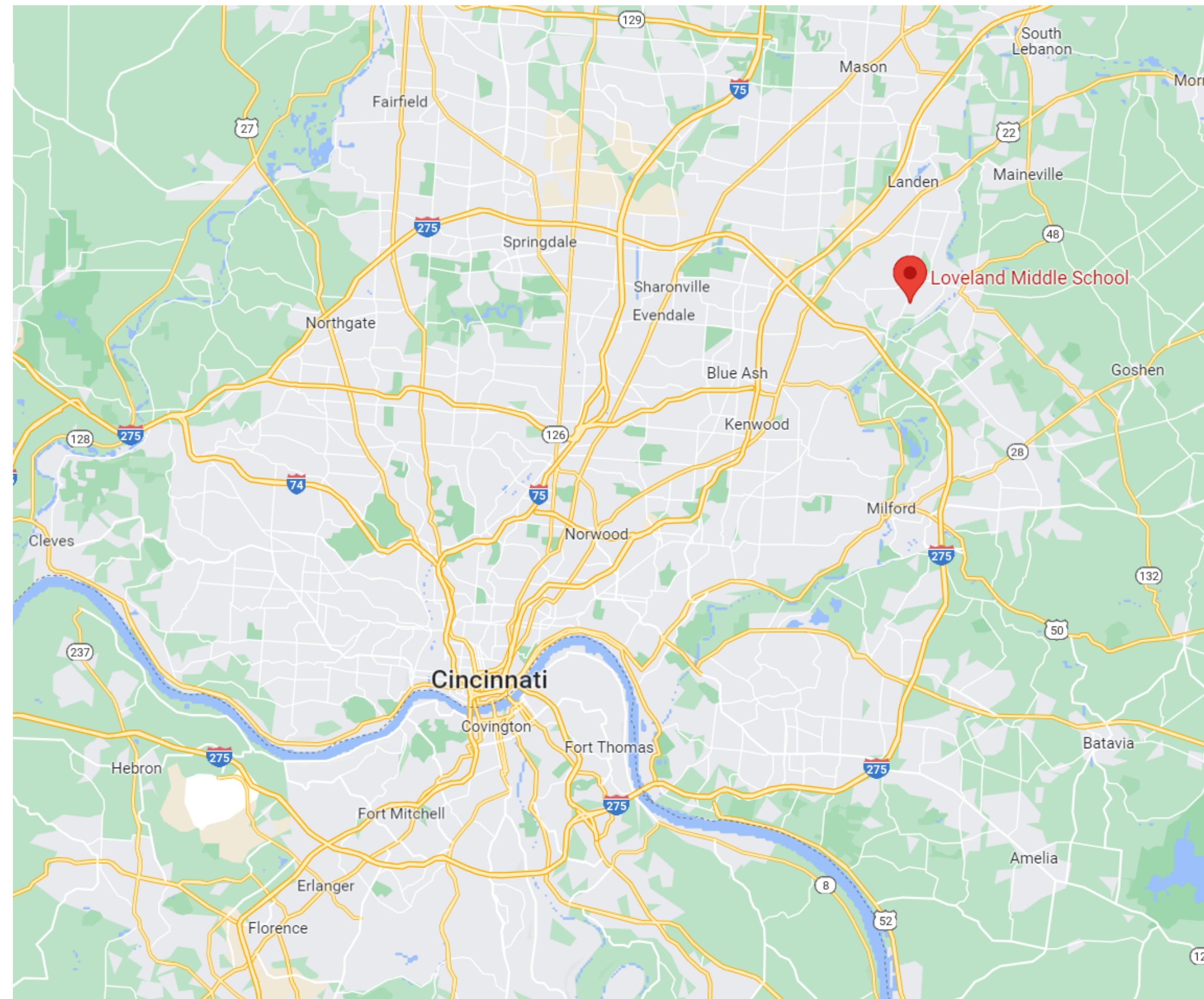
END OF SECTION 230923

PROJECT LOCATION

VICINITY MAP: STATE



VICINITY MAP: CITY



GENERAL INFORMATION

GOVERNING REGULATIONS

- OHIO BUILDING CODE .....2015
- INTERNATIONAL MECHANICAL CODE.....2015
- INTERNATIONAL ENERGY CONSERVATION CODE.....2012
- NATIONAL ELECTRICAL CODE (NEC)NFPA 70 .....2017

PROJECT DESCRIPTION

THIS PROJECT CONSISTS OF THE UPGRADE OF THE EXISTING HVAC CONTROLS, AND THE EXISTING FIRE ALARM SYSTEM THROUGHOUT THE ENTIRE SCHOOL. THE PROJECT ALSO INCLUDES THE ADDITION OF INDOOR AIR QUALITY IMPROVEMENTS THROUGHOUT THAT WILL INCREASE INDOOR AIR QUALITY IN THE CLASSROOMS AND REDUCE AND MONITOR OVERALL VOCs THROUGHOUT THE BUILDING.



**Loveland**  
CITY SCHOOL DISTRICT

**LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE**

LOVELAND CITY SCHOOL DISTRICT  
801 S Lebanon Rd, Loveland, OH 45140

BID DOCUMENTS  
02/23/2024

LOVELAND PROJECT MANAGER : JOHN AMES  
CMTA Project Manager: OWEN GREEN  
(OGREEN@CMTA.COM)



BUILDING SCIENCE LEADERSHIP



BID DOCUMENTS

LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE

LOVELAND CITY SCHOOL DISTRICT

801 S Lebanon Rd, Loveland, OH 45140

COVER SHEET

CLIENT/CMTA JOB #:	OLMS23
DATE:	02/23/2024
DRAWN:	OTG
CHECKED:	TLA

REVISIONS


M000



**GENERAL NOTES - MECHANICAL**

- 1. THE CONTRACTOR'S ATTENTION IS DIRECTED TO THE GENERAL AND SPECIAL CONDITIONS, "GENERAL CONDITIONS - MECHANICAL" OF THE PROJECT SPECIFICATIONS AND TO ALL OTHER CONTRACT DOCUMENTS AS THEY APPLY TO THIS BRANCH OF WORK. ATTENTION IS ALSO DIRECTED TO ALL OTHER SECTIONS OF THE CONTRACT DOCUMENTS WHICH AFFECTS THE WORK AND WHICH ARE HEREBY MADE A PART OF THE WORK SPECIFIED.
- 2. ALL MANUFACTURERS, SUPPLIERS, FABRICATORS, CONTRACTORS, ETC. SUBMITTING PROPOSALS FOR ANY PART OF THE WORK, SERVICES, MATERIALS OR EQUIPMENT TO BE USED ON OR APPLIED TO THIS PROJECT ARE HEREBY DIRECTED TO FAMILIARIZE THEMSELVES WITH THE CONTRACT DOCUMENTS. IN CASE OF CONFLICTS, THE CONTRACTOR SHALL CONTACT THE ENGINEER FOR CLARIFICATION AND FINAL DETERMINATION PRIOR TO THE BID.
- 3. THE WORK SHALL CONSIST OF FURNISHING ALL LABOR, EQUIPMENT, TRANSPORTATION, SUPPLIES, MATERIALS, APPURTENANCES AND SERVICES NECESSARY FOR THE SATISFACTORY INSTALLATION OF THE COMPLETE AND OPERATING SYSTEMS INDICATED OR SPECIFIED IN THE CONTRACT DOCUMENTS.
- 4. ANY MATERIALS, LABOR, EQUIPMENT OR SERVICES NOT MENTIONED SPECIFICALLY HEREIN WHICH MAY BE NECESSARY TO COMPLETE ANY PART OF THE SYSTEMS IN A SUBSTANTIAL MANNER, IN COMPLIANCE WITH THE REQUIREMENTS STATED, IMPLIED OR INTENDED IN THE PLANS AND SPECIFICATIONS, SHALL BE INCLUDED IN THE BID AS PART OF THE CONTRACT. THE ENGINEER DOES NOT DEFINE THE SCOPE OF INDIVIDUAL TRADES, SUBCONTRACTORS MATERIAL SUPPLIERS AND VENDORS. ANY SHEET NUMBERING OR SPECIFICATION NUMBERING SYSTEM USED WHICH IDENTIFIES DISCIPLINES IS SOLELY FOR THE ENGINEER'S CONVENIENCE AND IS NOT INTENDED TO DEFINE A SUBCONTRACTOR'S SCOPE OF WORK. INFORMATION REGARDING INDIVIDUAL TRADES, SUBCONTRACTORS, MATERIAL SUPPLIERS AND VENDORS MAY BE DETAILED, DESCRIBED AND INDICATED AT DIFFERENT LOCATIONS THROUGHOUT THE CONTRACT DOCUMENTS. NO CONSIDERATION WILL BE GIVEN TO REQUESTS FOR CHANGE ORDERS FOR FAILURE TO OBTAIN AND REVIEW THE COMPLETE SET OF CONTRACT DOCUMENTS WHEN PREPARING BIDS, PRICES AND QUOTATIONS. UNLESS STATED OTHERWISE, THE SUBDIVISION AND ASSIGNMENT OF WORK UNDER THE VARIOUS SECTIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR HOLDING THE PRIME CONTRACT.
- 6. IT IS THE INTENTION OF THE CONTRACT DOCUMENTS TO CALL FOR A COMPLETE AND OPERATIONAL SYSTEM, INCLUDING ALL COMPONENTS, ACCESSORIES, FINISH WORK, ETC NECESSARY FOR TROUBLE FREE OPERATION; TESTED AND READY FOR OPERATION. ANYTHING THAT MAY BE REQUIRED, IMPLIED, OR INFERRED BY THE CONTRACT DOCUMENTS SHALL BE PROVIDED AND INCLUDED AS PART OF THE BID.
- 7. ALL CONTRACTORS AND VENDORS PROVIDING A BID FOR THIS PROJECT SHALL REVIEW THE PLANS AND SPECIFICATIONS AND DETERMINE ANY MODIFICATIONS AND/OR ADJUSTMENTS NECESSARY RELATIVE TO THE PROPOSED EQUIPMENT AND MATERIALS WITH SPECIFIC MANUFACTURER'S INSTALLATION REQUIREMENTS. INCLUDE IN THE BID ANY NECESSARY METHODS, FEATURES, OPTIONS, ACCESSORIES, ETC. NECESSARY TO INSTALL THE PROPOSED EQUIPMENT AND MATERIALS, REGARDLESS OF WHETHER USED AS BASIS OF DESIGN OR BEING OFFERED AS A SUBSTITUTION, IN ACCORDANCE WITH THE SPECIFIC MANUFACTURER'S INSTALLATION REQUIREMENTS, WHETHER SPECIFICALLY DETAILED OR NOT, WITHIN THE PLANS AND SPECIFICATIONS.
- 8. THE BIDDER/PROPOSER SHALL COMPLETELY REVIEW THE CONTRACT DOCUMENTS. ANY INTERPRETATION AS TO DESIGN INTENT OR SCOPE SHALL BE PROVIDED BY THE ENGINEER. SHOULD ANY INTERPRETATION BE REQUIRED, THE BIDDER/PROPOSER SHALL REQUEST A CLARIFICATION NOT LESS THAN TEN (10) DAYS PRIOR TO THE SUBMISSION OF THE BID SO THAT THE CONDITION MAY BE CLARIFIED BY ADDENDUM. IN THE EVENT OF ANY CONFLICT, DISCREPANCY, OR INCONSISTENCY DEVELOPS, THE INTERPRETATION OF THE ENGINEER SHALL BE FINAL.
- 9. THE CONTRACTOR SHALL PROVIDE LAYOUT CONFIRMATION OF EQUIPMENT LOCATIONS TO VERIFY THAT ALL COMPONENTS WILL FIT IN THE PROPOSED SPACE AND HAVE ADEQUATE CLEARANCE FOR SERVICES. COORDINATE THE LOCATION OF DRAINS, CONNECTIONS, ETC. PRIOR TO COMMENCING INSTALLATION. WORK NOT SO COORDINATED SHALL BE REMOVED AND PROPERLY INSTALLED AT THE EXPENSE OF THE RESPONSIBLE CONTRACTOR(S).
- 10. EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS SHALL COMPLY WITH "GENERAL PROVISIONS - MECHANICAL PART 6." ANY VENDOR REQUESTING TO OBTAIN AN EQUIPMENT SUBSTITUTION SHALL REQUEST A CLARIFICATION NOT LESS THAN TEN (10) DAYS PRIOR TO THE SUBMISSION OF THE PROPOSAL, SO THAT IT MAY BE CONSIDERED AND POTENTIALLY INCLUDED BY ADDENDUM. REQUESTS MADE AFTER THIS PERIOD WILL BE REJECTED.
- 11. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLIANCE REGARDLESS IF CONTRACTOR IS IGNORANT OF CODES, RULES, REGULATIONS, LAWS, ETC. THE CONTRACTOR SHALL ALSO BE VERSED IN ALL CODES, RULES, REGULATIONS, LAWS, ETC. PERTINENT TO THEIR PART OF THE WORK PRIOR TO SUBMISSION OF THE PROPOSAL.
- 12. ALL WARRANTIES SHALL BEGIN STARTING AT THE PROJECT'S SUBSTANTIAL COMPLETION DATE. ALL EQUIPMENT, MATERIAL AND LABOR WARRANTIES SHALL BE FURNISHED BY THE EQUIPMENT SUPPLIER/VENDOR.
- 13. WHEREVER WORK PENETRATES ROOFING, IT SHALL BE DONE IN A MANNER THAT WILL NOT DIMINISH OR VOID THE ROOFING GUARANTEE OR WARRANTY IN ANY WAY. COORDINATE ALL SUCH WORK WITH THE ROOFING INSTALLER.
- 14. DUCTWORK, PIPING AND EQUIPMENT SHALL BE KEPT CLEAN AT ALL TIMES. DUCTWORK STORED ON THE JOB SITE SHALL BE PLACED A MINIMUM OF 4" ABOVE THE FLOOR AND BE COMPLETELY COVERED IN PLASTIC. INSTALLED DUCTWORK SHALL BE PROTECTED WITH PLASTIC. DO NOT INSTALL THE DUCTWORK OR INSULATION (PIPE OR DUCT) IF THE BUILDING IS NOT "DRIED-IN". IF THIS IS REQUIRED, THE ENTIRE LENGTHS SHALL BE COVERED IN PLASTIC TO PROTECT. THE OWNER/ENGINEER SHALL PERIODICALLY INSPECT THAT THESE PROCEDURES ARE FOLLOWED. IF DEEMED UNACCEPTABLE, THE CONTRACTOR SHALL BE REQUIRED TO CLEAN THE DUCT SYSTEM UTILIZING A NAZCA CERTIFIED CONTRACTOR.
- 15. THE PERMANENT SYSTEMS, WHEN INSTALLED, MAY BE USED FOR TEMPORARY SERVICES WITH THE CONSENT OF THE ENGINEER AND IN STRICT ACCORDANCE WITH "GENERAL PROVISIONS - MECHANICAL - TEMPORARY USE OF EQUIPMENT."
- 16. THE CONTRACTOR AND THEIR SUBCONTRACTORS SHALL INCLUDE IN THE BID TO PROVIDE EQUIPMENT AND CONTROLS STARTUP AND VERIFICATION FOR ALL MECHANICAL SYSTEMS SPECIFIED FOR THIS PROJECT AND IN STRICT ACCORDANCE WITH "GENERAL PROVISIONS - MECHANICAL - EQUIPMENT/CONTROLS STARTUP & VERIFICATION."
- 17. THE CONTRACTOR SHALL DETERMINE FROM THE CONTRACT DOCUMENTS, THE DATE OF COMPLETION FOR THE PROJECT AND INSURE THAT EQUIPMENT DELIVERY SCHEDULES CAN BE MET SO AS TO ALLOW THIS COMPLETION TO BE MET.
- 18. THROUGH COORDINATION WITH OTHER CONTRACTORS, VENDORS, AND SUPPLIERS ASSOCIATED WITH THIS PROJECT, THIS CONTRACTOR SHALL INSURE, 100% FUNCTIONAL, TESTED, INSPECTED AND APPROVED SYSTEMS. CLAIMS FOR ADDITIONAL COST OR CHANGE ORDERS WILL BE REJECTED.
- 19. PRIOR TO ORDERING ANY MATERIALS OR ROUGH-IN OF ANY KIND, THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL COORDINATION OF ALL ELECTRICAL REQUIREMENTS (I.E. VOLTAGE, PHASE, CIRCUIT BREAKER, WIRE SIZES, ETC.) WITH THE ELECTRICAL CONTRACTOR. THERE WILL BE NO CHANGE IN THE CONTRACT AMOUNT FOR ANY DISCREPANCIES.
- 20. ALL OFFSETS, TURNS, FITTINGS, TRIM, DETAIL, ETC., MAY NOT BE INDICATED, BUT SHALL BE PROVIDED AS REQUIRED. ADDITIONAL ALLOWANCES SHALL BE INCLUDED FOR SAME AT EACH PROPOSER'S DISCRETION.
- 21. DO NOT SCALE FROM DRAWINGS, PRINTING DISTORTS SCALE. WORK SHALL BE LAID OUT FROM CONTRACTOR GENERATED DIMENSIONED DRAWINGS.
- 22. THE CONTRACTOR SHALL ENSURE PROPER COORDINATION BETWEEN ALL TRADES SUCH THAT CONDUITS, PIPING, DUCTWORK, ETC. DOES NOT BLOCK ACCESS TO VALVES, EQUIPMENT, DUCT ACCESS DOORS, ETC. ITEMS THAT HAVE BEEN INSTALLED WHERE ACCESS IS COMPROMISED SHALL BE RELOCATED AT THE CONTRACTOR'S EXPENSE.
- 23. THESE DRAWINGS ARE ACCURATE TO THE BEST OF OUR KNOWLEDGE, HOWEVER LOCATIONS AND SIZES WERE TAKEN FROM DIFFERENT SOURCES AND ARE SUBJECT TO DEVIATION. THE CONTRACTOR SHALL ASSUME SOME DEVIATIONS AND INCLUDE OFFSETS, ADDITIONAL PIPING, ETC. AT THE TIME OF BID.
- 24. THIS CONTRACTOR SHALL BE RESPONSIBLE FOR ALL CUTTING AND PATCHING REQUIRED FOR THEIR WORK. ALL CUTTING AND PATCHING SHALL MATCH ADJACENT SURFACES AND PERFORMED BY SKILLED WORKERS OF THE TRADE. REFER TO SPECIFICATION SECTION "SLEEVING, CUTTING, PATCHING, REPAIRING, ETC." AND ARCHITECTURAL DRAWINGS FOR ADDITIONAL INFORMATION.
- 25. ALL SUPPORTS FOR EQUIPMENT, DEVICES OR FIXTURES SHALL BE UNIQUE, FROM THE BUILDING STRUCTURE. DO NOT SUPPORT WORK FROM OTHER TRADES, EQUIPMENT OR SUPPORTS WITHOUT WRITTEN PERMISSION FROM THE ENGINEER AND CONSENT OF THE OTHER TRADE, IN WRITING.
- 26. PRIOR TO PURCHASE OR FABRICATION OF PIPING, THE CONTRACTOR SHALL COORDINATE INSTALLATION WITH ACTUAL CONDITIONS AND INSTALL ACCORDINGLY.
- 27. VALVES, BALANCING DAMPERS OR ANY MECHANICAL/ELECTRICAL ITEM SHALL NOT BE LOCATED ABOVE A HARD CEILING. IF THIS IS NOT POSSIBLE, THEN AN APPROPRIATELY SIZED ACCESS DOOR SHALL BE PLACED AT NO ADDITIONAL COST UNDER THE ITEM WHETHER SHOWN OR NOT ON THE PLANS TO ALLOW ACCESS AND ADJUSTMENT.
- 28. THE CONTRACTOR SHALL VISIT THE SITE FOR EXACT LOCATIONS OF ALL WALL AND CEILING DEVICES. THIS SHALL INCLUDE PLUMBING FIXTURES, CEILING GRILLES AND DIFFUSERS, ETC. CONTRACTOR SHALL CLEAN UP CONSTRUCTION DEBRIS AT ALL TIMES DURING CONSTRUCTION.

**GENERAL NOTES - DEMOLITION**

- A. THE CONTRACTOR SHALL REFER TO THE ARCHITECTURAL PLANS FOR AREAS IN WHICH THE CEILING IS REMAINING. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING THE EXISTING CEILING AS REQUIRED AND REINSTALLATION. TEMPORARILY SUPPORT LIGHTS, DIFFUSERS, CEILING ETC. REPLACE BROKEN CEILING TILES WITH NEW AT NO ADDITIONAL COST TO OWNER. FIELD VERIFY EXACT REQUIREMENTS.
- B. ALL OUTAGES SHALL BE SCHEDULED THROUGH THE PROJECT REPRESENTATIVE FOR PROPER COORDINATION. A REQUEST FOR AN OUTAGE SHALL BE SUBMITTED IN WRITING A MINIMUM OF TWO WEEKS IN ADVANCE.
- C. DURING SPRINKLER SYSTEM OUTAGES THE CONTRACTORS SHALL PROVIDE FIRE WATCH OF AREAS WITH OUTAGES.
- D. ALL WALLS AND FLOOR SLABS SHALL BE REPAIRED TO MATCH EXISTING AND TO A LIKE NEW CONDITION. ALL RATED WALLS AND FLOOR SLABS SHALL BE PATCHED AND REPAIRED TO MAINTAIN RATING.
- E. ALL EXISTING BUILDING FINISHES SHALL BE PROTECTED DURING THE DEMOLITION PHASE.
- F. HEAVY DASHED LINES INDICATE ITEMS FOR REMOVAL (U.O.N) AND LIGHT SOLID LINES INDICATE EXISTING ITEMS TO REMAIN.
- G. COORDINATE DISPOSAL OF ALL FIXTURES, DEVICES, ETC. (INDICATED FOR DEMOLITION) WITH THE OWNER.

**ABBREVIATIONS**

ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
AFR	ABOVE FINISHED ROOF
APD	AIR PRESSURE DROP
AVG	AVERAGE
BAS	BUILDING AUTOMATION SYSTEM
BHP	BREAK HORSEPOWER
BTU	BRITISH THERMAL UNIT
CAV	CONSTANT AIR VOLUME
CFM	CUBIC FEET PER MINUTE
CO	CARBON MONOXIDE
CO2	CARBON DIOXIDE
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROLS
DN	DOWN
EAT	ENTERING AIR TEMPERATURE
EC	ELECTRICAL CONTRACTOR
ESP	EXTERNAL STATIC PRESSURE
ETR	EXISTING TO REMAIN
EWT	ENTERING WATER TEMPERATURE
FA	FREE AREA
FD	FIRE DAMPER
FLA	FULL LOAD AMPS
FPC	FIRE PROTECTION CONTRACTOR
FFM	FEET PER MINUTE
FPS	FEET PER SECOND
FSD	FIRE SMOKE DAMPER
GAL	GALLON (-S)
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
GR	GRAINS
HD	HEAD
HP	H (-ORSEPOWER, -EAT PUMP)
ID	I (-IDENTIFICATION, -NSIDE DIAMETER, -NSIDE DIMENSION)
kw	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LWT	LEAVING WATER TEMPERATURE
MBH	BTU PER HOUR [THOUSANDS]
MCA	MINIMUM CIRCUIT AMPS
MFG	MANUFACTURER
MOC	MAXIMUM OVERCURRENT PROTECTION [AMPS]
NC	NOISE CRITERIA <b>OR</b> NORMALLY CLOSED

**ABBREVIATIONS (CONTINUED)**

NO	NORMALLY OPEN <b>OR</b> NUMBER
NTS	NOT TO SCALE
OD	OUTSIDE DI (-AMETER, -MENSION)
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
PC	PLUMBING CONTRACTOR
PD	PRESSURE DROP
PH	PHASE [ELECTRICAL]
PPM	PARTS PER MILLION
PRS	PRESSURE REDUCING STATION
PRV	PRESSURE REDUCING VALVE (STEAM, WATER, GAS)
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	PSI GAUGE
RH	RELATIVE HUMIDITY [%]
RPM	REVOLUTIONS PER MINUTE
SD	SMOKE DAMPER
SP	STATIC PRESSURE
SQ FT	SQUARE FEET <b>OR</b> FOOT
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V	VOLT (-AGE, -S)
VAR	VARI (-ABLE, -IES)
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY
VFD	VARIABLE FREQUENCY DRIVE
W	WATT (-AGE, -S)
WB	WET BULB
WPD	WATER PRESSURE DROP
ΔP	DIFFERENTIAL PRESSURE
ΔT	TEMPERATURE DIFFERENCE
ℓ	CENTERLINE

**GENERAL SYMBOLS**

	TAGGED NOTE DESIGNATOR
	REVISION TRIANGLE
	ROOM TAG
	EQUIPMENT TAG
	POINT OF CONNECTION / CONNECT TO EXISTING
	POINT OF DEMOLITION

**PHASING NOTES**

- A. THIS PROJECT INTERFACES EXTENSIVELY WITH EXISTING BUILDING SERVICES. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE AND PHASE ALL TIE-INS AND INTERRUPTIONS OF EXISTING SERVICES TO MINIMIZE OR ELIMINATE DOWNTIME. AS AN EXAMPLE, MAIN GAS SERVICE, WATER SERVICE, ELECTRICAL SERVICE, HVAC SERVICES, STEAM GENERATION, ETC., WILL BE AFFECTED AND REPLACED OR MOVED DURING THIS PROJECT. THE CONTRACTOR SHALL INSTALL ALL NEW SERVICES AND EQUIPMENT AND HAVE THEM TESTED AND FULLY AND RELIABLY FUNCTIONAL PRIOR TO INTERRUPTING, RELOCATING OR REMOVING ANY EXISTING SERVICES. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO BARE ANY AND ALL COSTS ASSOCIATED WITH THIS PHASING, INCLUDING TEMPORARY SERVICES, TEMPORARY RELOCATION, PREMIUM TIME WORK, ETC. CONTRACTOR SHALL COORDINATE ALL SAID WORK WITH THE OWNER AND APPLICABLE UTILITIES PER THE CONTRACT DOCUMENTS.

**HAZARDOUS MATERIALS NOTES**

- A. THE CONTRACTOR IT IS HEREBY ADVISED THAT IS POSSIBLE THAT ASBESTOS AND/OR OTHER HAZARDOUS MATERIALS ARE OR WERE PRESENT IN THIS BUILDING(S). ANY WORKER, OCCUPANT, VISITOR, ETC., WHO ENCOUNTERS ANY MATERIAL OF WHOSE CONTENT THEY ARE NOT CERTAIN SHALL PROMPTLY REPORT THE EXISTENCE AND LOCATION OF THAT MATERIAL TO THE OWNER. FURTHERMORE, THE CONTRACTOR SHALL INSURE THAT NO ONE COMES NEAR TO OR IN CONTACT WITH ANY SUCH MATERIAL OR FUMES THEREFROM UNTIL ITS CONTENT CAN BE ASCERTAINED TO BE NON-HAZARDOUS.
- B. CMTA, INC. HAS NO EXPERTISE IN THE DETERMINATION OF THE PRESENCE OF ANY HAZARDOUS MATERIAL. THEREFORE, NO ATTEMPT HAS BEEN MADE BY CMTA TO IDENTIFY THE EXISTENCE OR LOCATION OF ANY SUCH HAZARDOUS MATERIAL. FURTHERMORE, CMTA NOR ANY AFFILIATE HEREOF WILL NOT OFFER OR MAKE ANY RECOMMENDATIONS RELATIVE TO THE REMOVAL, HANDLING OR DISPOSAL OF SUCH MATERIAL.
- C. IF THE WORK WHICH IS TO BE PERFORMED INTERFACES, CONNECTS OR RELATES IN ANY PHYSICAL WAY WITH OR TO EXISTING COMPONENTS WHICH CONTAIN OR BEAR ANY HAZARDOUS MATERIAL, ASBESTOS BEING ONE, THEN IT SHALL BE THE CONTRACTOR'S SOLE RESPONSIBILITY TO CONTACT THE OWNER AND SO ADVISE HIM/HER IMMEDIATELY.
- D. THE CONTRACTOR BY EXECUTION OF THE CONTRACT FOR ANY WORK AND/OR BY THE ACCOMPLISHMENT OF ANY WORK THEREBY AGREE TO BRING NO CLAIM RELATIVE TO HAZARDOUS MATERIALS FOR NEGLIGENCE, BREACH OF CONTRACT, INDEMNITY, OR ANY OTHER SUCH ITEM AGAINST CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS OR CONSULTANTS. ALSO, THE CONTRACTOR FURTHER AGREES TO DEFEND, INDEMNIFY AND HOLD CMTA, ITS PRINCIPALS, EMPLOYEES, AGENTS AND CONSULTANTS HARMLESS FROM ANY SUCH RELATED CLAIMS WHICH MAY BE BROUGHT BY ANY SUBCONTRACTORS, SUPPLIERS OR ANY OTHER THIRD PARTIES.
- E. THE CONTRACTOR IS DIRECTED TO THE SPECIFICATIONS FOR FURTHER INFORMATION.

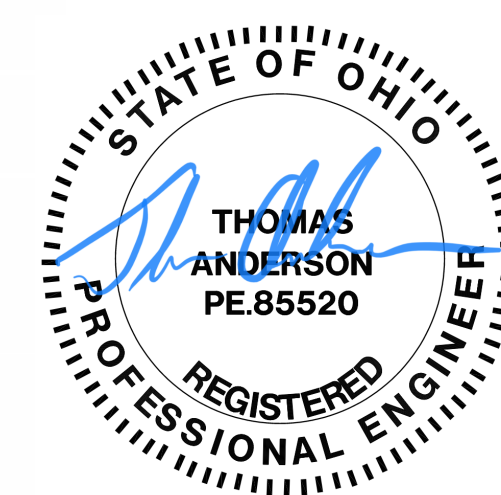
**HVAC LEGEND**

	SUPPLY AIR DIFFUSER
	RETURN AIR GRILLE
	EXHAUST AIR DIFFUSER
	TRANSFER AIR GRILLE W/ SOUND ATTENUATING BOOT
	SIDEWALL DIFFUSER/GRILLE
	AIR DEVICE TAG (REGISTER, GRILLE, DIFFUSER, LOUVER)
	RECTANGULAR DUCT
	ROUND/SPIRAL DUCT
	FLAT OVAL DUCT
	SUPPLY AIR DUCT
	RETURN AIR DUCT
	EXHAUST AIR DUCT
	OUTSIDE AIR DUCT
	TRANSFER AIR DUCT
	COMBUSTION AIR EXHAUST DUCT
	COMBUSTION AIR INTAKE DUCT
	SA AIR DUCT TURNING UP
	SA AIR DUCT TURNING DOWN
	RA AIR DUCT TURNING UP
	RA AIR DUCT TURNING DOWN
	EA AIR DUCT TURNING UP
	EA AIR DUCT TURNING DOWN
	EXISTING DUCT - (XXX) DENOTES SYSTEM
	DUCT TO BE DEMOLISHED - (XXX) DENOTES SYSTEM
	DUCT TO BE ABANDONED IN PLACE - (XXX) DENOTES SYSTEM
	MITERED ELBOW WITH TURNING VANES
	FLEXIBLE DUCT
	THERMOSTAT
	TEMPERATURE SENSOR
	HUMIDITY SENSOR
	CARBON DIOXIDE SENSOR
	TEMPERATURE & CARBON DIOXIDE SENSOR
	MANUAL BALANCING/VOLUME DAMPER
	MOTORIZED DAMPER

**NOTE: NOT ALL SYMBOLS AND ABBREVIATIONS MAY BE USED ON THIS PROJECT**

**MECHANICAL PIPING LEGEND**

	PIPE ELBOW TURNING UP
	PIPE ELBOW TURNING DOWN
	PIPE TEE; CONNECTION ON TOP
	PIPE TEE; CONNECTION ON BOTTOM
	PIPE CAP
	CONDENSATE DRAIN
	CHILLED WATER SUPPLY/RETURN
	CONDENSER WATER SUPPLY/RETURN
	DUAL TEMP. WATER SUPPLY/RETURN
	GEOTHERMAL WATER SUPPLY/RETURN
	HIGH PRESSURE STEAM CONDENSATE
	HIGH PRESSURE STEAM; (#) DENOTES PRESSURE
	HEAT PUMP WATER SUPPLY/RETURN
	HEAT RECOVERY SUPPLY/RETURN PIPING
	HEATING WATER SUPPLY/RETURN
	LOW PRESSURE STEAM CONDENSATE
	LOW PRESSURE STEAM; (#) DENOTES PRESSURE
	MEDIUM PRESSURE STEAM RETURN
	MEDIUM PRESSURE STEAM; (#) DENOTES PRESSURE
	STEAM VENT PIPING
	PIPING TO BE DEMOLISHED - (XXX) DENOTES SYSTEM
	EXISTING PIPING - (XXX) DENOTES SYSTEM

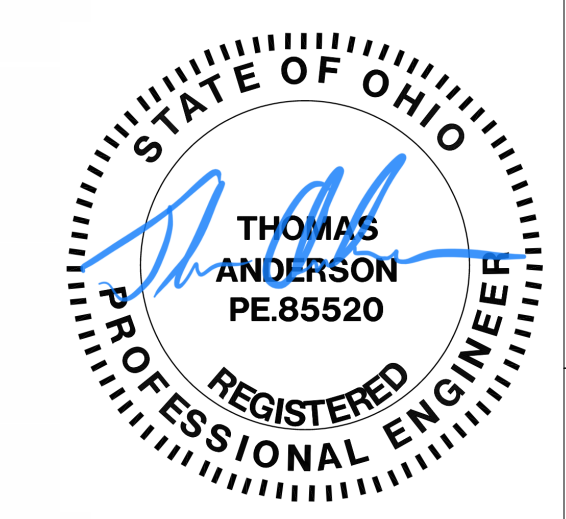
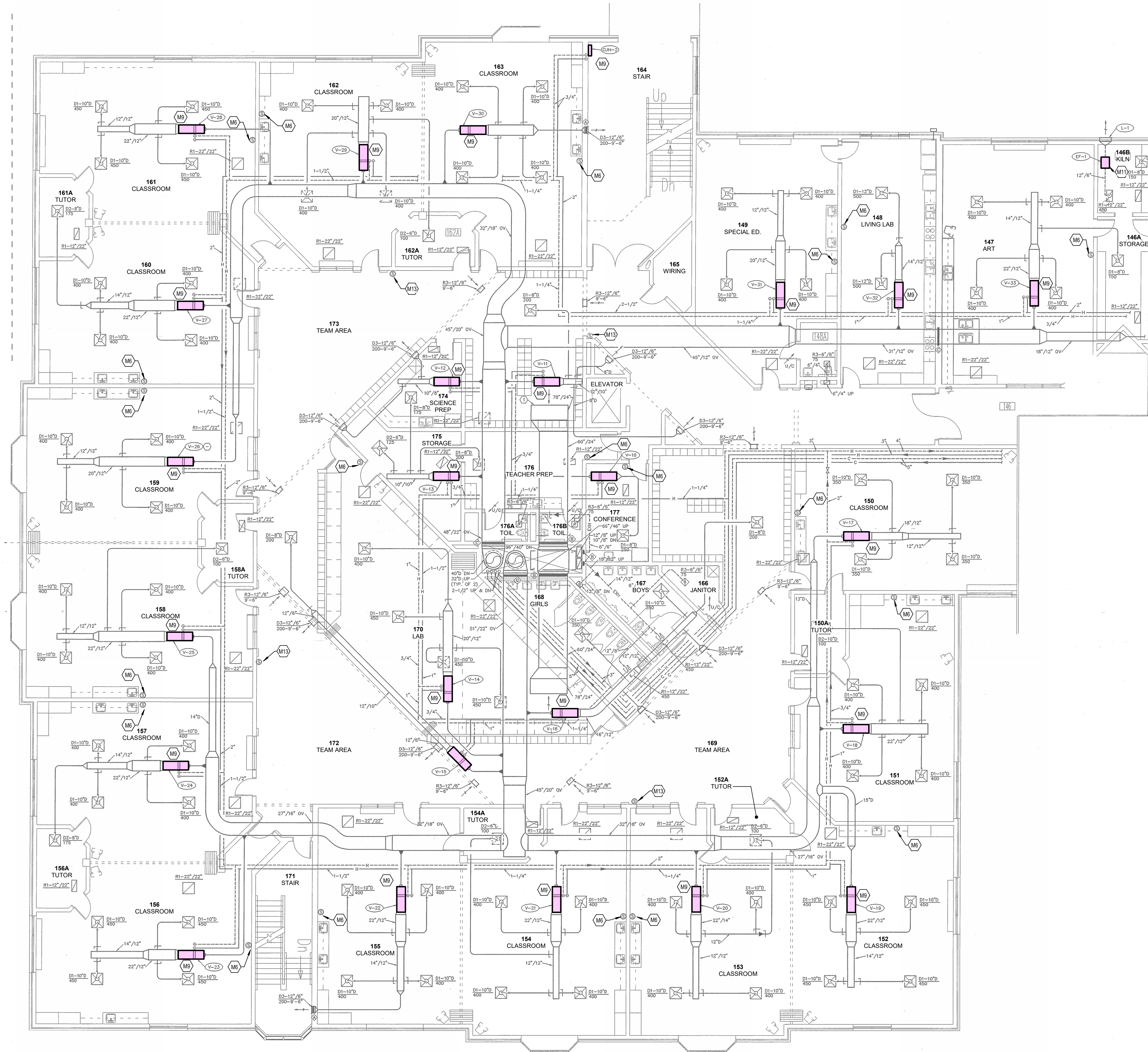


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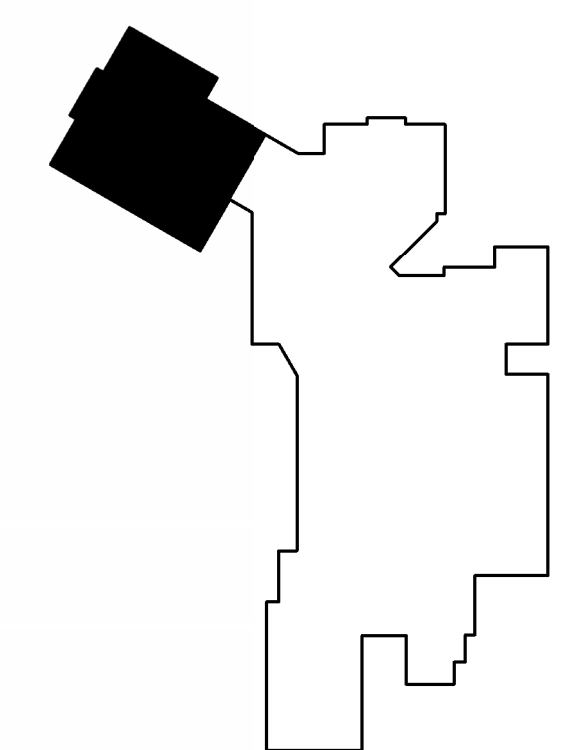


**TAGGED NOTES**

- M6 DEMOLISH EXISTING THERMOSTAT SENSOR; INSTALL NEW THERMOSTAT AND VOC SENSOR AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
- M9 PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
- M11 ENABLE/DISABLE AND MONITOR EXISTING EF FAN VIA RELAY.
- M13 DEMOLISH EXISTING THERMOSTAT SENSOR; INSTALL NEW THERMOSTAT AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.



KEY PLAN



MECHANICAL - FIRST FLOOR CLASSROOM AREA  
1/8" = 1'-0"

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M101

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TAGGED NOTES	
M2	PROVIDE RELAY FOR EXHAUST FAN FOR ENABLE/DISABLE AND TIE TO BAS TIME SCHEDULE
M3	PROVIDE GPS-MOD NEEDPOINT BIPOLAR IONIZATION UNIT, OR EQUAL, UNIT TO BE INSTALLED AT FACE OF CHILLED WATER COIL. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
M6	DEMOLISH EXISTING THERMOSTAT SENSOR, INSTALL NEW THERMOSTAT AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING, RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M9	PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M10	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALON/TRIDUUM JACE) FOR AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M11	ENABLE/DISABLE AND MONITOR EXISTING EF FAN VIA RELAY.
M12	MONITOR EXISTING FREEZERS/COOLERS WITH AN ALARM POINT IN THE BAS.
M13	DEMOLISH EXISTING THERMOSTAT SENSOR, INSTALL NEW THERMOSTAT AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING, RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M14	PROVIDE NEW CO2 SENSOR IN THE MAIN RETURN DUCT AND MODULATE TO OA DAMPER TO MAINTAIN A CO2 CONCENTRATION BELOW 1000 PPM.



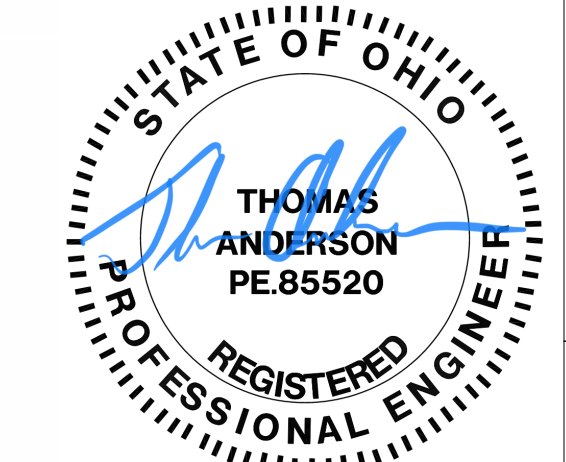
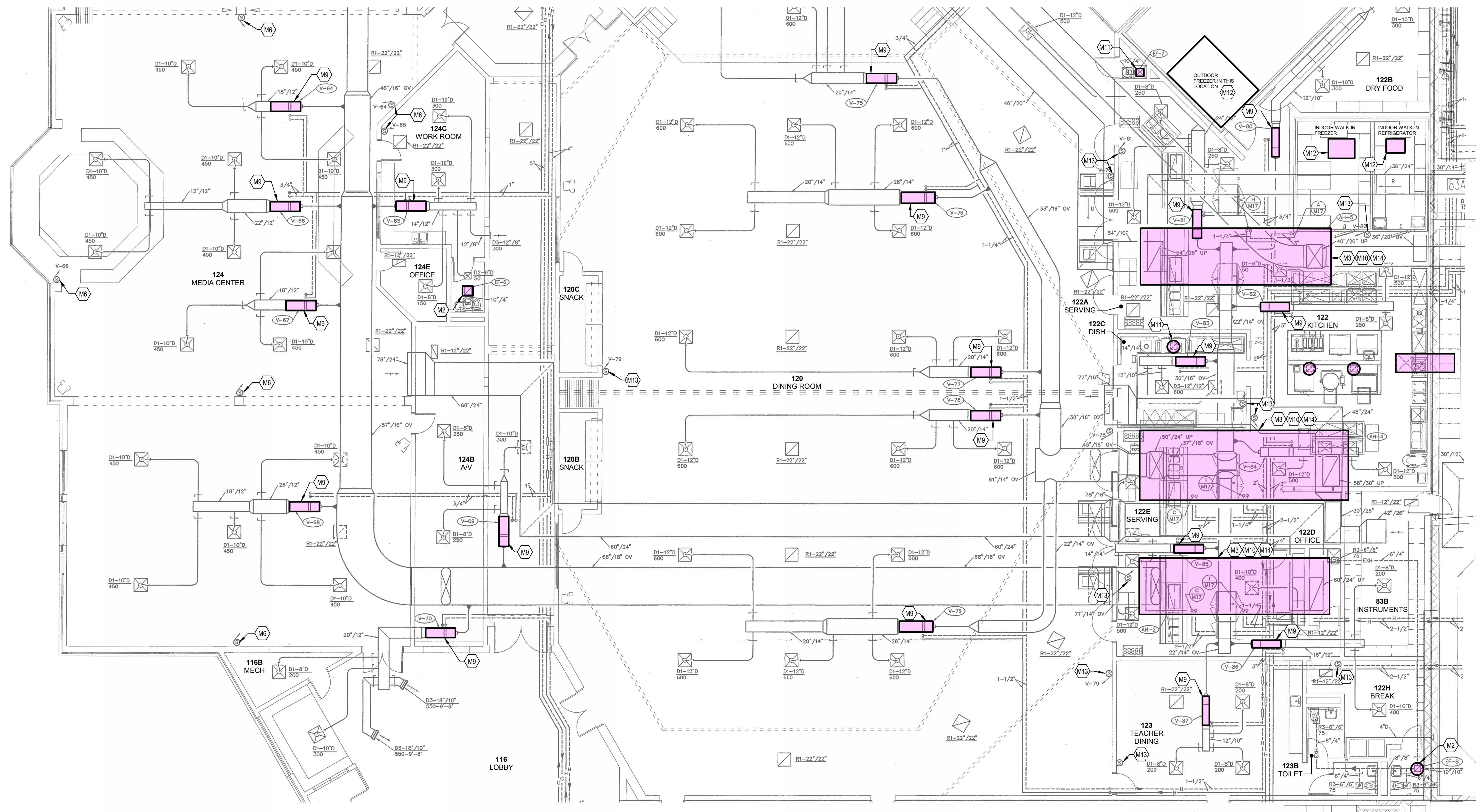
BID DOCUMENTS

LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE

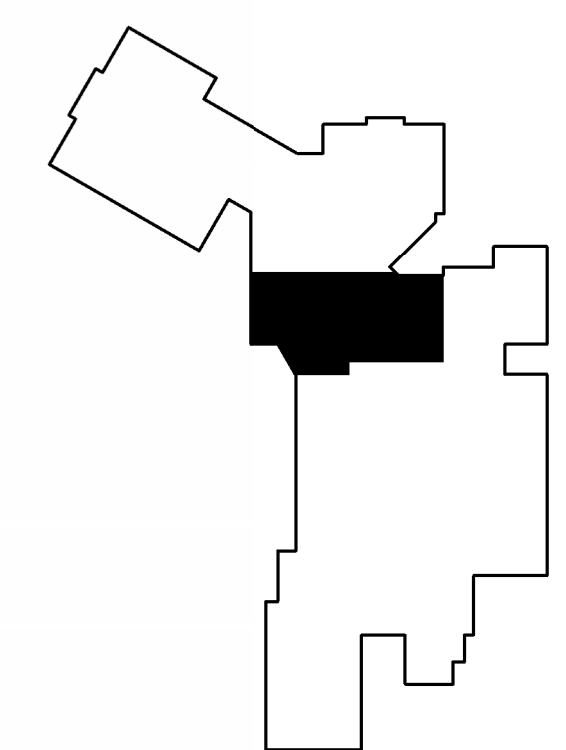
LOVELAND CITY SCHOOL DISTRICT

801 S Lebanon Rd, Loveland, OH 45140

CENTRAL AREA TEMPERATURE CONTROLS PLAN B



KEY PLAN



MECHANICAL - FIRST FLOOR CENTRAL AREA B  
1/8" = 1'-0"

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M203

TAGGED NOTES	
M2	PROVIDE RELAY FOR EXHAUST FAN FOR ENABLE/DISABLE AND TIE TO BAS TIME SCHEDULE
M6	DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT AND VOC SENSOR AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M9	PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M11	ENABLE/DISABLE AND MONITOR EXISTING EF FAN VIA RELAY.



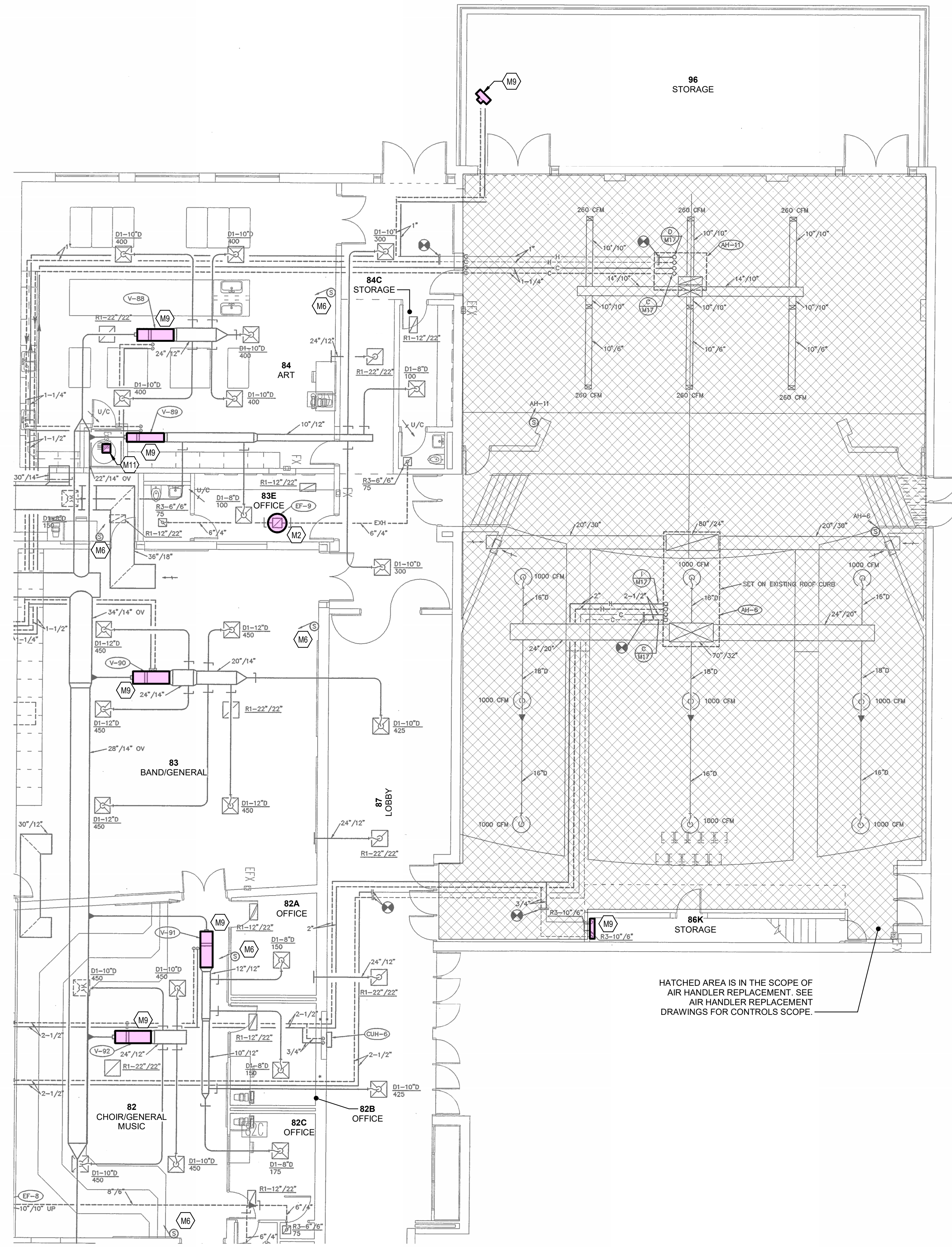
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LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE

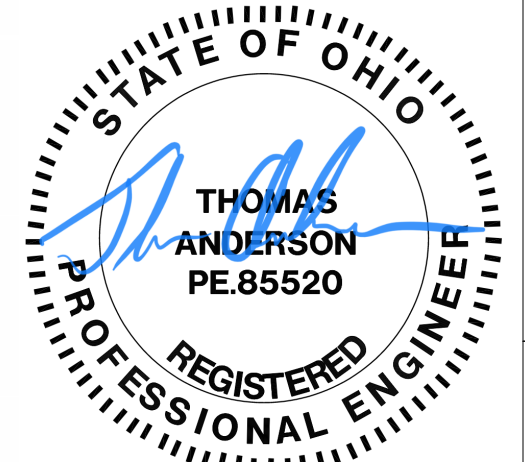
LOVELAND CITY SCHOOL DISTRICT

801 S Lebanon Rd., Loveland, OH 45140

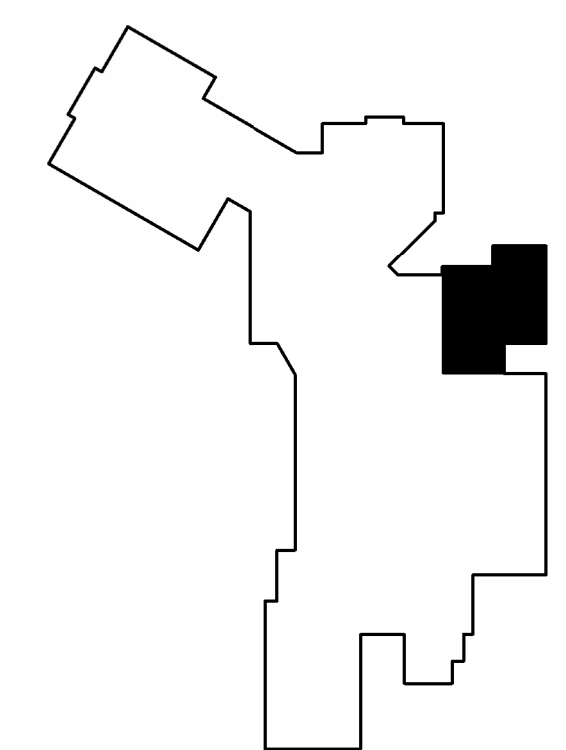
UPPER SECTION TEMPERATURE CONTROLS PLAN



HATCHED AREA IS IN THE SCOPE OF AIR HANDLER REPLACEMENT. SEE AIR HANDLER REPLACEMENT DRAWINGS FOR CONTROLS SCOPE.



KEY PLAN



MECHANICAL - FIRST FLOOR UPPER SECTION  
M204 1/8" = 1'-0"

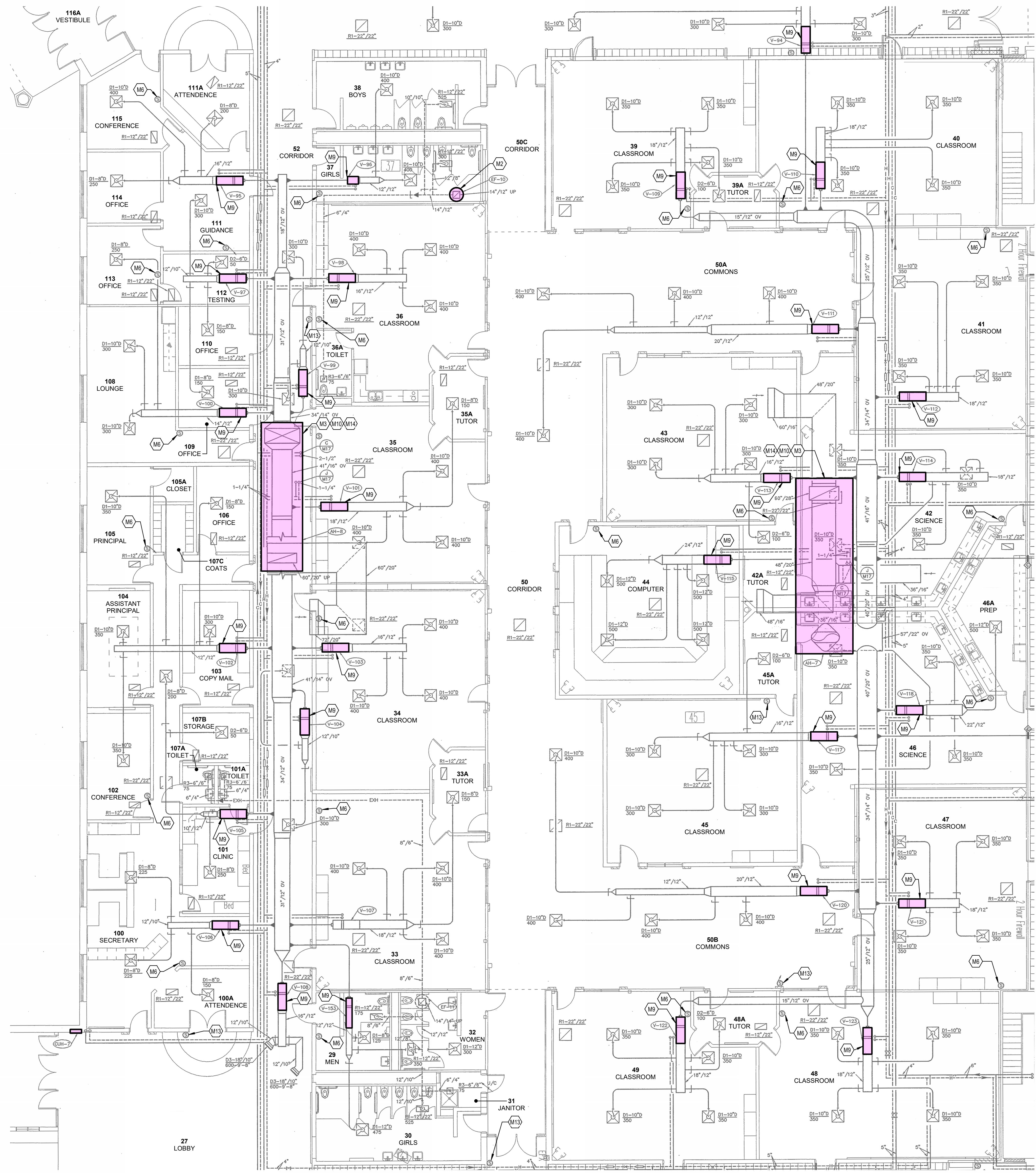
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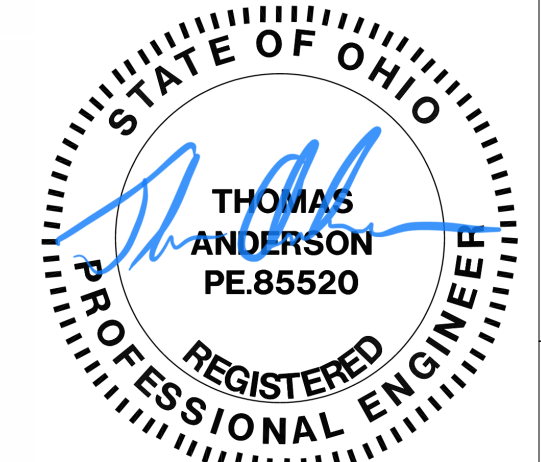
M204

LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE  
 LOVELAND CITY SCHOOL DISTRICT  
 801 S Lebanon Rd., Loveland, OH 45140  
 CENTER SECTION TEMPERATURE CONTROLS PLAN A

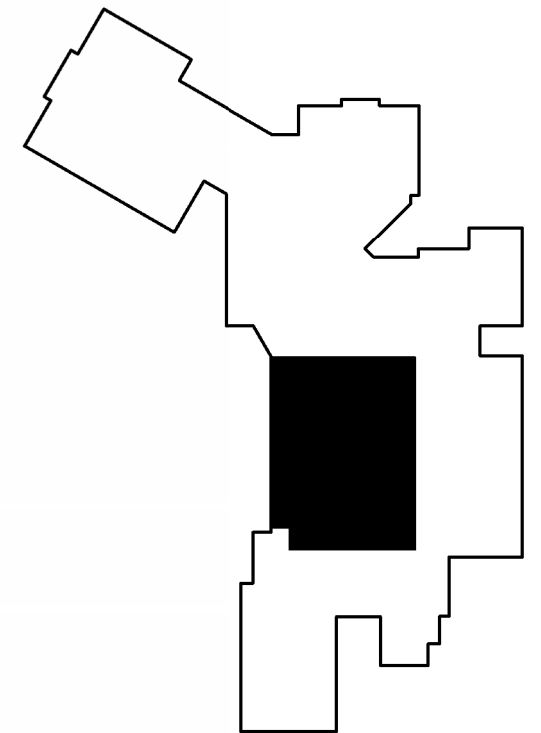
TAGGED NOTES	
M2	PROVIDE RELAY FOR EXHAUST FAN FOR ENABLE/DISABLE AND TIE TO BAS TIME SCHEDULE
M3	PROVIDE GPS-MOD NEEDPOINT BIPOLAR IONIZATION UNIT, OR EQUAL, UNIT TO BE INSTALLED AT FACE OF CHILLED WATER COIL. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
M6	DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT AND VOC SENSOR AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M9	PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M10	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALON/TRIDUUM JACE) FOR AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M13	DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M14	PROVIDE NEW CO2 SENSOR IN THE MAIN RETURN DUCT AND MODULATE TO OA DAMPER TO MAINTAIN A CO2 CONCENTRATION BELOW 1000 PPM.



MECHANICAL - FIRST FLOOR CENTRAL SECTION A  
 1/8" = 1'-0"



KEY PLAN



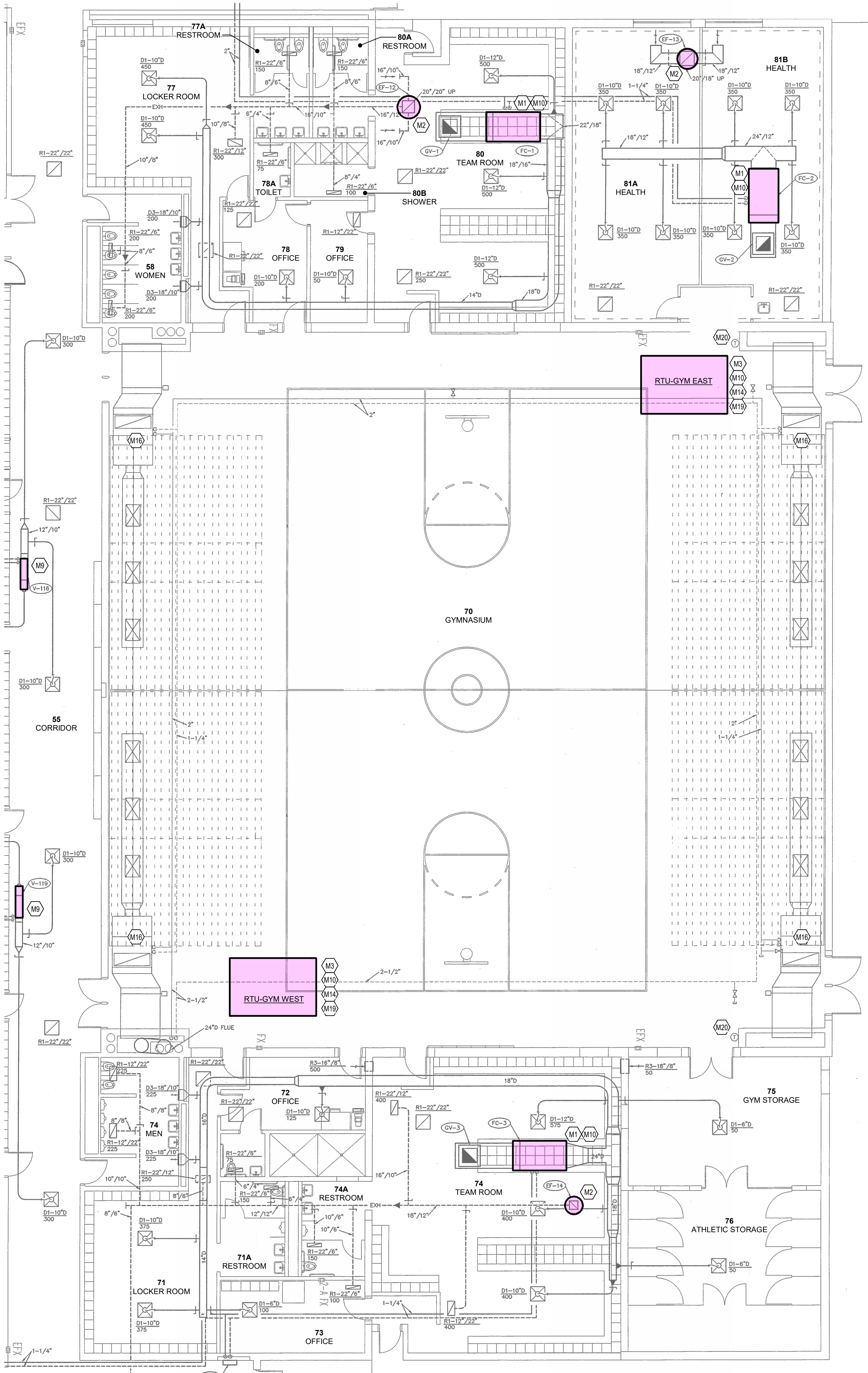
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M205

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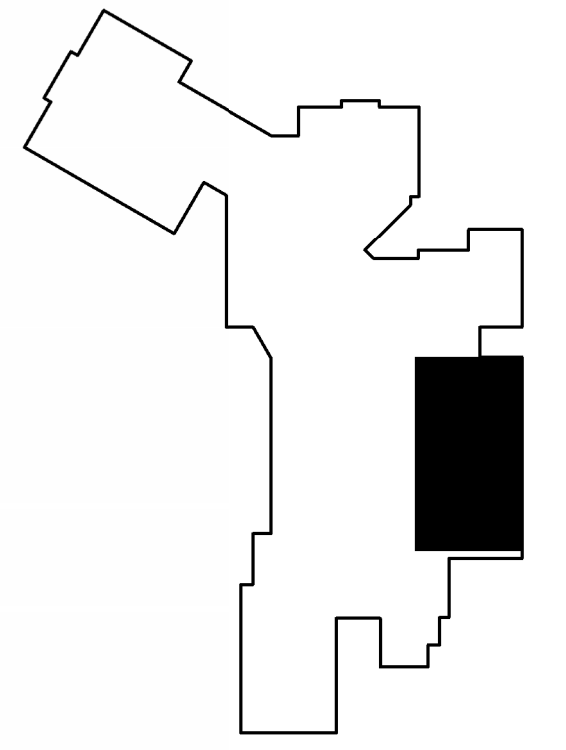
- TAGGED NOTES**
- M1 PROVIDE GPS-FC48-AC NEEDPOINT BIPOLAR IONIZATION UNIT, OR EQUAL, CAPABLE OF HANDLING UP TO 4,800 CFM FOR IN HVAC UNIT. UNIT TO BE INSTALLED AT FAN INLET. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
  - M2 PROVIDE RELAY FOR EXHAUST FAN FOR ENABLE/DISABLE AND TIE TO BAS TIME SCHEDULE.
  - M3 PROVIDE GPS-MOD NEEDPOINT BIPOLAR IONIZATION UNIT, OR EQUAL, UNIT TO BE INSTALLED AT FACE OF CHILLED WATER COIL. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
  - M9 PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
  - M10 PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALONTRIDIUM JACE) FOR AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
  - M14 PROVIDE NEW CO2 SENSOR IN THE MAIN RETURN DUCT AND MODULATE TO OA DAMPER TO MAINTAIN A CO2 CONCENTRATION BELOW 1000 PPM.
  - M16 EXISTING AIR HANDLING UNIT IS NO LONGER IN OPERATION AND HAS BEEN ABANDONED IN PLACE. THERE IS NO CONTROLS SCOPE FOR THIS UNIT.
  - M19 INTEGRATE NEW CONTROLS TO EXISTING DYGAS HEAT ROOF TOP UNIT. UNIT IS CONTROLLED VIA PACKAGED CONTROLLER.
  - M20 DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT WITH LOCKING COVER AND VOC SENSOR AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.



**MECHANICAL - FIRST FLOOR CENTRAL SECTION**  
 1/8" = 1'-0"



KEY PLAN

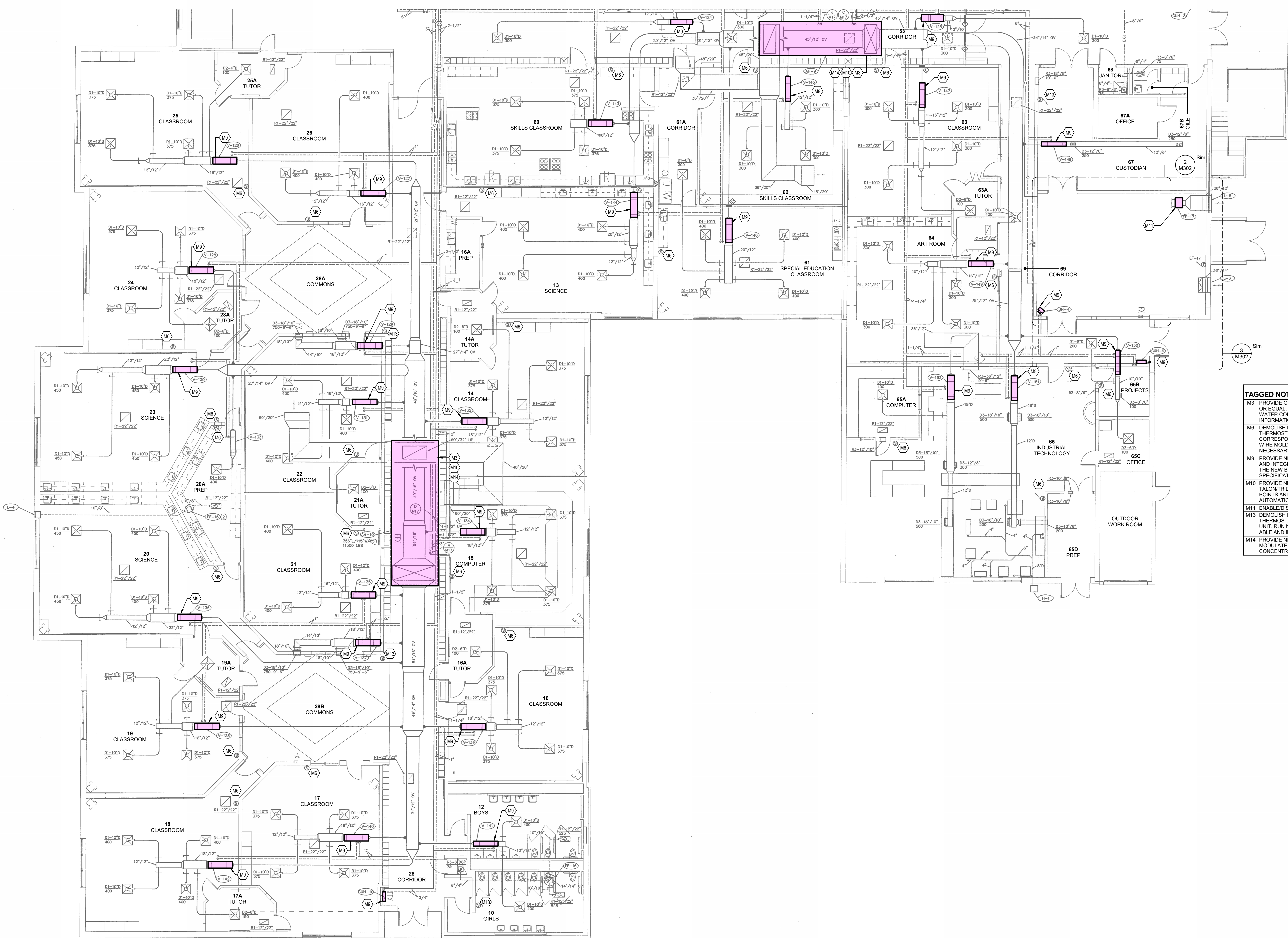


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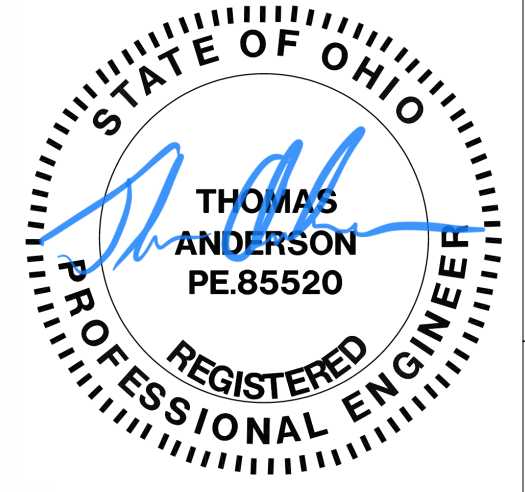

**M206**

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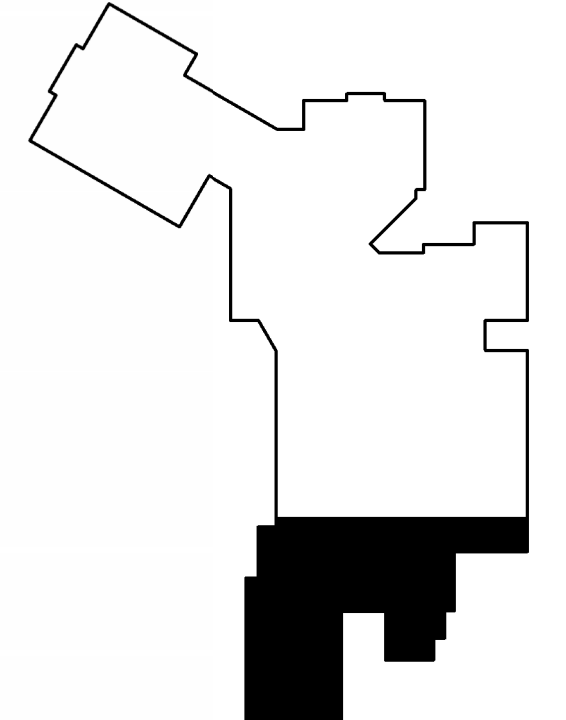


**TAGGED NOTES**

M3	PROVIDE GPS-MOD NEEDPOINT BIPOLAR IONIZATION UNIT, OR EQUAL UNIT TO BE INSTALLED AT FACE OF CHILLED WATER COIL. REFER TO SPECIFICATIONS FOR MORE INFORMATION.
M6	DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT AND VOC SENSOR AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M9	PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M10	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALON/TRIDIUM JACE) FOR AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M11	ENABLE/DISABLE AND MONITOR EXISTING EF FAN VIA RELAY.
M13	DEMOLISH EXISTING THERMOSTAT SENSOR. INSTALL NEW THERMOSTAT AND FULLY INTEGRATE WITH CORRESPONDING UNIT. RUN NEW CONTROL WIRING. RE-USE WIRE MOLDING AS ABLE AND INSTALL NEW WIRE MOLDING AS NECESSARY.
M14	PROVIDE NEW CO2 SENSOR IN THE MAIN RETURN DUCT AND MODULATE TO OA DAMPER TO MAINTAIN A CO2 CONCENTRATION BELOW 1000 PPM.



KEY PLAN



**MECHANICAL - FIRST FLOOR LOWER SECTION**  
1/8" = 1'-0"

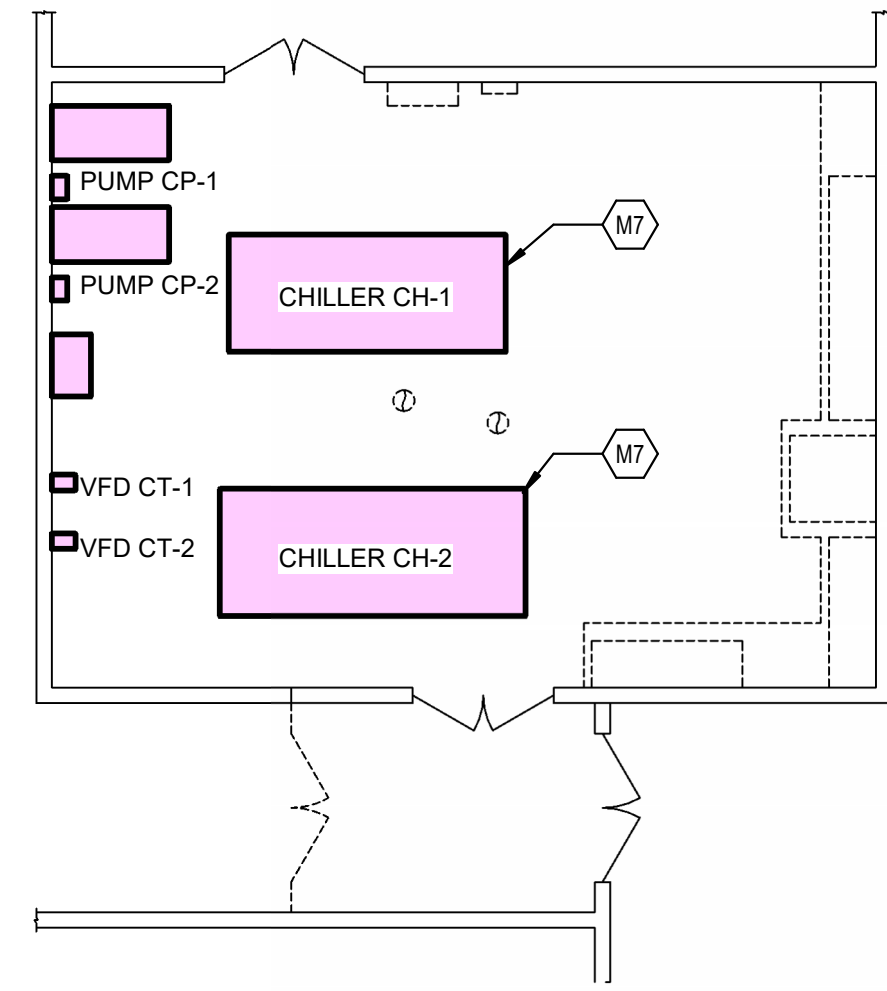
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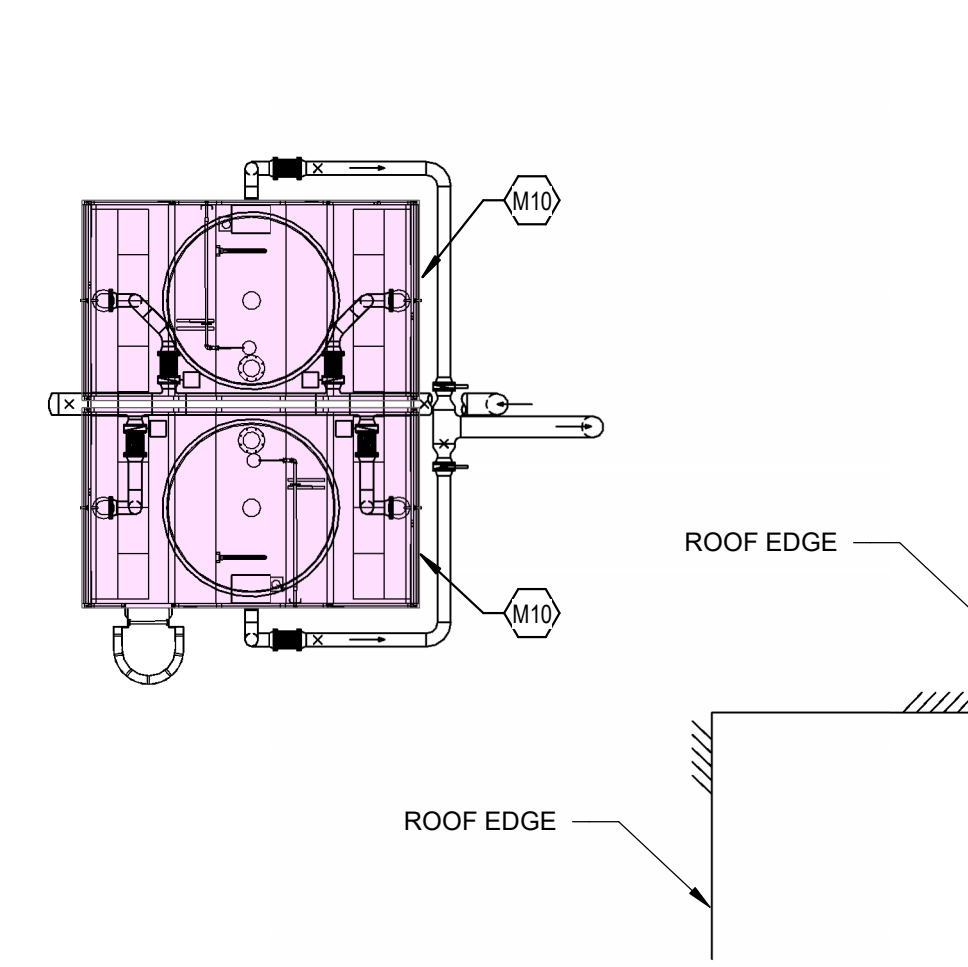

M301

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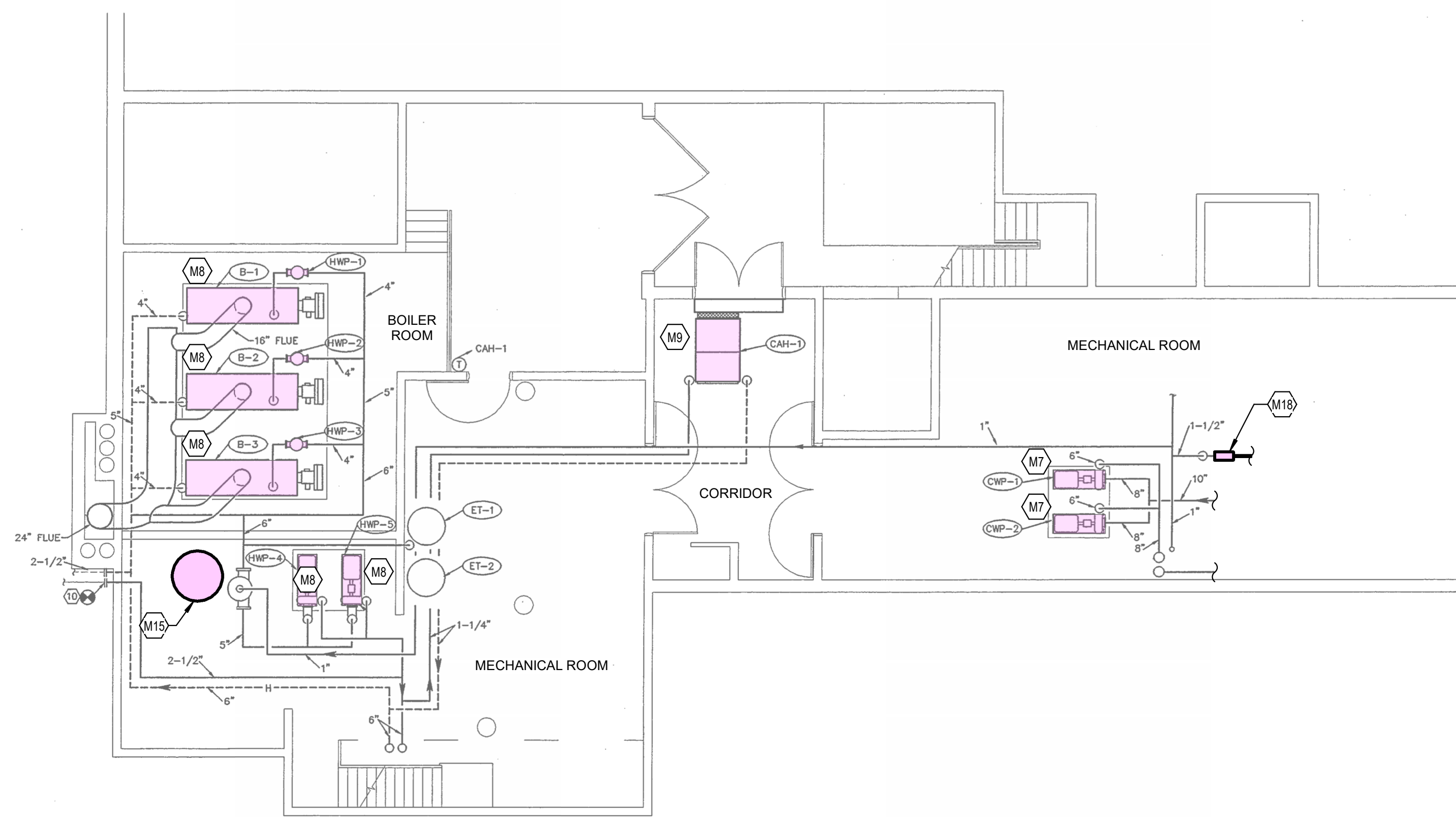
TAGGED NOTES	
M7	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALONTRIDIUM JACE) FOR THE CHILLED WATER PLANT AND INTEGRATE THE EXISTING CHILLER AND ALL ASSOCIATED PUMPS INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M8	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALONTRIDIUM JACE) FOR THE HOT WATER PLANT AND INTEGRATE THE EXISTING BOILERS AND ALL ASSOCIATED PUMPS INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M9	PROVIDE NEW UNITARY CONTROLLER (SIEMENS TALON DXR) AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M10	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALONTRIDIUM JACE) FOR AND INTEGRATE ALL EXISTING POINTS AND SEQUENCES INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M15	PROVIDE NEW NETWORK CONTROLLER (SIEMENS TALONTRIDIUM JACE) FOR THE DOMESTIC HOT WATER PLANT AND INTEGRATE THE EXISTING WATER HEATERS AND ALL ASSOCIATED PUMPS INTO THE NEW BUILDING AUTOMATION SYSTEM PER THE SPECIFICATIONS.
M18	NEW FILL LINE WATER METER TO BE INSTALLED IN THIS LOCATION.



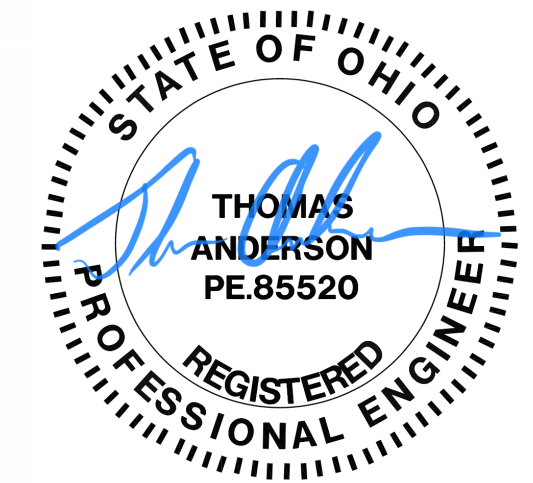
2 MECHANICAL - CHILLER ROOM  
1/8" = 1'-0"



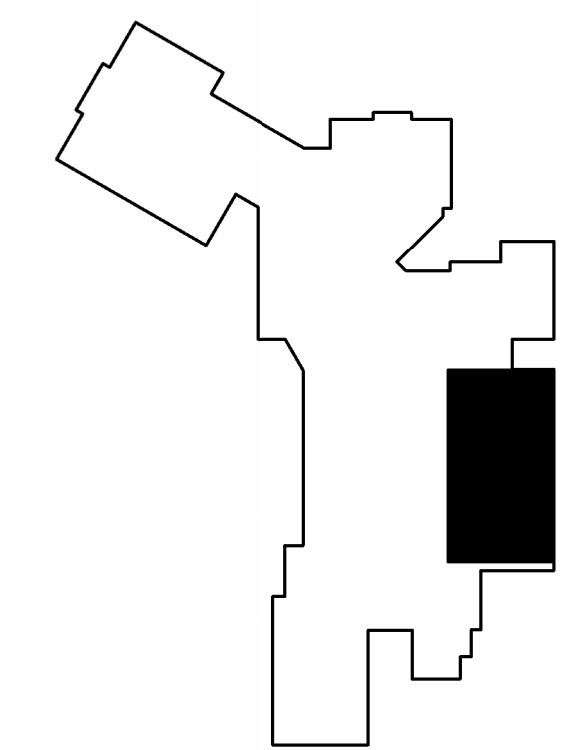
3 MECHANICAL - COOLING TOWERS  
1/8" = 1'-0"



1 MECHANICAL - BOILER ROOM  
1/8" = 1'-0"



KEY PLAN



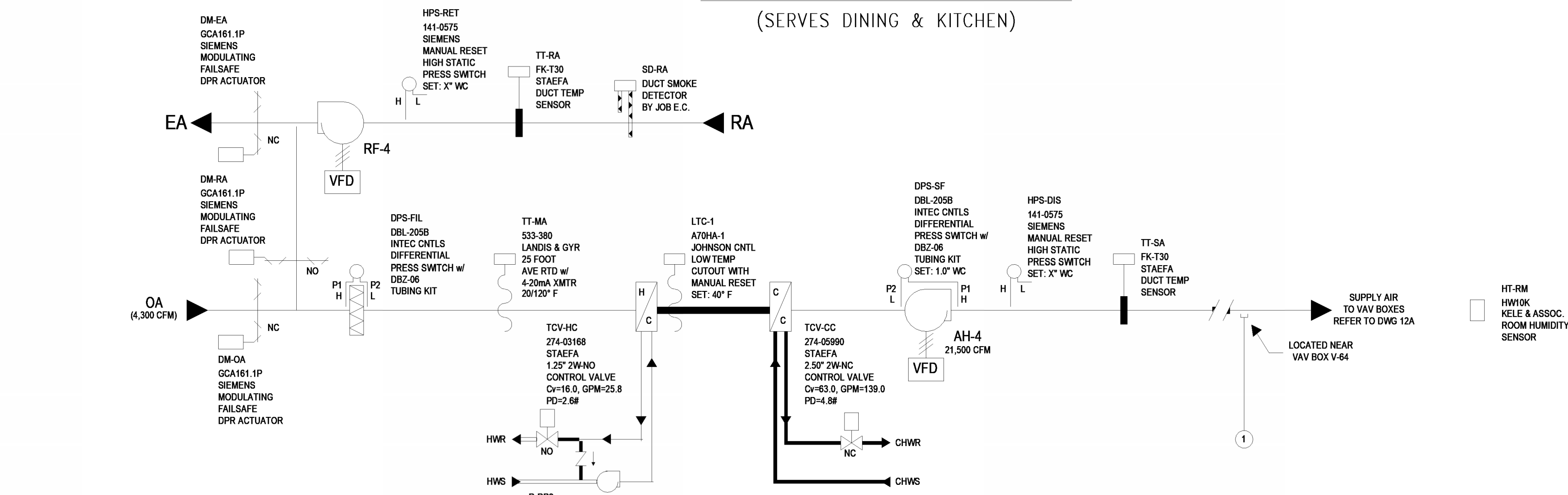
CLIENT/CMTA JOB #:	OLMS23
DATE:	02/23/2024
DRAWN:	OTG
CHECKED:	TLA

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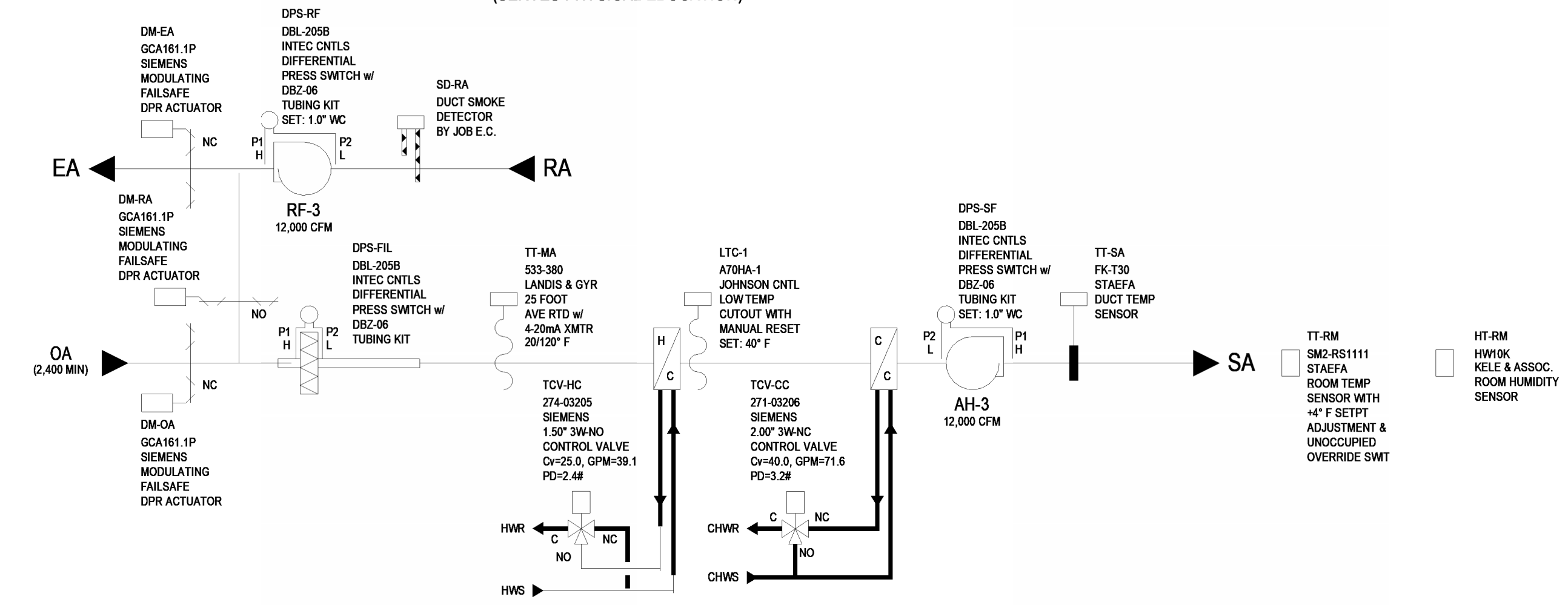
M302



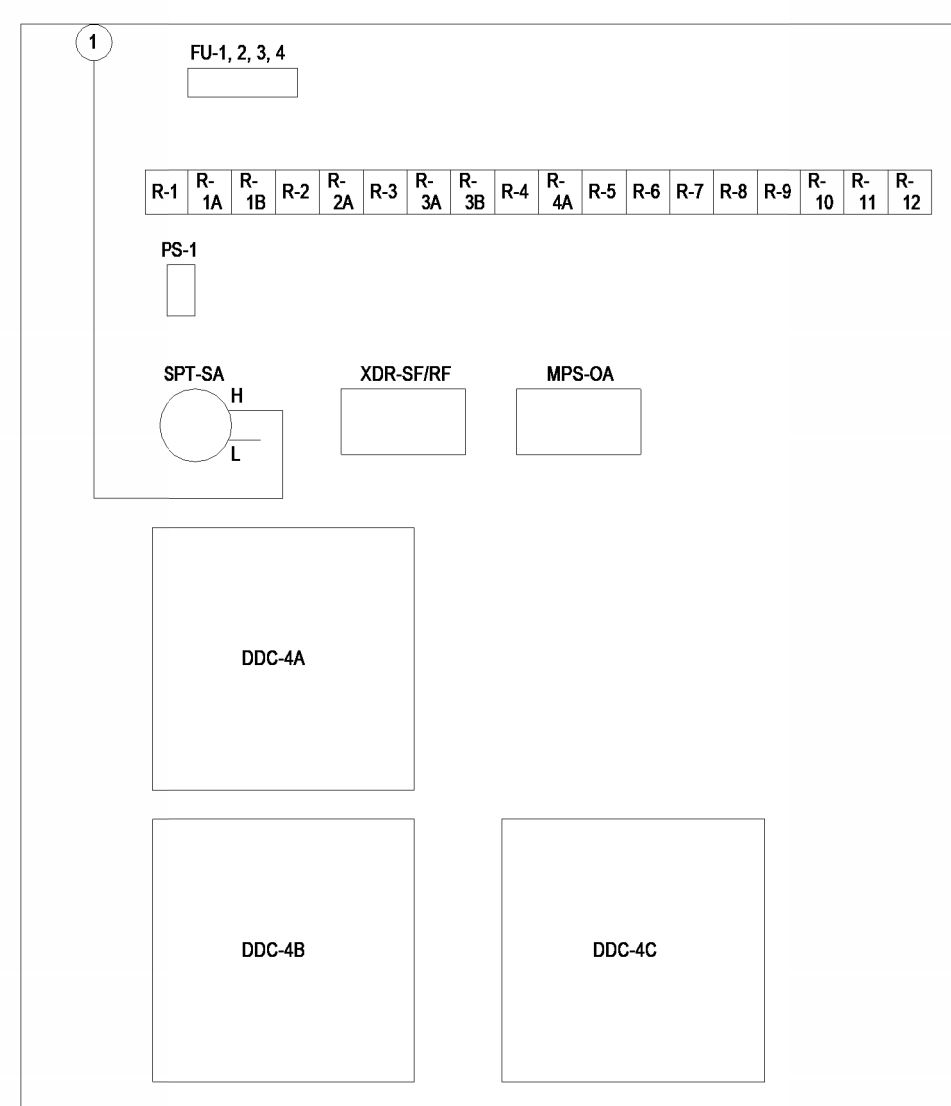
BELOW: AIR HANDLING UNIT AH-4  
(SERVES DINING & KITCHEN)



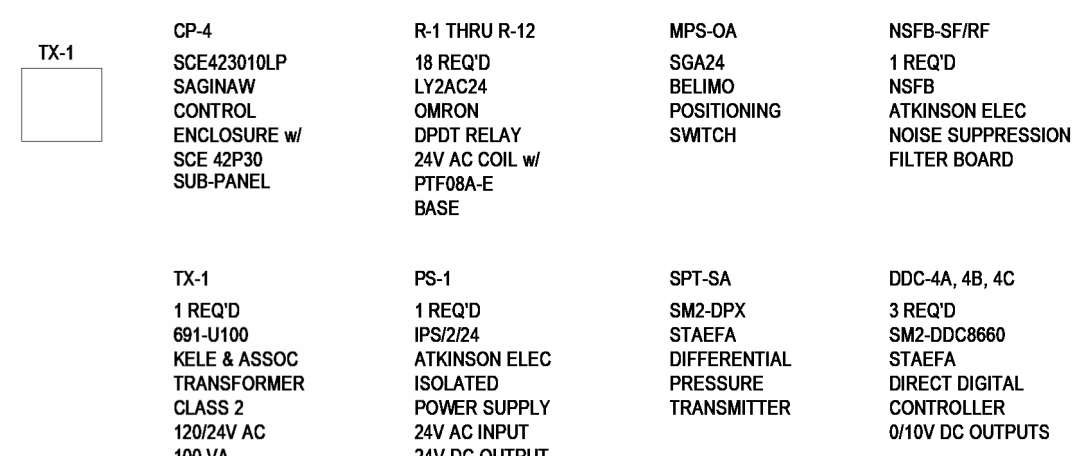
BELOW: AIR HANDLING UNIT AH-3  
(SERVES PHYSICAL EDUCATION)



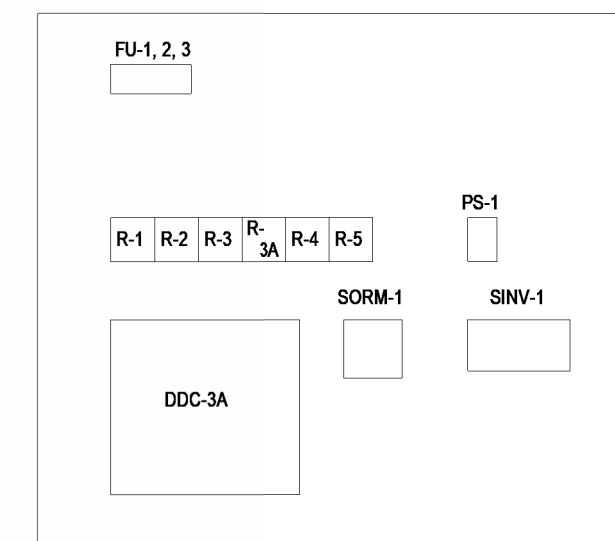
BELOW: CONTROL PANEL CP-4 INTERIOR



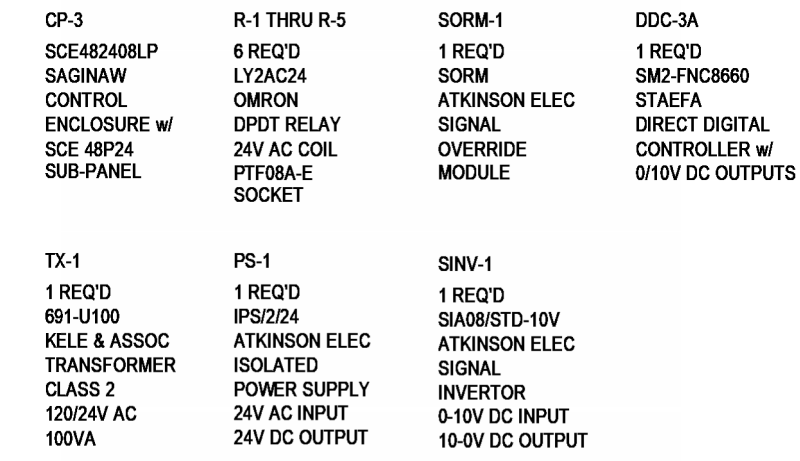
BELOW: CONTROL PANEL CP-4 DEVICES



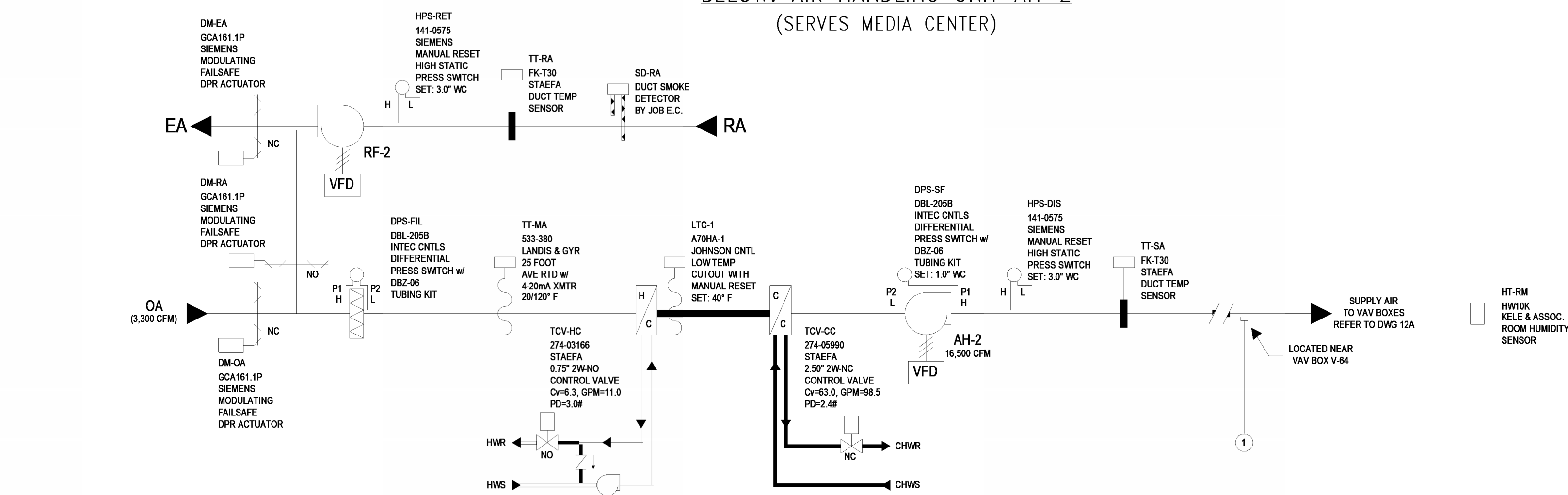
BELOW: CONTROL PANEL CP-3 INTERIOR



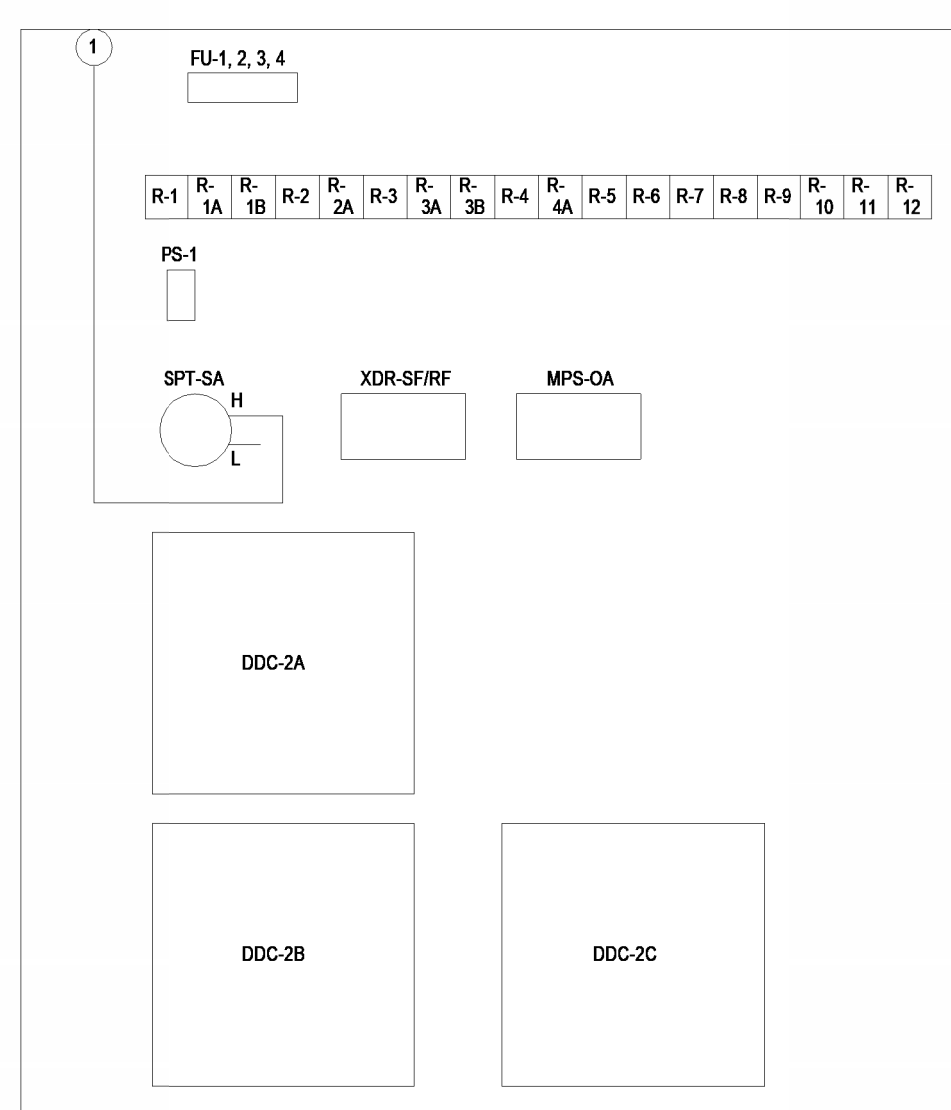
BELOW: CONTROL PANEL CP-3 DEVICES



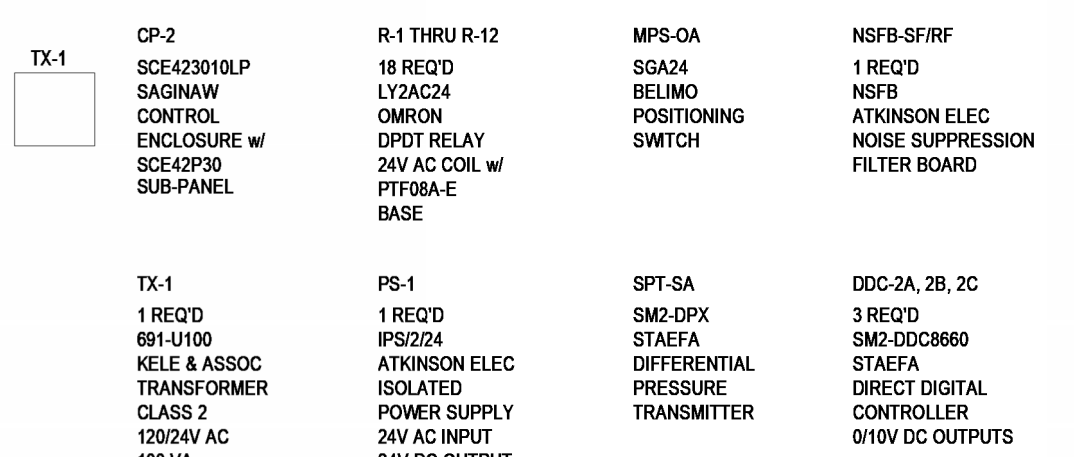
BELOW: AIR HANDLING UNIT AH-2  
(SERVES MEDIA CENTER)



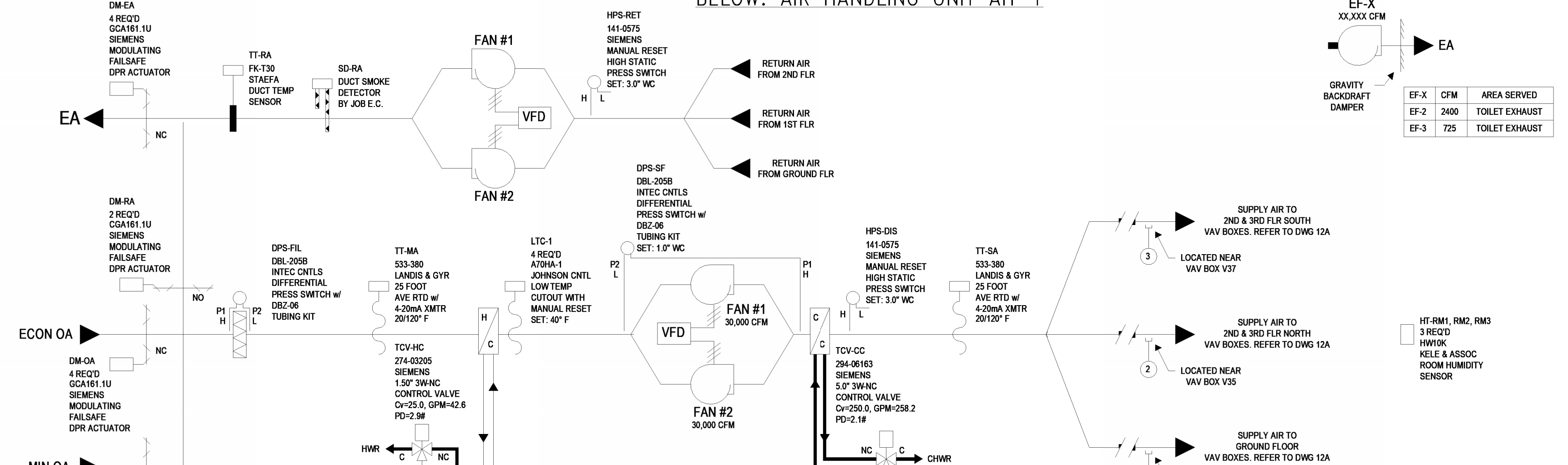
BELOW: CONTROL PANEL CP-2 INTERIOR



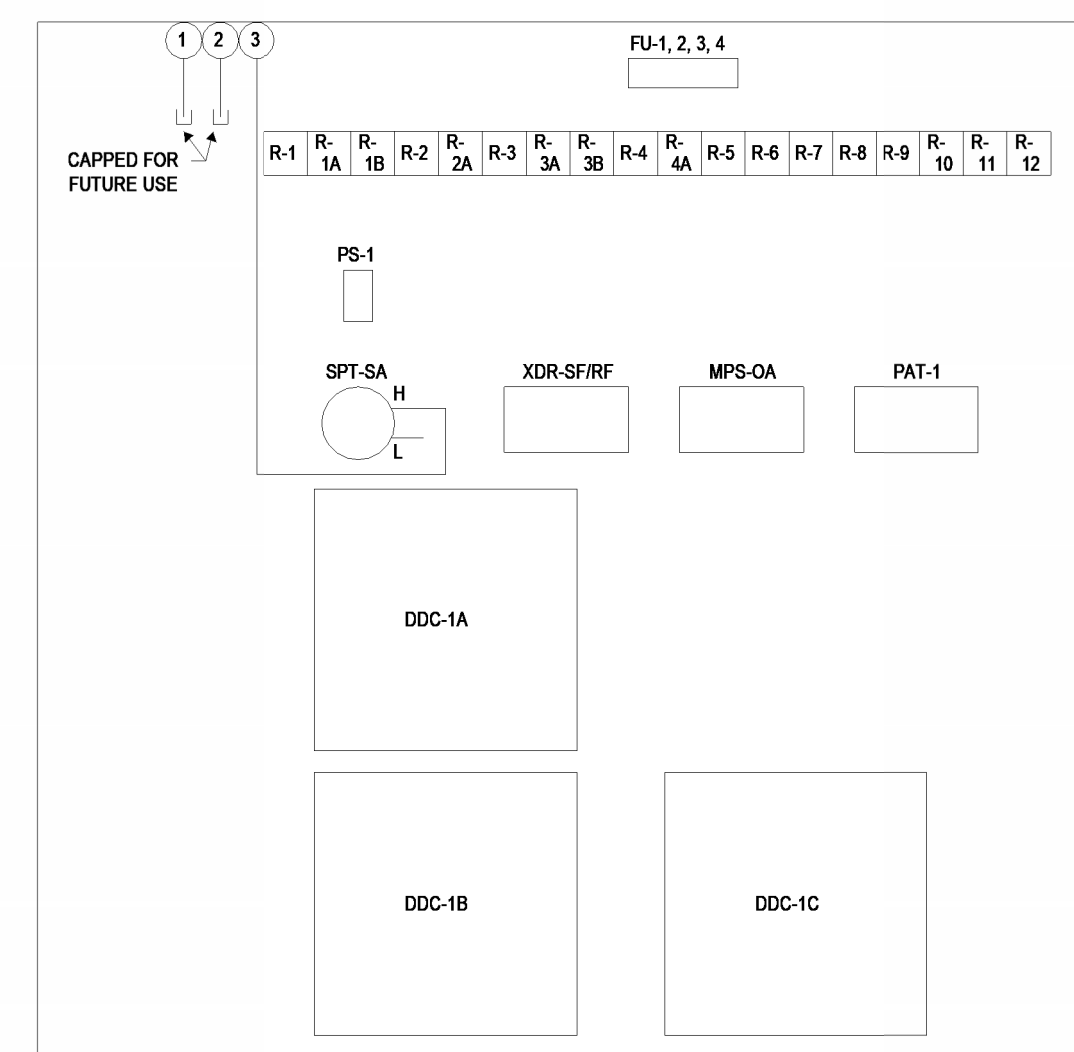
BELOW: CONTROL PANEL CP-2 DEVICES



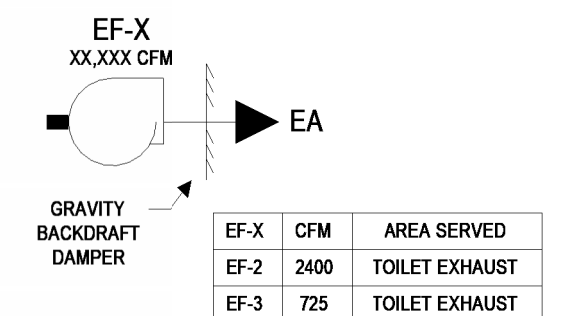
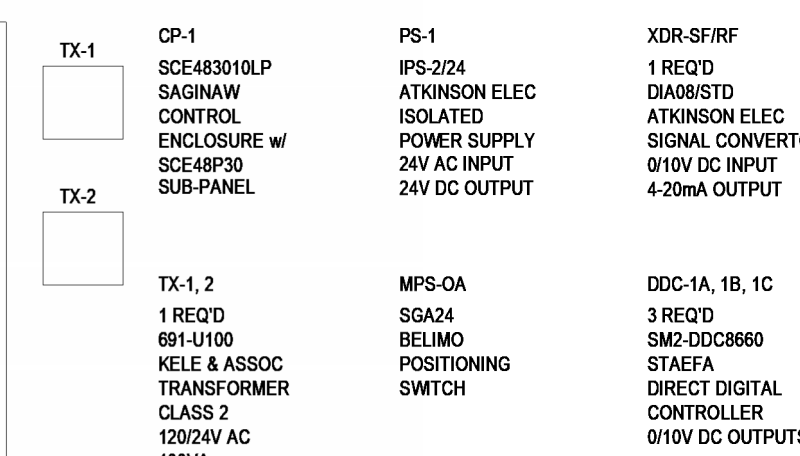
BELOW: AIR HANDLING UNIT AH-1



BELOW: CONTROL PANEL CP-1 INTERIOR



BELOW: CONTROL PANEL CP-1 DEVICES



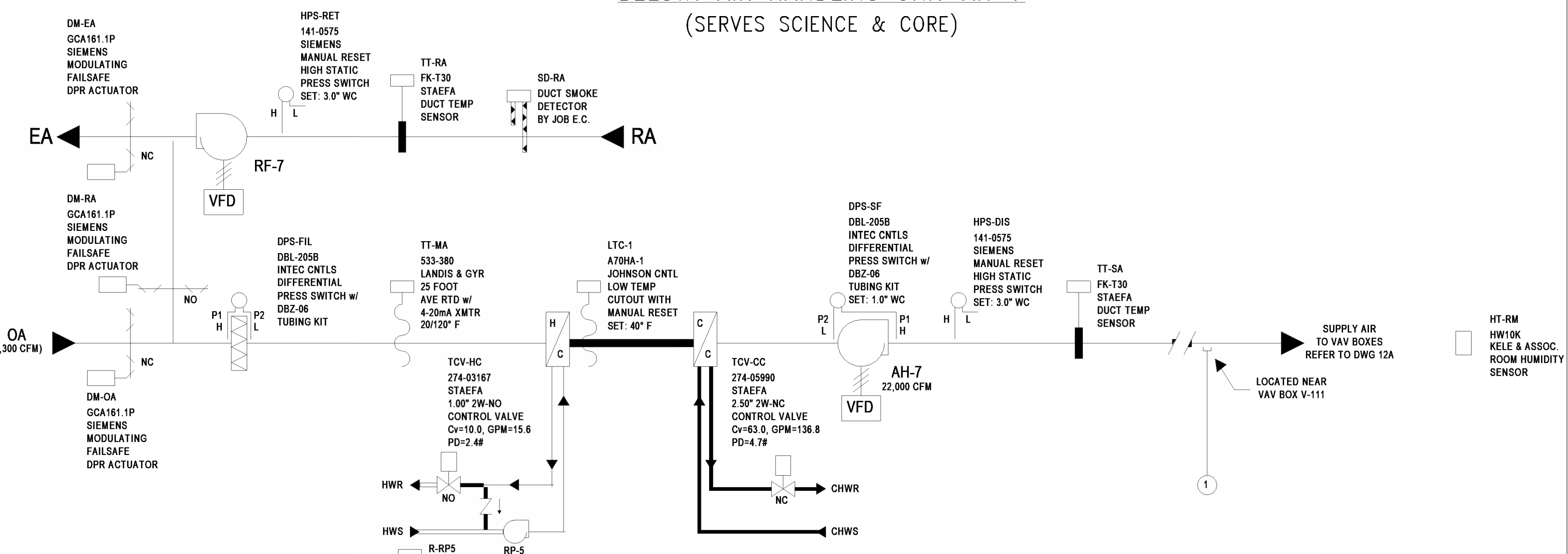
CLIENT/CMTA JOB #:	OLMS23
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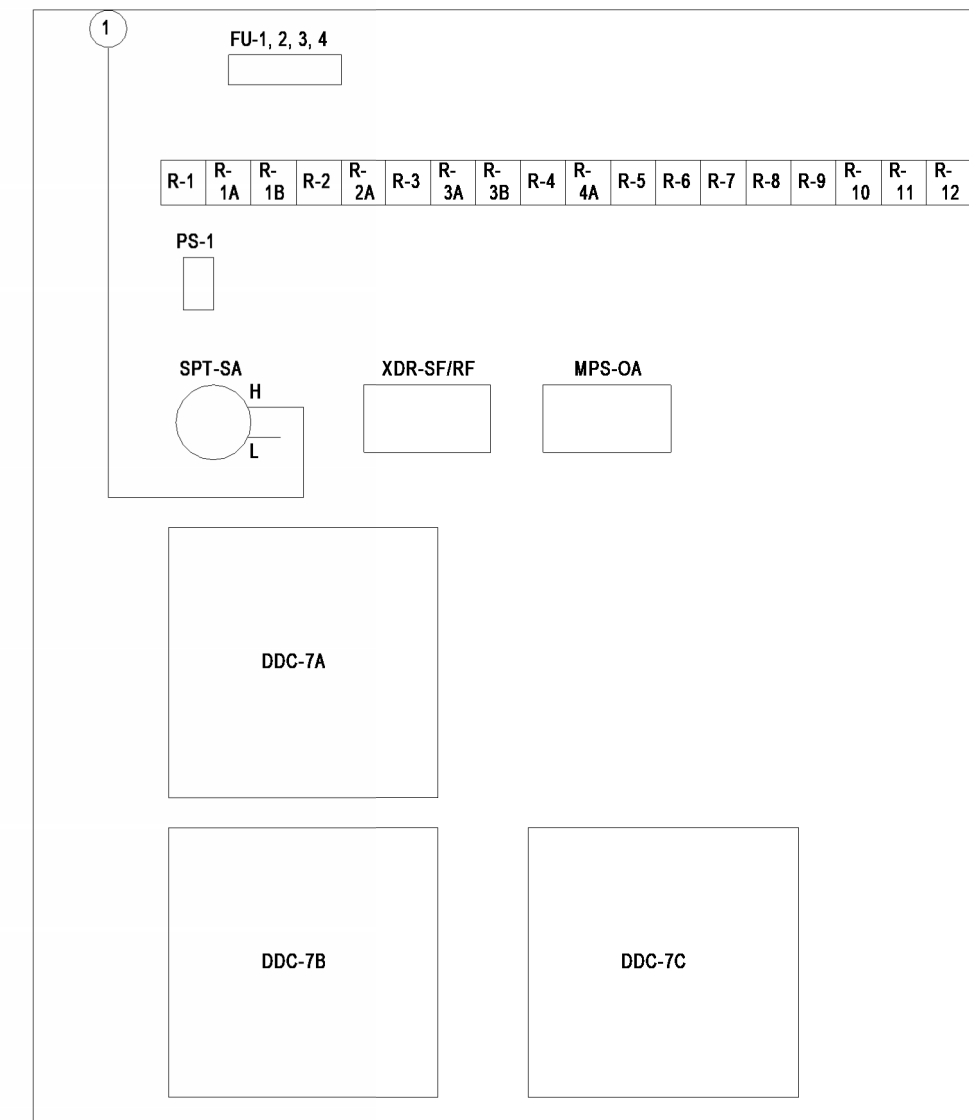

CLIENT/CMTA JOB #:	OLMS23
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CHECKED:	TLA

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BELOW: AIR HANDLING UNIT AH-7 (SERVES SCIENCE & CORE)



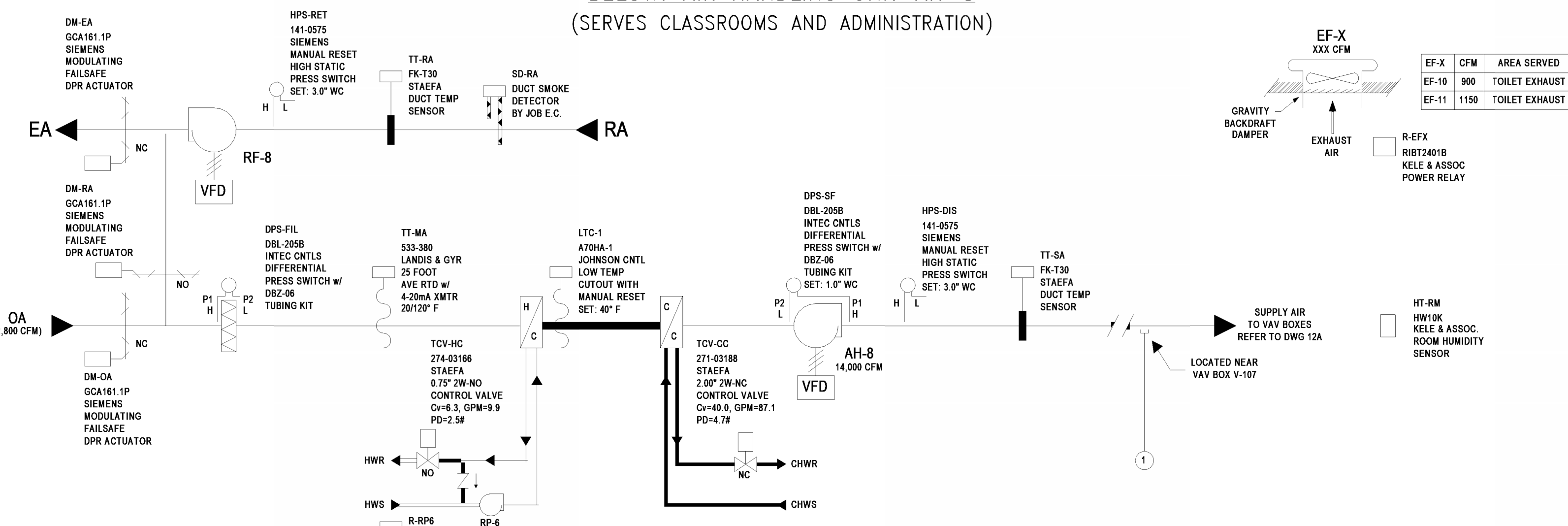
BELOW: CONTROL PANEL CP-7 INTERIOR



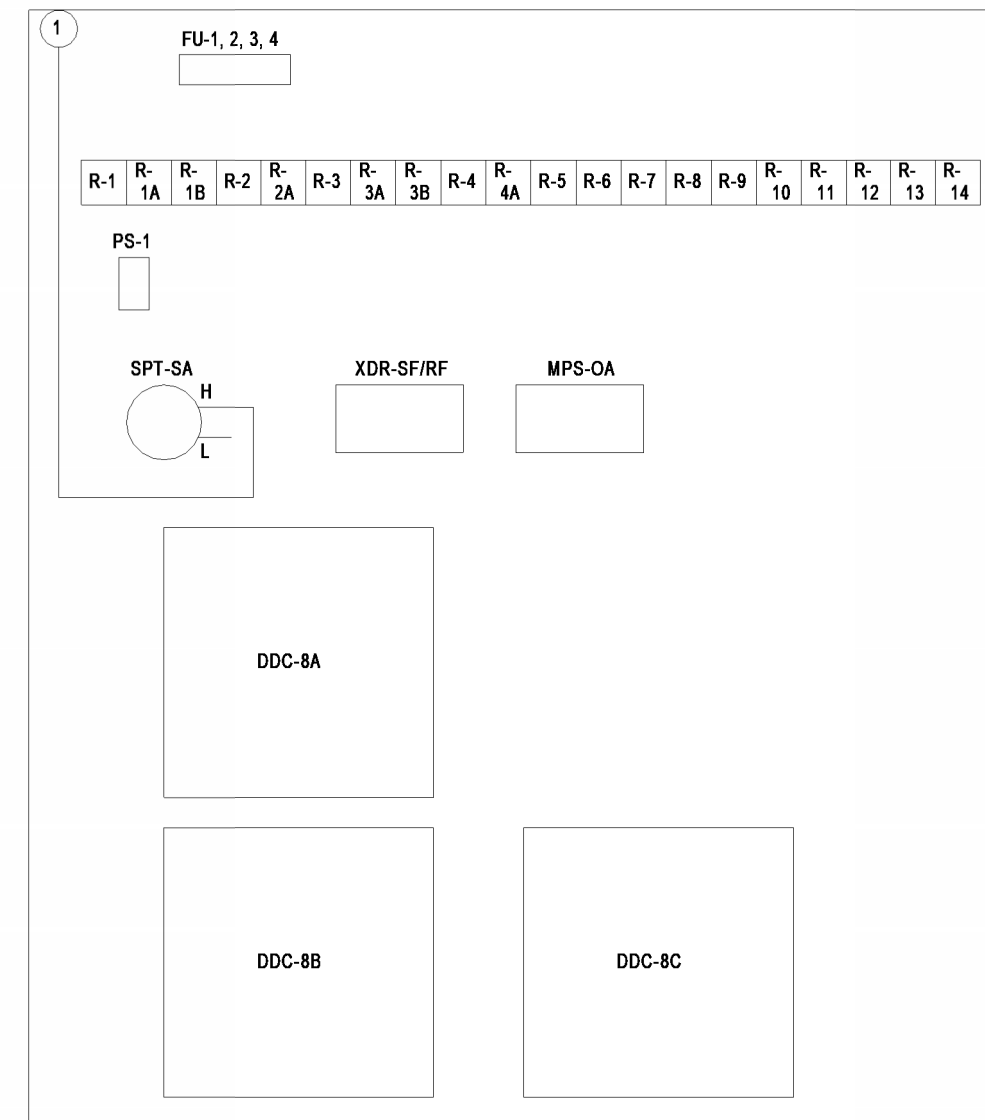
BELOW: CONTROL PANEL CP-7 DEVICES

- |   |  |  |   |
|---|--|--|---|
| CP-7<br>SCE423010LP<br>SAGINAW<br>CONTROL<br>ENCLOSURE w/<br>SCE 42P30<br>SUB-PANEL         | R-1 THRU R-12<br>19 REQ'D<br>LY2AC24<br>NSF8<br>OMRON<br>DPDT RELAY<br>24V AC COIL w/<br>PT100-E<br>BASE | MPS-OA<br>SG424<br>BEILMO<br>POSITIONING<br>SWITCH                     | NSFB-SFRF<br>1 REQ'D<br>NSFB<br>ATKINSON ELEC<br>NOISE SUPPRESSION<br>FILTER BOARD                    |
| TX-1<br>1 REQ'D<br>691-U100<br>KELE & ASSOC<br>TRANSFORMER<br>CLASS 2<br>1300V AC<br>100 VA | PS-1<br>1 REQ'D<br>IP5204<br>ATKINSON ELEC<br>ISOLATED<br>POWER SUPPLY<br>24V AC INPUT<br>24V DC OUTPUT  | SPT-SA<br>SM2-DPX<br>STAEFA<br>DIFFERENTIAL<br>PRESSURE<br>TRANSMITTER | DDC-7A, 7B, 7C<br>3 REQ'D<br>SM2-DDC660<br>STAEFA<br>DIRECT DIGITAL<br>CONTROLLER<br>0/10V DC OUTPUTS |

BELOW: AIR HANDLING UNIT AH-8 (SERVES CLASSROOMS AND ADMINISTRATION)



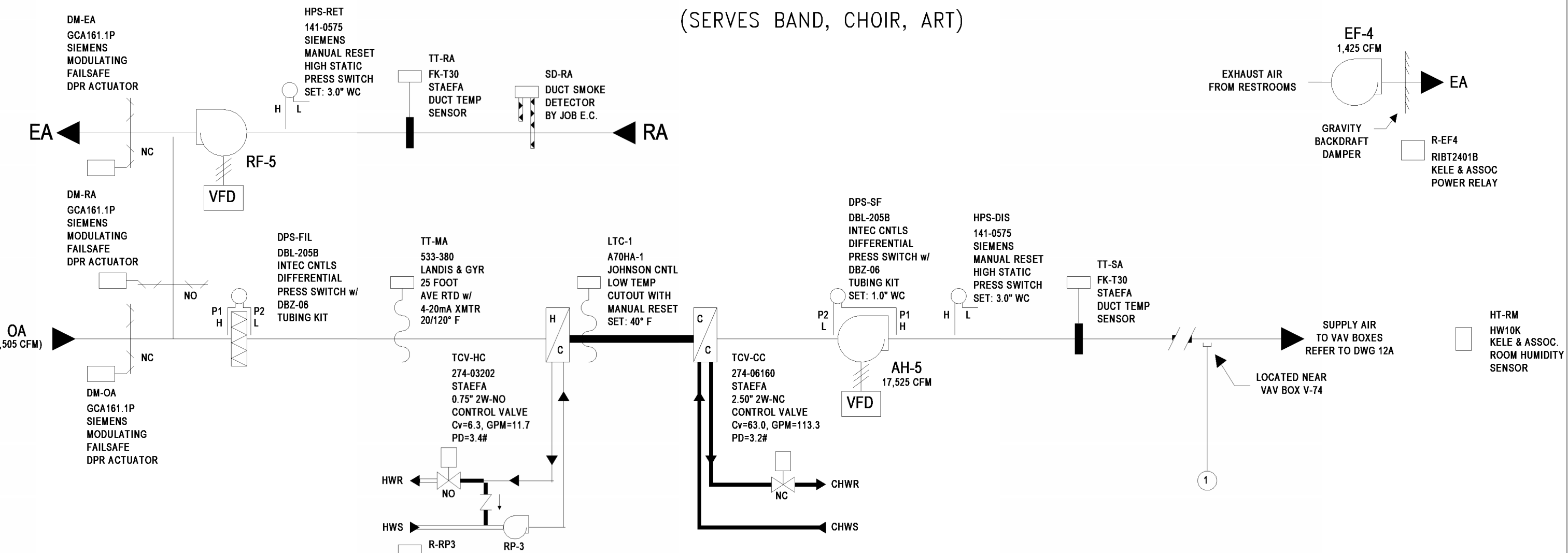
BELOW: CONTROL PANEL CP-8 INTERIOR



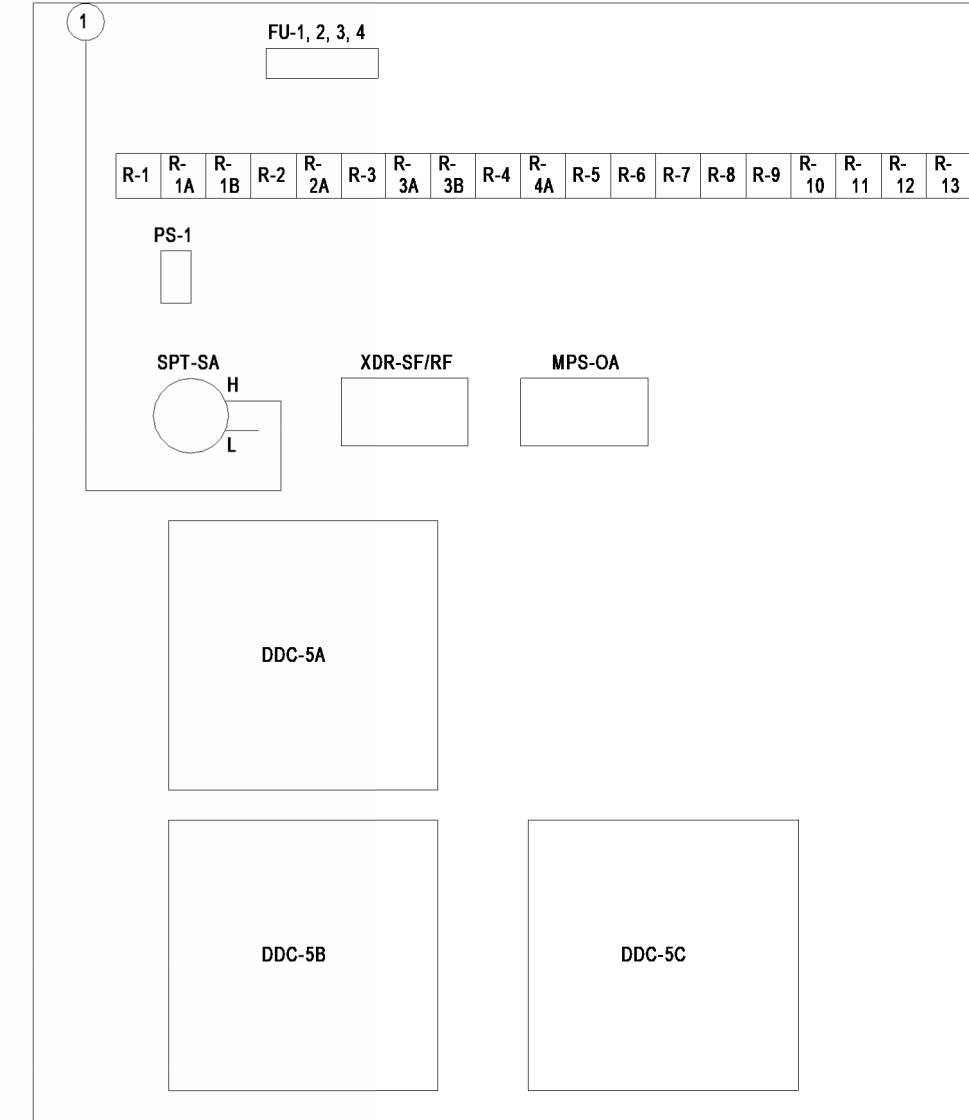
BELOW: CONTROL PANEL CP-8 DEVICES

- |   |  |  |   |
|---|--|--|---|
| CP-8<br>SCE423010LP<br>SAGINAW<br>CONTROL<br>ENCLOSURE w/<br>SCE 42P30<br>SUB-PANEL         | R-1 THRU R-14<br>19 REQ'D<br>LY2AC24<br>NSF8<br>OMRON<br>DPDT RELAY<br>24V AC COIL w/<br>PT100-E<br>BASE | MPS-OA<br>SG424<br>BEILMO<br>POSITIONING<br>SWITCH                     | NSFB-SFRF<br>1 REQ'D<br>NSFB<br>ATKINSON ELEC<br>NOISE SUPPRESSION<br>FILTER BOARD                    |
| TX-1<br>1 REQ'D<br>691-U100<br>KELE & ASSOC<br>TRANSFORMER<br>CLASS 2<br>1300V AC<br>100 VA | PS-1<br>1 REQ'D<br>IP5204<br>ATKINSON ELEC<br>ISOLATED<br>POWER SUPPLY<br>24V AC INPUT<br>24V DC OUTPUT  | SPT-SA<br>SM2-DPX<br>STAEFA<br>DIFFERENTIAL<br>PRESSURE<br>TRANSMITTER | DDC-8A, 8B, 8C<br>3 REQ'D<br>SM2-DDC660<br>STAEFA<br>DIRECT DIGITAL<br>CONTROLLER<br>0/10V DC OUTPUTS |

BELOW: AIR HANDLING UNIT AH-5 (SERVES BAND, CHOIR, ART)



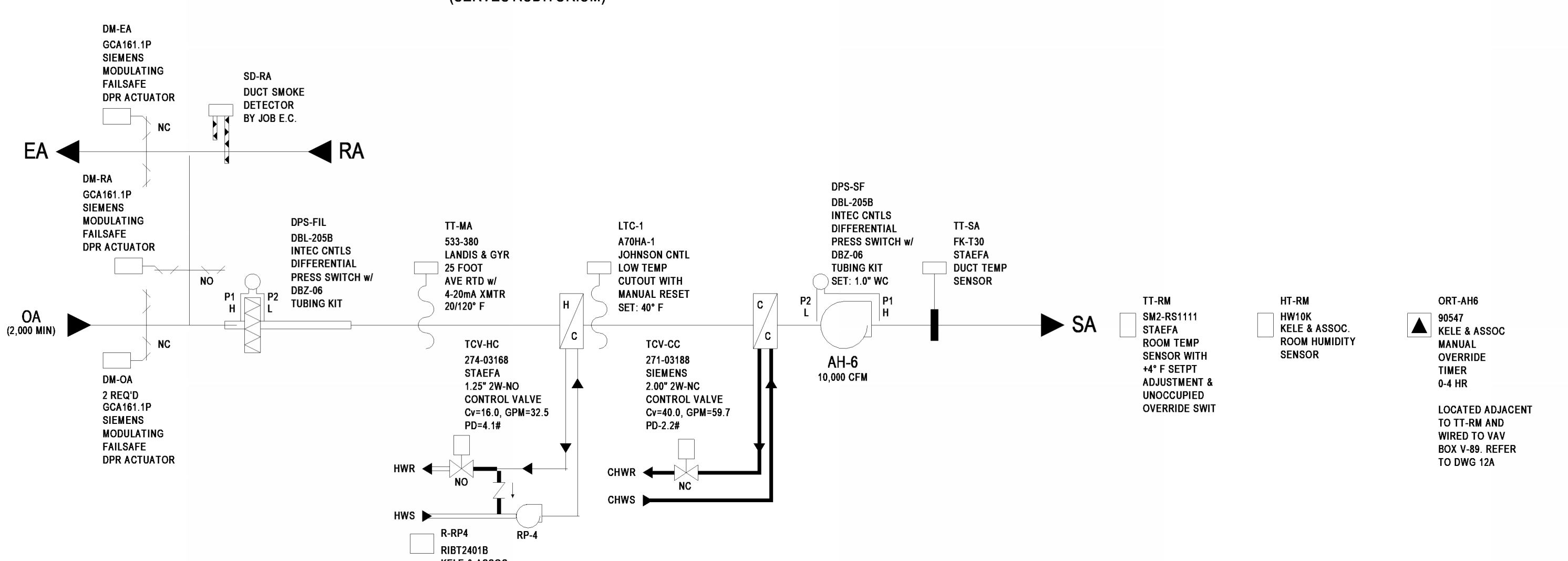
BELOW: CONTROL PANEL CP-5 INTERIOR



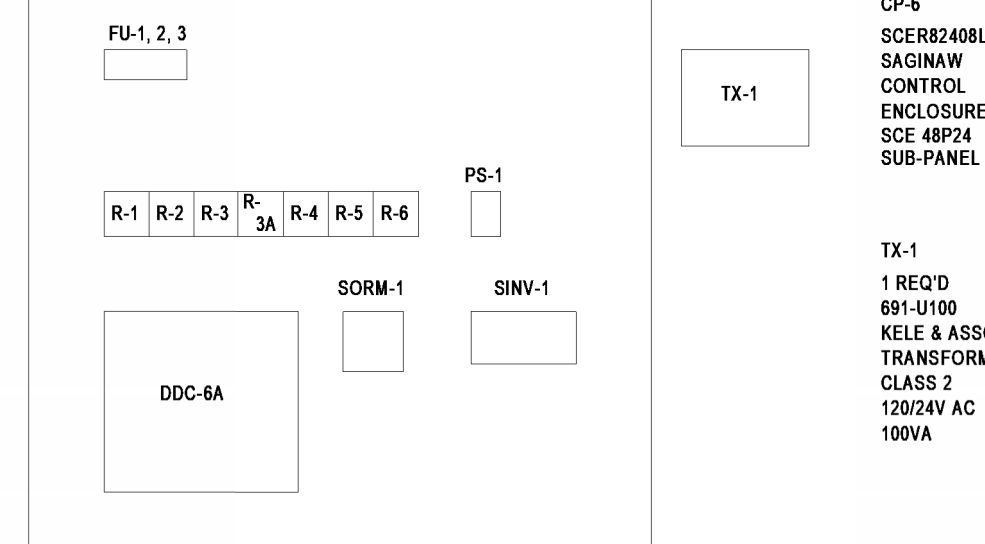
BELOW: CONTROL PANEL CP-5 DEVICES

- |   |  |  |   |
|---|--|--|---|
| CP-5<br>SCE423010LP<br>SAGINAW<br>CONTROL<br>ENCLOSURE w/<br>SCE 42P30<br>SUB-PANEL         | R-1 THRU R-13<br>19 REQ'D<br>LY2AC24<br>NSF8<br>OMRON<br>DPDT RELAY<br>24V AC COIL w/<br>PT100-E<br>BASE | MPS-OA<br>SG424<br>BEILMO<br>POSITIONING<br>SWITCH                     | NSFB-SFRF<br>1 REQ'D<br>NSFB<br>ATKINSON ELEC<br>NOISE SUPPRESSION<br>FILTER BOARD                    |
| TX-1<br>1 REQ'D<br>691-U100<br>KELE & ASSOC<br>TRANSFORMER<br>CLASS 2<br>1300V AC<br>100 VA | PS-1<br>1 REQ'D<br>IP5204<br>ATKINSON ELEC<br>ISOLATED<br>POWER SUPPLY<br>24V AC INPUT<br>24V DC OUTPUT  | SPT-SA<br>SM2-DPX<br>STAEFA<br>DIFFERENTIAL<br>PRESSURE<br>TRANSMITTER | DDC-5A, 5B, 5C<br>3 REQ'D<br>SM2-DDC660<br>STAEFA<br>DIRECT DIGITAL<br>CONTROLLER<br>0/10V DC OUTPUTS |

BELOW: AIR HANDLING UNIT AH-6 (SERVES AUDITORIUM)

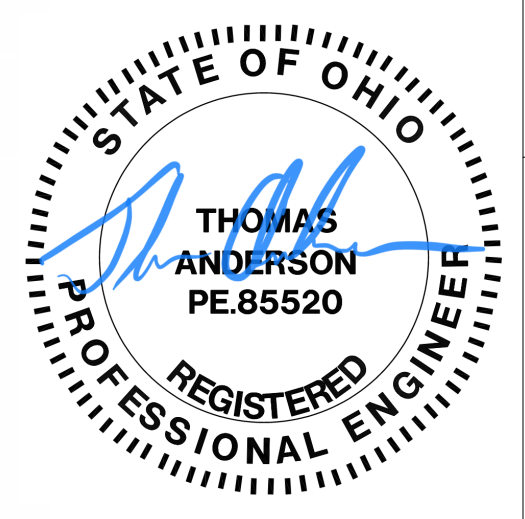


BELOW: CONTROL PANEL CP-6 INTERIOR



BELOW: CONTROL PANEL CP-6 DEVICES

- |   |   |  |  |
|---|---|--|--|
| CP-6<br>SCE423010LP<br>SAGINAW<br>CONTROL<br>ENCLOSURE w/<br>SCE 42P30<br>SUB-PANEL         | R-1 THRU R-6<br>7 REQ'D<br>LY2AC24<br>NSF8<br>OMRON<br>DPDT RELAY<br>24V AC COIL<br>PT100-E<br>BASE     | SORM-1<br>1 REQ'D<br>SM2-INC660<br>STAEFA<br>SIGNAL<br>DIRECT DIGITAL<br>CONTROLLER w/<br>MODULE         | DDC-6A<br>1 REQ'D<br>SM2-DDC660<br>STAEFA<br>DIRECT DIGITAL<br>CONTROLLER w/<br>0/10V DC OUTPUTS |
| TX-1<br>1 REQ'D<br>691-U100<br>KELE & ASSOC<br>TRANSFORMER<br>CLASS 2<br>1300V AC<br>100 VA | PS-1<br>1 REQ'D<br>IP5204<br>ATKINSON ELEC<br>ISOLATED<br>POWER SUPPLY<br>24V AC INPUT<br>24V DC OUTPUT | SNV-1<br>1 REQ'D<br>SNR810-10V<br>ATKINSON ELEC<br>SIGNAL<br>INVERTER<br>0-10V DC INPUT<br>10V DC OUTPUT |  |



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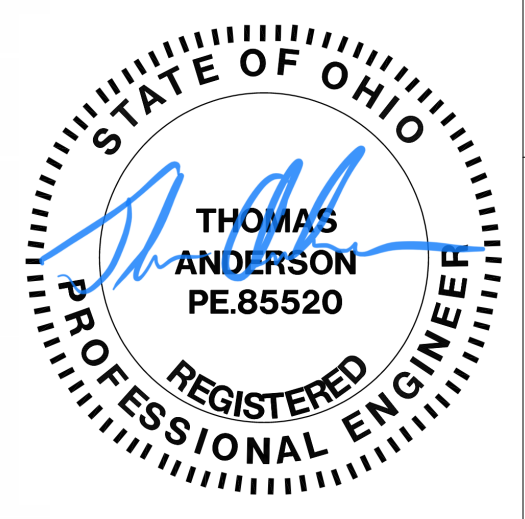
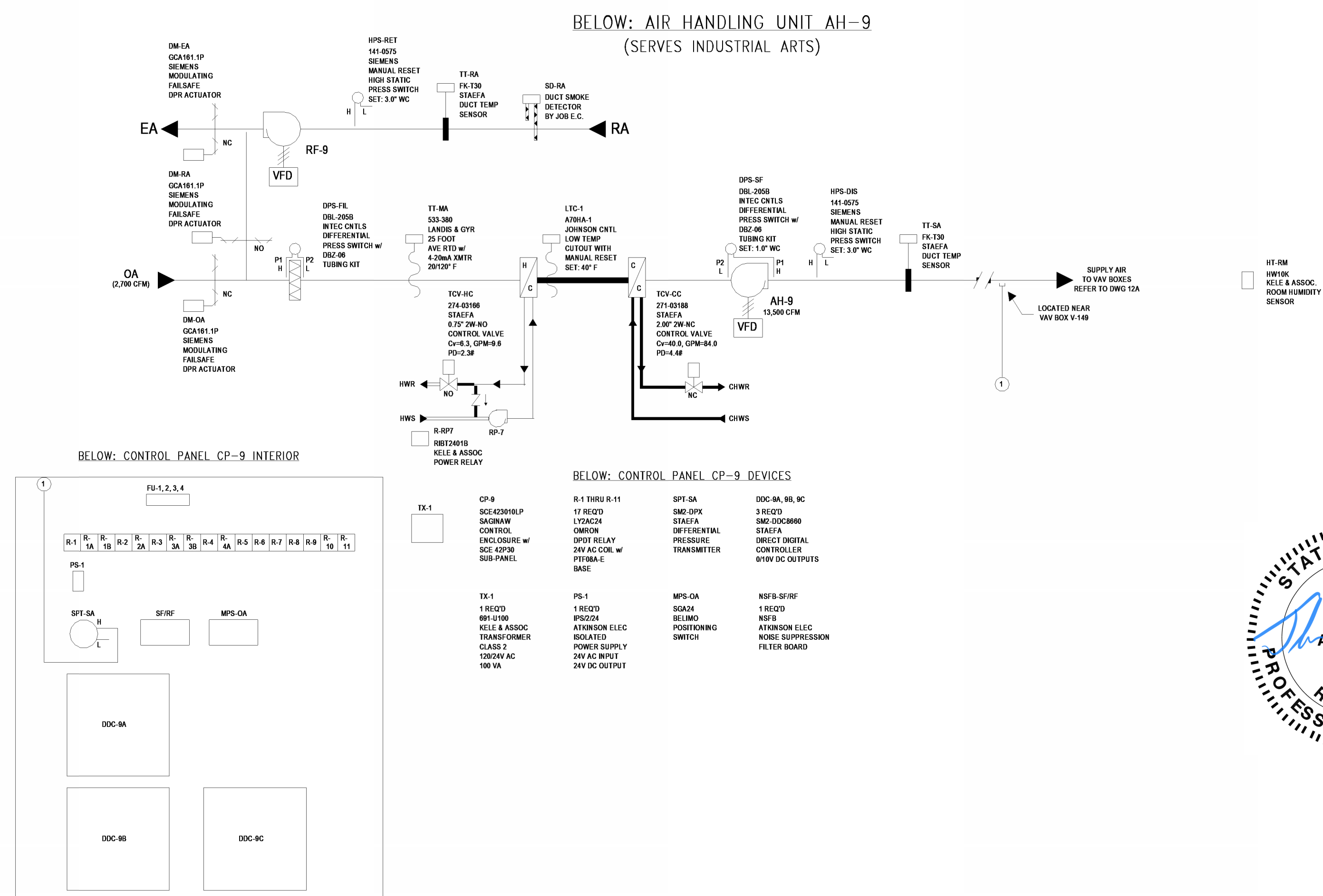
BID DOCUMENTS

LOVELAND MIDDLE SCHOOL HVAC CONTROLS UPDATE

LOVELAND CITY SCHOOL DISTRICT

801 S Lebanon Rd., Loveland, OH 45140

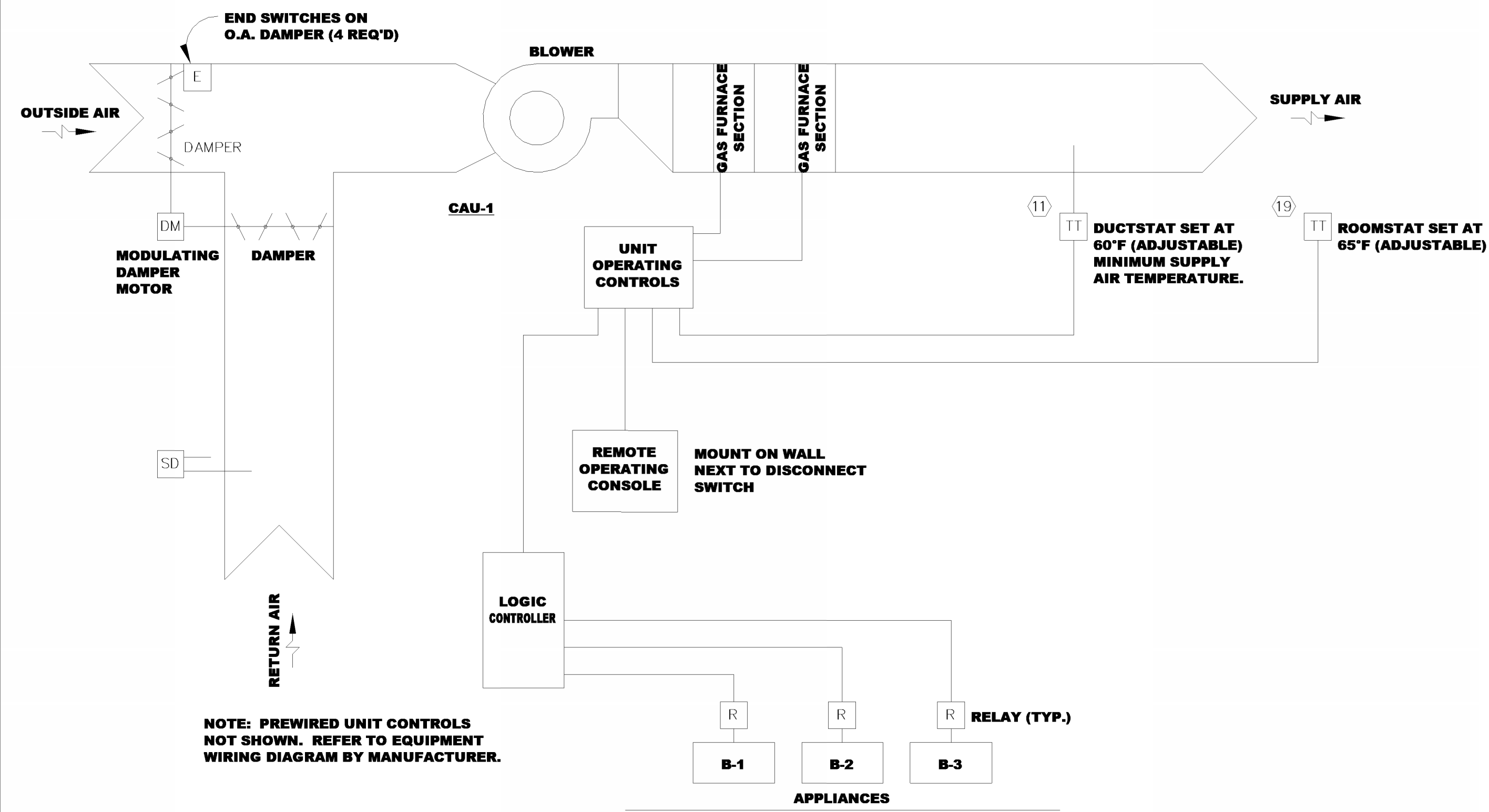
EXISTING CONTROLS DIAGRAMS



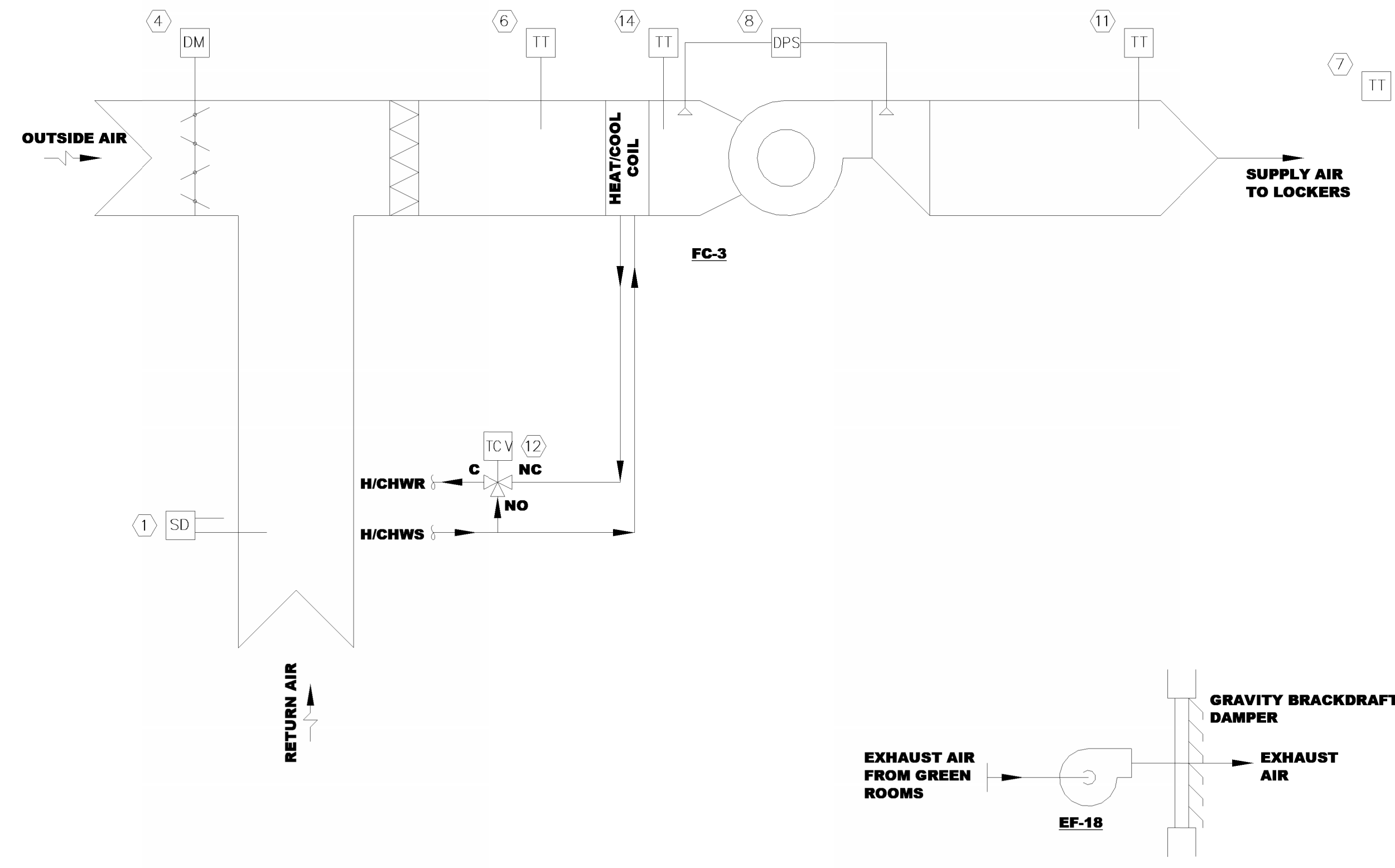
CLIENT/CMTA JOB #:	OLMS23
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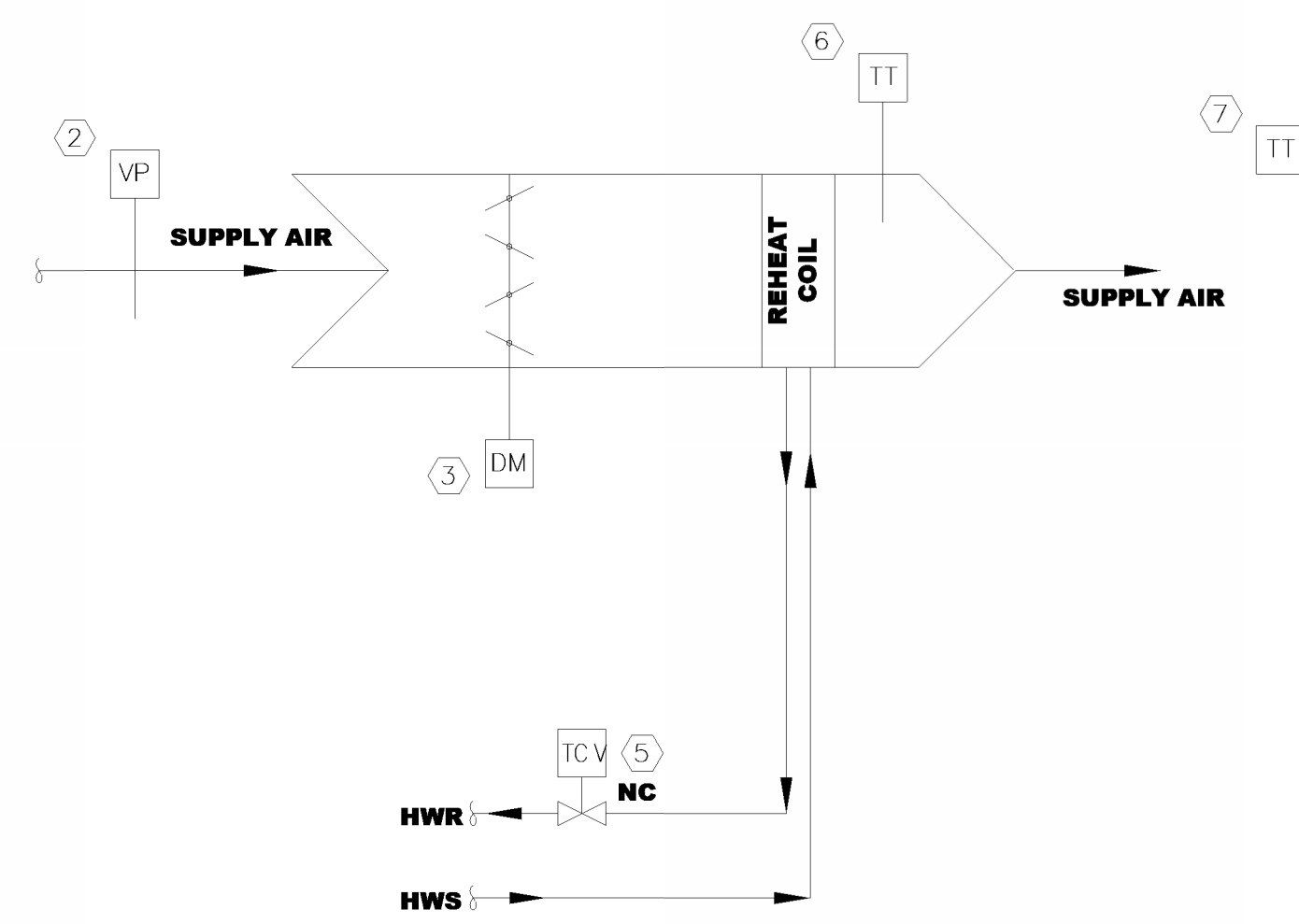

M402



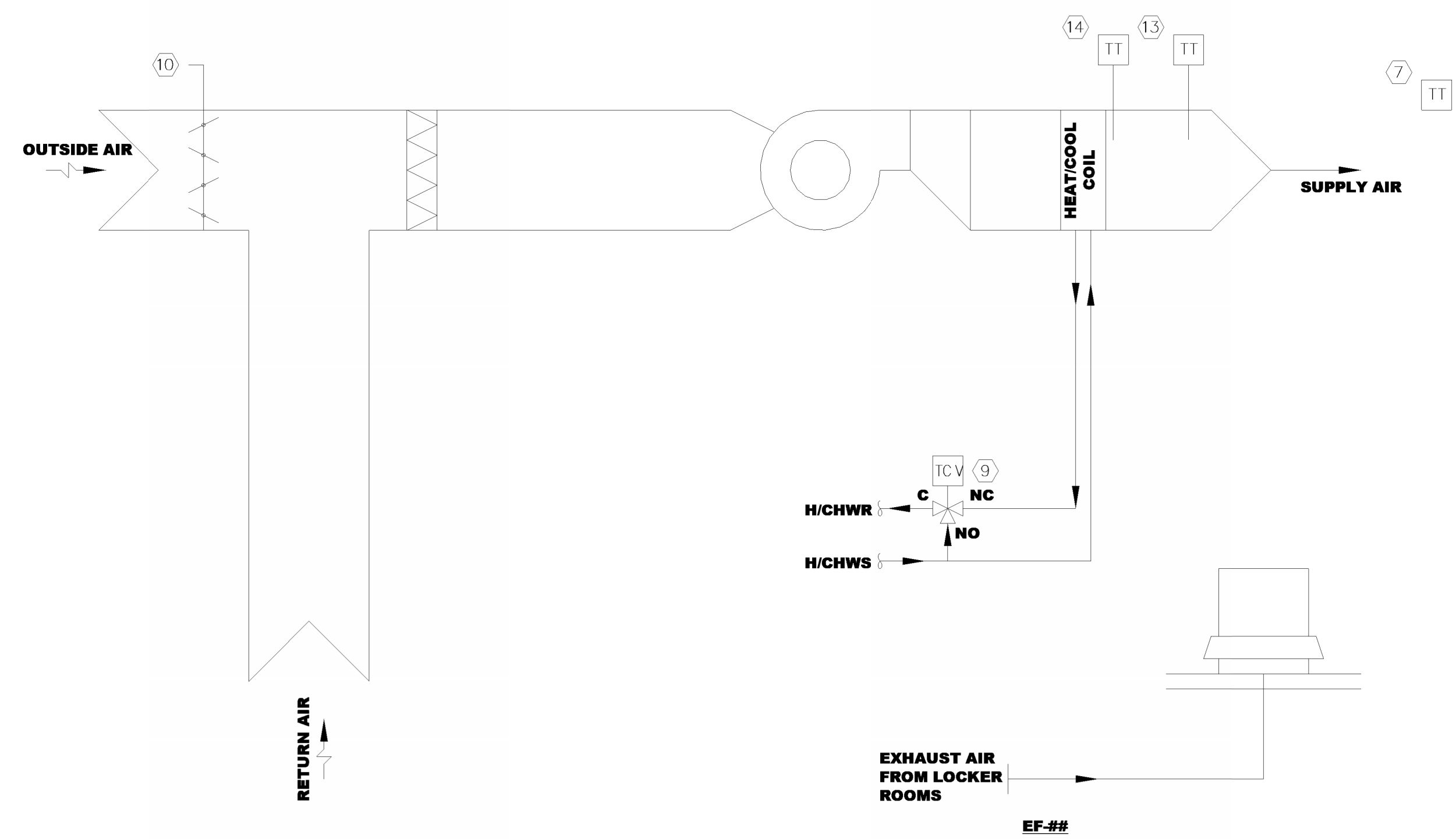
**COMBUSTION AIR UNIT CAU-1 CONTROL DIAGRAM**  
SCALE: NONE



**FAN COIL UNIT FC-4 CONTROL DIAGRAM**  
SCALE: NONE



**VARIABLE AIR VOLUME BOX CONTROL DIAGRAM**  
SCALE: NONE



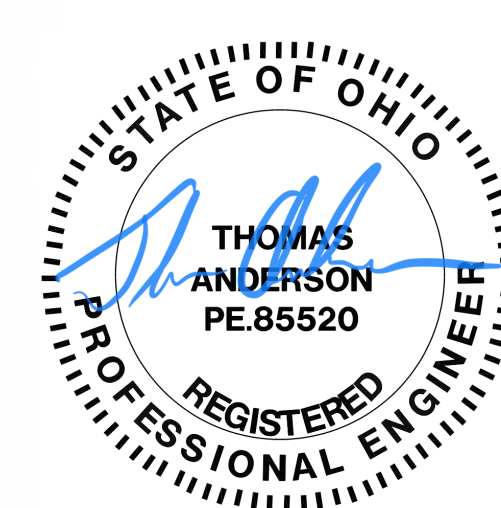
**FAN COIL UNIT FC-5,6,7,8.,9,10 CONTROL DIAGRAM**  
SCALE: NONE

Ⓞ DRAWING NOTES:

- ① SD-RA, DUCT SMOKE DETECTOR.
- ② DM-OA, ASU1D10/F, STAEFFA, MODULATING FAILSAFE DPR ACTUATOR.
- ③ TT-MA, FK-T30, STAEFFA, DUCT TEMP SENSOR.
- ④ TT-RM, SM2-RS1111, STAEFFA, ROOM TEMP SENSOR WITH 1/4" SET PT ADJUSTMENT AND OCCUPIED OVERRIDE SWITCH.
- ⑤ DPS-SF, DBL-205B, INTEC CONTROLS, DIFFERENTIAL PRESS SWITCH W/ DBZ-06 TUBING KIT, SET 1.0" WC.
- ⑥ TCV-HC, M3P, STAEFFA, 3W-NC,
- ⑦ OA AIR DUCT AND MANUAL BALANCING DAMPER PRESENT ON FC-5,6,7 AND 8. FC-9 AND 10 ARE 100% OA UNITS.
- ⑧ TT-SA, FK-T30, STAEFFA, DUCT TEMP SENSOR.
- ⑨ TCV-HC, M3P256/C1, STAEFFA, 1.0" 3W-NC, CNTL VALVE, Cv=9.3, GPM=14, PD=2.3#.
- ⑩ TT-SA, FB-KT30/C2, STAEFFA, DUCT TEMP SENSOR.
- ⑪ TT-FZ, FREEZESTAT.

Ⓞ DRAWING NOTES:  
EXISTING EQUIPMENT

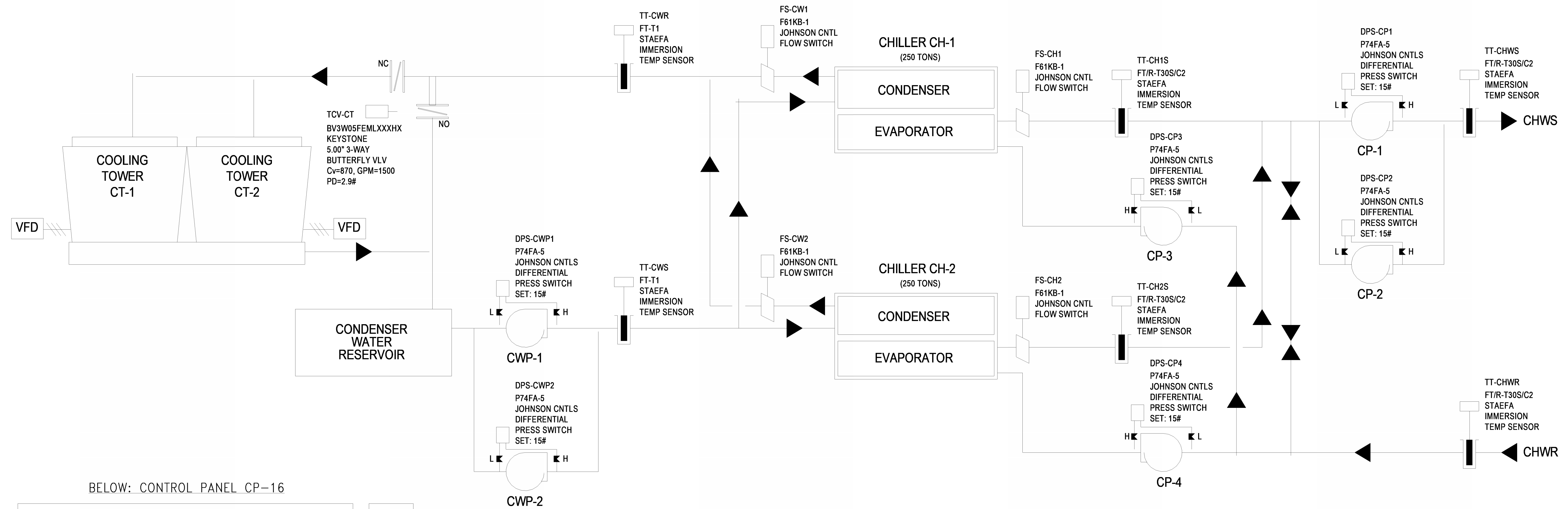
- ① VP-1, SM2-SVP, STAEFFA, THERMAL ANEMOMETER VELOCITY SENSOR.
- ② DM-1, EM402-102, STAEFFA, DAMPER ACTUATOR.
- ③ TCV-RHC, INTEC, 2W-NC, CNTL VALVE.
- ④ TT-SA, FB-KT30/C2, STAEFFA, DUCT TEMP SENSOR.
- ⑤ TT-RM, SM2-RS1111, STAEFFA, ROOM TEMP SENSOR WITH 1/4" SET PT ADJUSTMENT AND OCCUPIED OVERRIDE SWITCH.



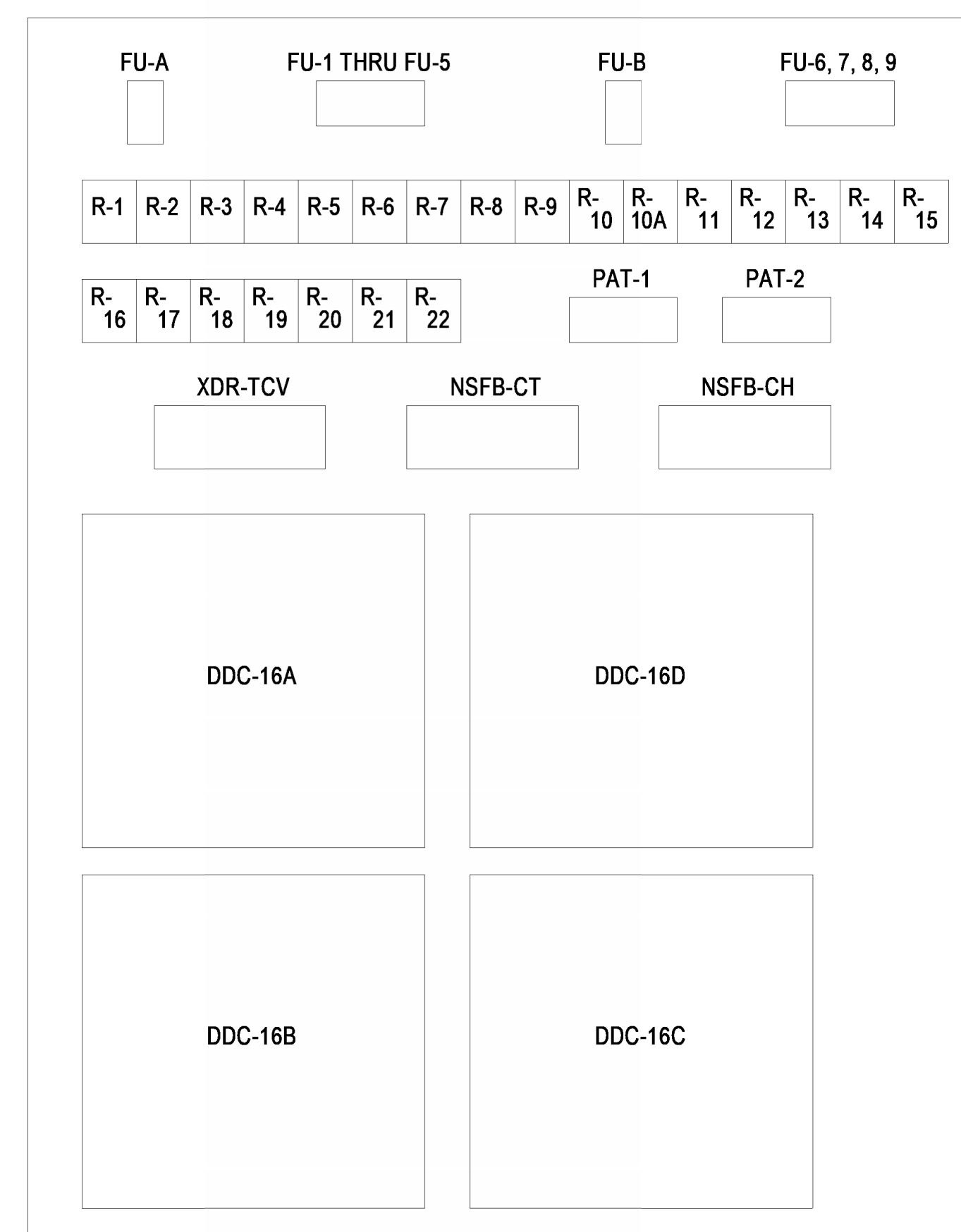
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BELOW: CHILLED WATER SYSTEM



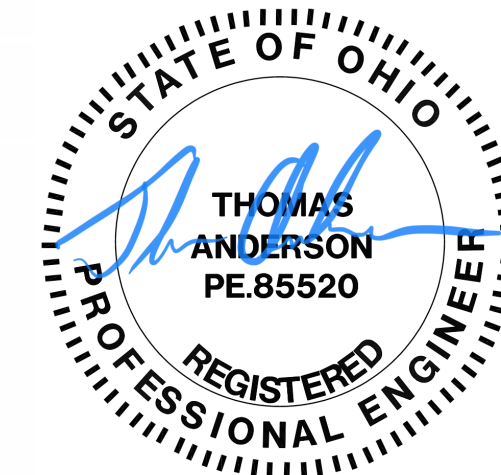
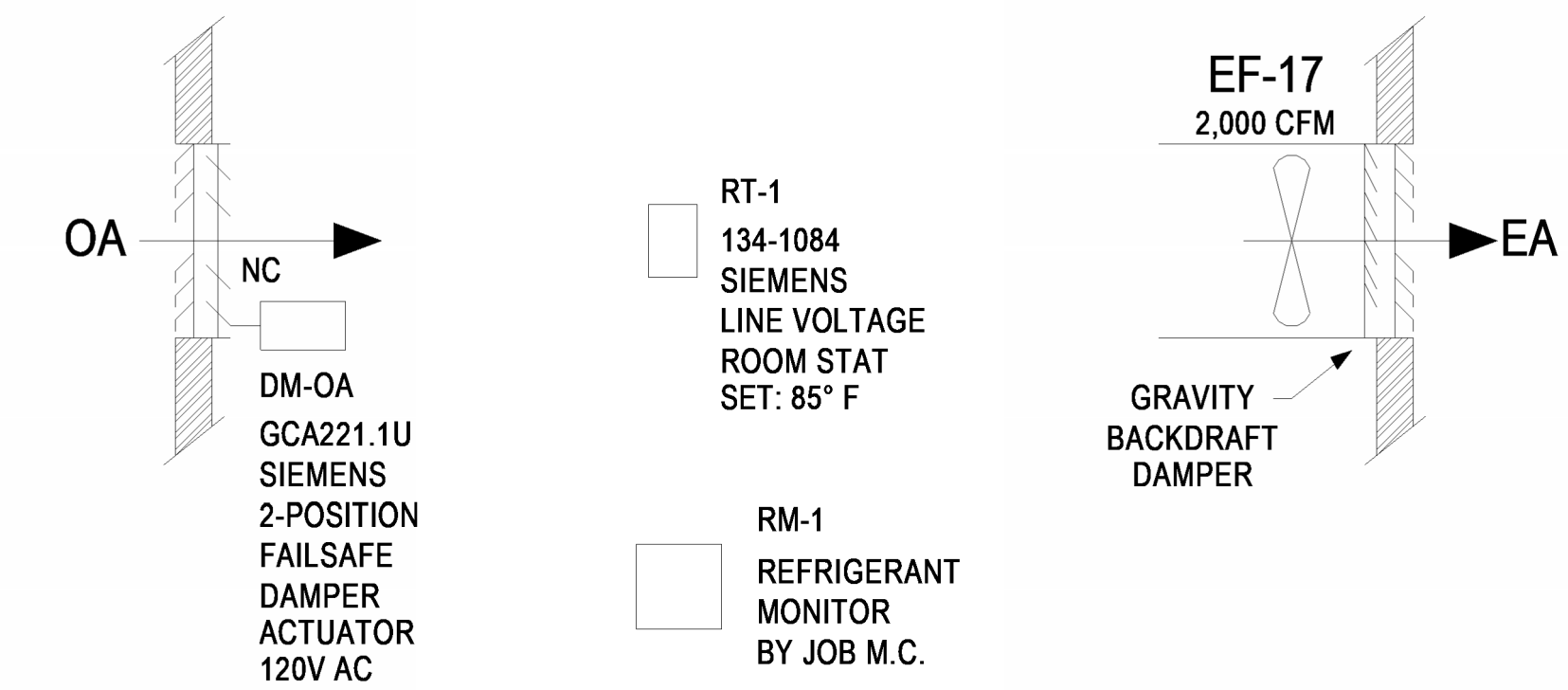
BELOW: CONTROL PANEL CP-16



BELOW: CONTROL PANEL CP-16 DEVICES

CP-16 SCE483010LP SAGINAW CONTROL ENCLOSURE w/ SCE 48P30 SUB-PANEL	R-1 THRU R-22 22 REQ'D LY2AC24 OMRON DPDT RELAY 24V COIL w/ PTF08A-E SOCKET	NSFB-CT, CH 2 REQ'D NSFB ATKINSON ELEC NOISE SUPPRESSION FILTER BOARD	PAT-1, 2 KELE MPA-2 KWH PULSE TO KW 4-20mA TRANSDUCER
TX-1, 2 2 REQ'D 691-U100 KELE & ASSOC TRANSFORMER CLASS 2 120/24V AC 100 VA	XDR-TCV 1 REQ'D DISM-E/2 ATKINSON ELEC DUAL ISOLATED SIGNAL MODULE 0-10V DC INPUTS 0-10V DC OUTPUTS	DDC-16A, 16B, 16C, 16D 4 REQ'D SM2-DDC8660 STAEFA DIRECT DIGITAL CONTROLLER w/ 0/10VDC OUTPUTS	

BELOW: MECHANICAL EQUIPMENT ROOM #66 VENTILATION



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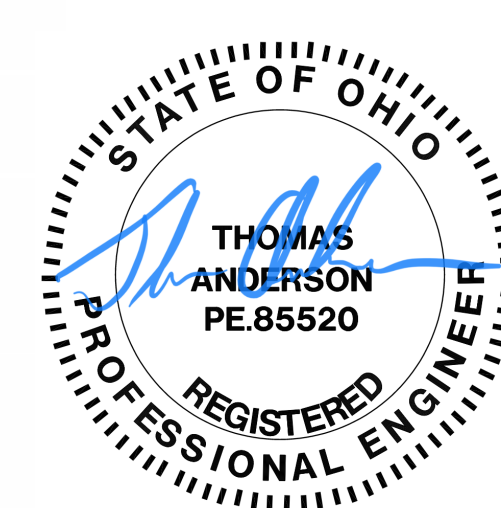
REVISIONS


M500

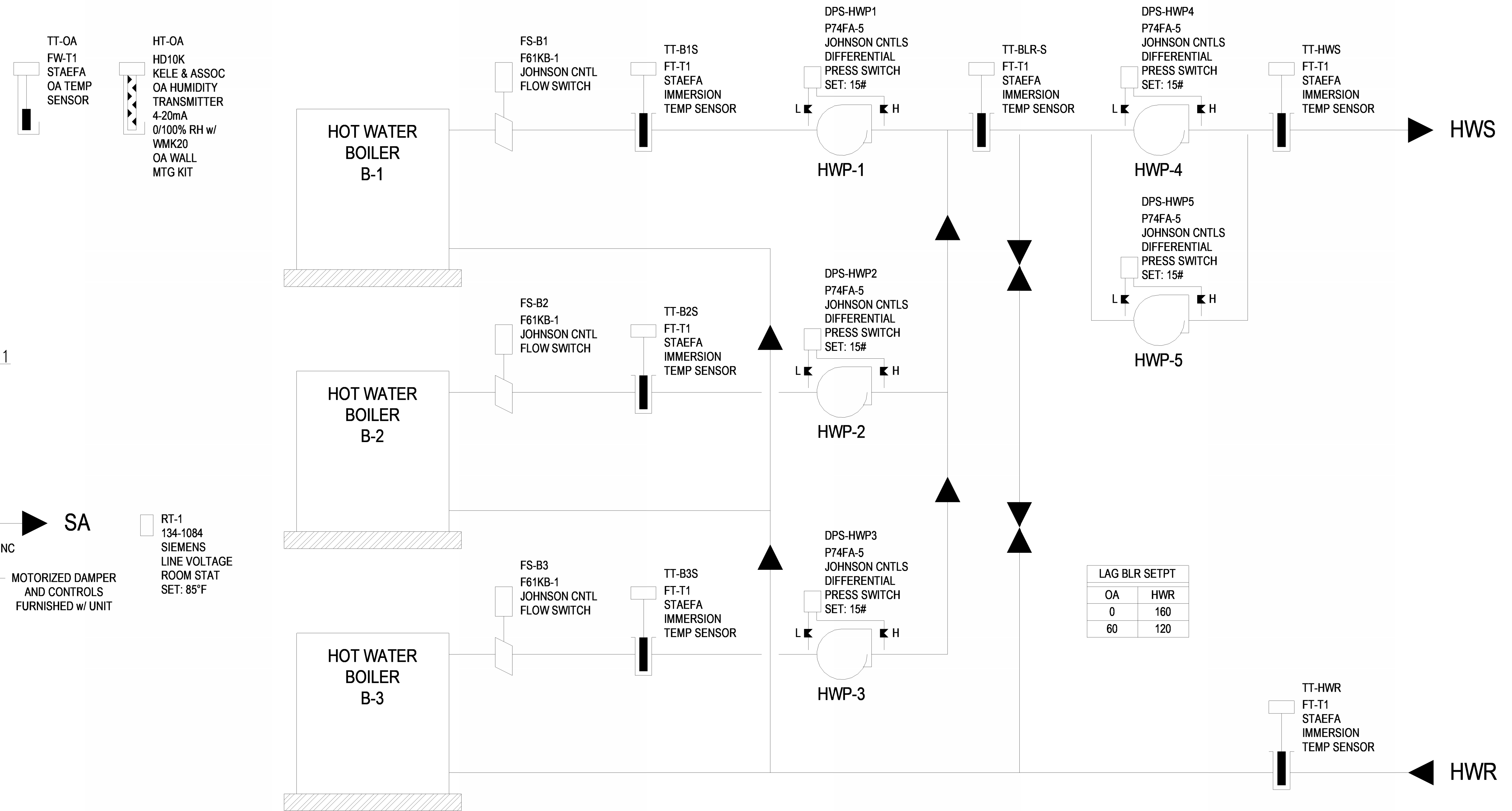
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CHECKED:	TLA

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M501

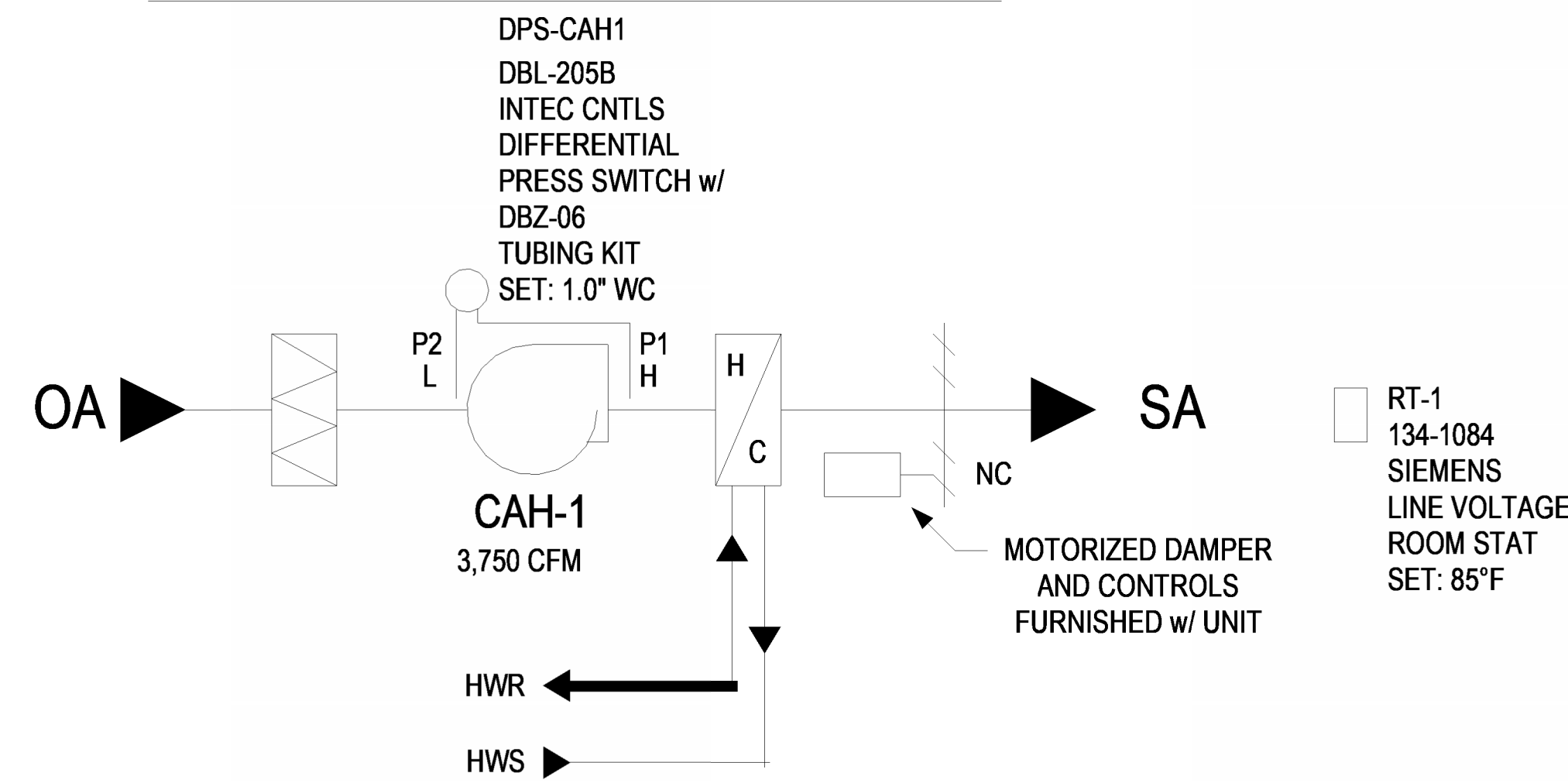


BELOW: HEATING HOT WATER SYSTEM

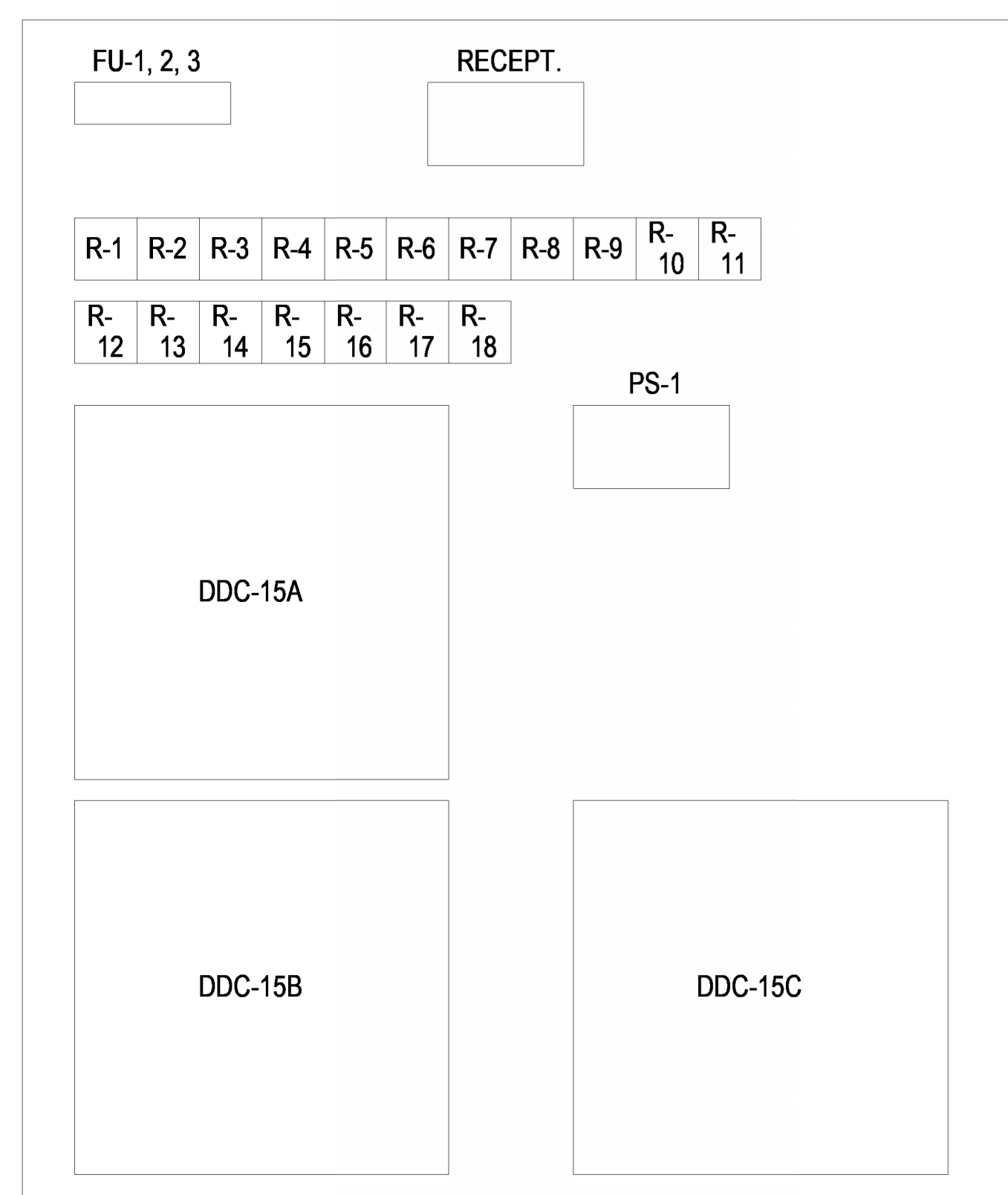


OA	HWR
0	160
60	120

BELOW: COMBUSTION AIR HEATER CAH-1



BELOW: CONTROL PANEL CP-15 INTERIOR



BELOW: CONTROL PANEL CP-15 DEVICES

TX-1	CP-1 SCE483010LP SAGINAW CONTROL ENCLOSURE w/ SCE 48P30 SUB-PANEL	R-1 THRU R-18 18 REQ'D LY2AC24 OMRON DPDT RELAY 24V AC COIL w/ PTF08A-E BASE	DDC-15A, 15B, 15C 3 REQ'D SM2-DDC8660 STAEFA DIRECT DIGITAL CONTROLLER 0/10V OUTPUTS
TX-2	TX-1, 2 2 REQ'D 691-U100 KELE & ASSOC TRANSFORMER CLASS 2 120/24V AC 100VA	PS-1 1 REQ'D IPS-2/24 ATKINSON ELEC 2-CHANNEL ISOLATED POWER SUPPLY 24V AC INPUT 24V DC OUTPUT	PB-1 1 REQ'D 800T-A2A ALLEN-BRADLEY MOMENTARY PUSHBUTTON w/ 800T-X538 LEGEND *ALARM RESET*