ADVERTISEMENT FOR BIDS

Sealed bids will be received and publicly read by the Purchasing Department of The University of Louisiana at Monroe, via mail or delivered to Coenen Hall Room 140, 4014 LaSalle Street, Monroe, LA 71209-2250 at 2:00 P.M., July 22, 2025 for the following:

Bid #50006-074 – Warhawk Baseball Stadium HVAC Renovations

Any person requiring special accommodations shall notify the purchasing department of the type(s) of accommodation required not less than seven (7) days before the bid opening.

Complete Bidding Documents may be obtained from: The University of Louisiana at Monroe, Purchasing Department, 4014 LaSalle St., Room 140, Monroe, Louisiana, 71209-2250, via fax request at 318.342.5218 or the State of Louisiana LaPac page: https://wwwcfprd.doa.louisiana.gov/osp/lapac/pubmain.cfm by using Bid No. 50006-074.

There will be a pre-bid meeting held on July 1, 2025 at 10:00 a.m. at ULM Warhawk Field at 322 Warhawk Way, Monroe, Louisiana, 71209. The Architect will be available to answer questions related to the plans and specifications.

All bids shall be accompanied by Bid Security in an amount of five percent (5.0%) of the sum of the base bid and all alternates. The form of this security shall be as stated in the Instruction to Bidders included in the Bid Documents for this project.

The successful Bidder shall be required to furnish a Performance Bond written as described in the Instruction to Bidders included in the Bid Documents for this project.

Bids shall be accepted from Contractors who are licensed under LA R.S. 37:2150-2192 in the areas of: Heat, Air Conditioning, Ventilation, Duct Work and Refrigeration. Bidder is required to comply with provisions and requirements of LA R.S. 38:2212(A)(1)(a). No bid may be withdrawn for a period of thirty (30) days after receipt of bids, except under the provisions of LA R.S. 38:2214.

The Owner reserves the right to reject any and all bids for just cause. In accordance with LA R.S. 38:2212(B)(2), the provisions and requirements of this Section, those stated in the advertisement for bids, and those required on the bid form shall not be considered as informalities and shall not be waived by any public entity.

STATE OF LOUISIANA

THE UNIVERSITY OF LOUISIANA MONROE
MONROE, LOUISIANA
A Member of the University of Louisiana System

INVITATION TO BID
FOR
BID NO. 50006-074
Warhawk Baseball Stadium HVAC Renovations

ISSUING AGENCY:	The University of Louisiana Monroe Purchasing Department 700 University Avenue, Coenen Hall 140 Monroe, LA 71209
PROCUREMENT SPECIALIST:	Shakeya Bennett/Email: rodgers@ulm.edu
Telephone:	318.342.5208
REQUISITIONED BY:	Michael Davis
Telephone:	318.342.5171
RELEASE DATE:	June 17, 2025
OPENING DATE:	July 22, 2025
BID OPENING TIME:	2:00 p.m., Central Time
BID OPENING LOCATION:	The University of Louisiana at Monroe Purchasing Department Coenen Hall 140 700 University Avenue Monroe, La 71209

This ITB is available in electronic form at https://wwwcfprd.doa.louisiana.gov/osp/lapac/pubmain.cfm. It is in printed form by submitting a written request to the email listed above. It is the Bidder's responsibility to check the Office of State Purchasing LaPAC website frequently for any possible addenda that may be issued. ULM is not responsible for a bidder's failure to download any addenda documents required to complete an Invitation to Bid.

Notice To Vendors This Is Not An Order. It Is Merely A Request For Prices	**THE UNIVERSITY OF LOUISIANA AT MONROE** **Monroe, Louisiana** **REQUEST FOR QUOTATION** Facilities **Department**	**DATE** **June 17, 2025**	**Date and Time by Which Quotation Must be Returned:** **July 22, 2025 at 2:00 pm**

Name and Address of Vendor (Firm or Individual)

PURCHASE REQUISITION NO. R0030394 BID 50006-074 P. O. No.

TO THE VENDOR:

To be returned on or before date specified above to:

THE UNIVERSITY OF LOUISIANA AT MONROE
PURCHASING DEPARTMENT
4014 LASALLE ST, COENEN BLDG. 140
MONROE, LOUISIANA 71209-2250

NOTE: THE UNIVERSITY RESERVE THE RIGHT TO ACCEPT OR REJECT ANY OR ALL BIDS, AND WAIVE INFORMALITIES

THIS BID IS DUE IN PURCHASING OFFICE AS STATED ABOVE
LATE BIDS NOT ACCEPTED

INSTRUCTIONS TO BIDDERS:

1. READ THE ENTIRE BID, INCLUDING ALL TERMS AND CONDITIONS AND SPECIFICATIONS.
2. ALL BID PRICES MUST BE TYPED OR WRITTEN IN INK. ANY CORRECTIONS, ERASURES OR OTHER FORMS OF ALTERATION TO UNIT PRICES SHOULD BE INITIALED BY THE BIDDER.
3. THIS BID IS TO BE MANUALLY SIGNED IN INK.
4. BID PRICES SHALL INCLUDE DELIVERY OF ALL ITEMS FREIGHT ON BOARD (FOB) DESTINATION OR AS OTHERWISE PROVIDED. BIDS CONTAINING "PAYMENT IN ADVANCE" OR CASH ON DELIVERY (COD) REQUIREMENTS MAY BE REJECTED. PAYMENT IS TO BE MADE WITHIN 30 DAYS AFTER RECEIPT OF PROPERLY EXECUTED INVOICE OR DELIVERY, WHICHEVER IS LATER.
5. BIDS SUBMITTED ARE SUBJECT TO PROVISIONS OF THE LAWS OF THE STATE OF LOUISIANA INCLUDING BUT NOT LIMITED TO L.R.S. 39:1551-1736; PURCHASING RULES AND REGULATIONS; EXECUTIVE ORDERS; STANDARD TERMS AND CONDITIONS; SPECIAL CONDITIONS; AND SPECIFICATIONS LISTED IN THIS SOLICITATION.
6. THIS IS A SEALED BID. MUST BE MAILED OR DELIVERED TO THE PURCHASING DEPARTMENT, COENEN HALL 140, 700 UNIVERSITY AVE, MONROE LA 71209.
7. TO ASSURE CONSIDERATION OF YOUR BID, ALL BIDS AND ADDENDA SHOULD BE RETURNED IN AN ENVELOPE OR PACKAGE CLEARLY MARKED WITH THE BID NUMBER.
8. BIDS OR QUOTATIONS MAY BE CONSIDERED FOR ALL OR PART OF TOTAL QUANTITIES.
9. NOTE: A COMPLETE RECORD OF ALL BIDS IS KEPT ON FILE IN THE PURCHASING DEPARTMENT SUBJECT TO THE INSPECTIONS OF ANY CITIZEN. EVERY COURTESY WILL BE AFFORDED ANY CITIZEN WHO IS INTERESTED IN INVESTIGATING FOR ANY PURPOSE THE RECORD OF STATE PURCHASES. COPIES OF EVALUATION CAN BE FAXED TO YOU ONLY AFTER RECEIPT OF WRITTEN REQUEST. PLEASE DO NOT CALL.
10. IMPORTANT: BY SIGNING THE BID, THE BIDDER CERTIFIES COMPLIANCE WITH ALL INSTRUCTIONS TO BIDDERS, TERMS, CONDITIONS AND SPECIFICATIONS, AND FURTHER CERTIFIES THAT THIS BID IS MADE WITHOUT COLLUSION OR FRAUD. THIS BID IS TO BE MANUALLY SIGNED IN INK BY A PERSON AUTHORIZED TO BIND THE VENDOR. ALL BID INFORMATION SHALL BE MADE WITH BLUE INK OR TYPEWRITTEN.
11. ORDER OF PRIORITY. IN THE EVENT THERE IS A CONFLICT BETWEEN THE INSTRUCTIONS TO BIDDERS OR STANDARD CONDITIONS AND THE SPECIAL CONDITIONS, THE SPECIAL CONDITIONS SHALL GOVERN.

For questions regarding this bid, please contact Shakeya Bennett at rodgers@ulm.edu

TO THE VENDOR:	**THIS QUOTATION IS SUBMITTED BY**
Bid Bond of 5% will be required Performance Bond of 50% will be required	Name of Vendor (Firm or Individual) _____ Signature _____ Name (Printed) _____
Pre-bid Meeting: July 1, 2025	Telephone # _____
Deadline to Receive Inquiries: July 1, 2025	Fax# _____
Deadline to Respond to Inquiries: July 11, 2025	Email Address _____
Bid Opening: July 22, 2025	Title _____
Louisiana Contractor's License #:	Vendor Quote # _____ Date Submitted _____

Definitions

(1) "Alternate" means an item on the bid form that may either increase or decrease the quantity of work or change the type of work within the scope of the project, material, or equipment specified in the bidding documents, or both.

(2) "Bidding documents" means the bid notice, plans and specifications, bid form, bidding instructions, addenda, special provisions, and all other written instruments prepared by or on behalf of a public entity for use by prospective bidders on a public contract.

(3)(a) "Change order" means any contract modification that includes an alteration, deviation, addition, or omission as to a preexisting public work contract, which authorizes an adjustment in the contract price, contract time, or an addition, deletion, or revision of work.

(b) "Change order outside the scope of the contract" means a change order which alters the nature of the thing to be constructed or which is not an integral part of the project objective.

(c) "Change order within the scope of the contract" means a change order which does not alter the nature of the thing to be constructed and which is an integral part of the project objective.

(4) "Contractor" means any person or other legal entity who enters into a public contract.

(5)(a) "Emergency" means an unforeseen mischance bringing with it destruction or injury of life or property or the imminent threat of such destruction or injury or as the result of an order from any judicial body to take any immediate action which requires construction or repairs absent compliance with the formalities of this Part, where the mischance or court order will not admit of the delay incident to advertising as provided in this Part. In regard to a municipally owned public utility, an emergency shall be deemed to exist and the public entity may negotiate as provided by R.S. 38:2212(P) for the purchase of fuel for the generation of its electric power where the public entity has first advertised for bids as provided by this Part but has failed to receive more than one bid.

(b) An "extreme public emergency" means a catastrophic event which causes the loss of ability to obtain a quorum of the members necessary to certify the emergency prior to making the expenditure to acquire materials or supplies or to make repairs necessary for the protection of life, property, or continued function of the public entity.

(6) "Licensed design professional" means the architect, landscape architect, or engineer who shall have the primary responsibility for the total design services performed in connection with a public works project. Such professional shall be licensed as appropriate and shall be registered under the laws of the state of Louisiana.

(7)(a) "Louisiana resident contractor", for the purposes of this Part, includes any person, partnership, association, corporation, or other legal entity and is defined as one that either:

(i) Is an individual who has been a resident of Louisiana for two years or more immediately prior to bidding on work,

(ii) Is any partnership, association, corporation, or other legal entity whose majority interest is owned by and controlled by residents of Louisiana, or

(iii) For two years prior to bidding has maintained a valid Louisiana contractor's license and has operated a permanent facility in the state of Louisiana and has not had a change in ownership or control throughout those two years.

(b) For the purposes of Item (a)(ii) of this Paragraph, ownership percentages shall be determined on the basis of:

(i) In the case of corporations, all common and preferred stock, whether voting or nonvoting, and all bonds, debentures, warrants, or other instruments convertible into common or preferred stock.

(ii) In the case of partnerships, capital accounts together with any and all other capital advances, loans, bonds, debentures, whether or not convertible into capital accounts.

(8) "Negotiate" means the process of making purchases and entering into contracts without formal advertising and public bidding with the intention of obtaining the best price and terms possible under the circumstances.

(9) "Probable construction costs" means the estimate for the cost of the project as designed that is determined by the public entity or the designer.

(10) "Public contract" or "contract" means any contract awarded by any public entity for the making of any public works or for the purchase of any materials or supplies.
(11) "Public entity" means and includes the state of Louisiana, or any agency, board, commission, department, or public corporation of the state, created by the constitution or statute or pursuant thereto, or any political subdivision of the state, including but not limited to any political subdivision as defined in Article VI Section 44 of the Constitution of Louisiana, and any public housing authority, public school board, or any public officer whether or not an officer of a public corporation or political subdivision. "Public entity" shall not include a public body or officer where the particular transaction of the public body or officer is governed by the provisions of the model procurement code.
(12) "Public work" means the erection, construction, alteration, improvement, or repair of any public facility or immovable property owned, used, or leased by a public entity.
(13) "Responsive bidder" means the apparent low bidder who submits the proper information or documentation as required by the bidding documents within the ten-day period
(14) "Responsible bidder" means contractor or subcontractor who has an established business and who has demonstrated the capability to provide goods and services in accordance with the terms of the contract, plan, and specifications without excessive delays, extensions, cost overruns, or changes for which the contractor or subcontractor was held to be responsible, and who does not have a documented record of past projects resulting in arbitration or litigation in which such contractor or subcontractor was found to be at fault. Responsible Bidder will have a negotiable net worth, or shall be underwritten by an entity with a negotiable net worth, which is equal to or exceeds in value the total cost amount of the public contract as provided in the bid submitted by such bidder. All property comprising the negotiable net worth shall be pledged and otherwise unencumbered throughout the duration of the contract period.
(15) "Written" or "in writing" means the product of any method of forming characters on paper, other materials, or viewable screen, which can be read, retrieved, and reproduced, including information that is electronically transmitted and stored.

Veteran-Owned and Service-Connected Disabled Veteran-Owned (Veteran Initiative) and Louisiana Initiative for Small Entrepreneurships (Hudson Initiative) Program

This procurement has been designated as suitable for Louisiana certified small entrepreneurships participation.

The State of Louisiana Veteran and Hudson Initiatives small entrepreneurship programs are designed to provide additional opportunities for Louisiana-based small entrepreneurships (sometimes referred to as LaVet's and SE's respectively) to participate in contracting and procurement with the state. A certified Veteran-Owned and Service-Connected Disabled Veteran-Owned small entrepreneurship (LaVet) and a Louisiana Initiative for Small Entrepreneurships (Hudson Initiative) are businesses that have been certified by the Louisiana Department of Economic Development. All eligible vendors are encouraged to become certified. Qualification requirements and online certification are available at https://smallbiz.louisianaeconomicdevelopment.com.

Bidders that are not eligible for certification are encouraged to use Veteran-Owned and Service-Connected Disabled Veteran- Owned and Hudson Initiative small entrepreneurships where sub-contracting opportunities exist.

For a good faith effort, written notification is the preferred method to inform Louisiana certified Veteran Initiative and Hudson Initiative small entrepreneurships of potential subcontracting opportunities. A current list of certified Veteran-Owned and Service-Connected Disabled Veteran-Owned and Hudson Initiative small entrepreneurships may be obtained from the Louisiana Economic Development Certification System at https://smallbiz.louisianaeconomicdevelopment.com. Additionally, a current list of Hudson Initiative small entrepreneurships, which have been certified by the Louisiana Department of Economic Development and have opted to enroll in the State of Louisiana Procurement and Contract (LaPAC) Network, may be accessed from https://wwwcfprd.doa.louisiana.gov/OSP/LaPAC/vendor/srchven2.cfm. You may then determine the search criteria (i.e. alphabetized list of all certified vendors, by commodities, etc.), and select "SmallE".

Copies of notification to at least three (or more) certified Veteran Initiative and Hudson Initiative small entrepreneurships will satisfy the notification requirements. Notification must be provided to the certified entrepreneurships by the bidder in writing no less than five working days prior to the date of bid opening. Notification must include the scope of work, location to review plans and specifications (if applicable), information about required qualifications and specifications, any bonding and insurance information and/or requirements (if applicable), and the name of a person to contact. If a certified Veteran-Owned or Service- Connected Disabled Veteran-Owned or Hudson Initiative small entrepreneurship was not selected, the bidder must certify and maintain written justification of the selection process. The state reserves the right to request confirmation of this information at any time.

In the event questions arise after an award is made relative to the bidder's good faith efforts, the bidder will be required to provide supporting documentation to demonstrate its good faith subcontracting plan was actually followed. If it is at any time determined that the contractor did not in fact perform its good faith subcontracting plan, the contract award or the existing contract may be terminated.

Contractors will be required to report Veteran-Owned and Service-Connected Disabled Veteran-Owned and Hudson Initiative small entrepreneurship subcontractor or distributor participation and the dollar amount of each to the ULM Purchasing Department along with the Clear Lien.

The statutes (LA R.S. 39:2171 *et. seq.*) concerning the Veteran Initiative may be viewed at www.legis.la.gov; and the statutes (LA R.S 39:2001 *et. seq.)* concerning the Hudson Initiative may be viewed at www.legis.la.gov. The rules for the Veteran Initiative (LAC 19:VII.Chapters 11 and 15) and for the Hudson Initiative (LAC 19:VIII.Chapters 11 and 13) may be viewed at http://www.doa.louisiana.gov/osp/se/se.htm.

The State requires competitive pricing, qualifications, and demonstrated competencies in the selection of contractors.

If you are a Certified Small Entrepreneur (Hudson Initiative), Veteran Owned Small Entrepreneurs, or Service- Connected Disabled Veteran-Owned (Veteran Initiative) vendor, please state your Certification Number below.

Certification No./Date of certification.: _____

LOUISIANA UNIFORM PUBLIC WORK BID FORM

TO: The University of Louisiana at Monroe
700 University Avenue
Coenen Hall 140
Monroe LA 71209-2250

BID FOR: Warhawk Baseball Stadium HVAC Renovations
Bid No.: 50006-074

The undersigned bidder hereby declares and represents that she/he; a) has carefully examined and understands the Bidding Documents, b) has not received, relied on, or based his bid on any verbal instructions contrary to the Bidding Documents or any addenda, c) has personally inspected and is familiar with the project site, and hereby proposes to provide all labor, materials, tools, appliances and facilities as required to perform, in a workmanlike manner, all work and services for the construction and completion of the referenced project, all in strict accordance with the Bidding Documents prepared by: EMA Engineering & Consulting Inc.. and dated: May 2, 2025.

Bidders must acknowledge all addenda. The Bidder acknowledges receipt of the following ADDENDA (where applicable):

No. ____ Dated: _____ No. ____ Dated: _____ No. ____ Dated: _____

No. ____ Dated: _____ No. ____ Dated: _____ No. ____ Dated: _____

TOTAL BASE BID: For all work required by the Bidding Documents for the _____ **we bid the sum of:**

_____ **Dollars ($**_____**)**

ALTERNATES: For any and all work required by the Bidding Documents for Alternates including any and all unit prices designated as alternates in the unit price description**.**

Alternate No. 1 Add Replace Heating Water System, Including Boiler, Pumps, Piping and Accessories ($)

Alternate No. 2 Add Replace Air Handling Units AHU-2 and AHU-3, and Replace Exhaust Fans EF-1 and EF-3 ($)

Alternate No. 3 Add Replace Air Handling Unit AHU-4, Replace Exhaust Fan EF-2 and EF-4, and Replace Press Box Fan-Coil Units ($)

NAME OF BIDDER: _____

ADDRESS OF BIDDER: _____

_____

FAX NO.: _____ **EMAIL ADDRESS**: _____

LOUISIANA CONTRACTOR'S LICENSE NUMBER: _____

NAME OF AUTHORIZED SIGNATORY OF BIDDER: _____

TITLE OF AUTHORIZED SIGNATORY OF BIDDER: _____

AUTHORIZED SIGNATURE OF BIDDER *: _____

DATE: _____

* If someone other than a corporate officer signs for the Bidder/Contractor, a copy of a corporate resolution or other signature authorization must be required for submission of bid. Failure to include a copy of the appropriate signature authorization, if required, may result in the rejection of the bid unless bidder has complied with LA R.S. 38:2212(B)(5)

BID SECURITY in the form of a bid bond, certified check or cashier's check as prescribed by LA R.S. 38:2218.A is attached to and made a part of this bid. If a bid bond is provided it shall be on the attached form and only on the attached form.

LIQUIDATED DAMAGES shall be assessed at the rate of $300 per day each day work is not completed. The contractor shall fully complete all work 360 consecutive calendar days in accordance with the project specifications.

BID BOND
FOR
ULM Bid 50006-074 Warhawk Baseball Stadium HVAC Renovation

Date: _____

KNOW ALL MEN BY THESE PRESENTS:

That _____ of _____

_____ , as Principal, and

_____ , as Surety, are held and firmly bound unto the _____ (Obligee), in the full and just sum of five (5%) percent of the total amount of this bid, including all alternates, lawful money of the United States, for payment of which sum, well and truly be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally firmly by these presents.

Surety represents that it is listed on the current U. S. Department of the Treasury Financial Management Service list of approved bonding companies as approved for an amount equal to or greater that the amount for which it obligates itself in this instrument or that it is a Louisiana domiciled insurance company with at least an A - rating in the latest printing of the A. M. Best's Key Rating Guide. If surety qualifies by virtue of its Best's listing, the Bond amount may not exceed ten percent of policyholders' surplus as shown in the latest A. M. Best's Key Rating Guide.

Surety further represents that it is licensed to do business in the State of Louisiana and that this Bond is signed by surety's agent or attorney-in-fact. This Bid Bond is accompanied by appropriate power of attorney.

THE CONDITION OF THIS OBLIGATION IS SUCH that, whereas said Principal is herewith submitting its proposal to the Obligee on a Contract for:

_____

NOW, THEREFORE, if the said Contract be awarded to the Principal and the Principal shall, within such time as may be specified, enter into the Contract in writing and give a good and sufficient bond to secure the performance of the terms and conditions of the Contract with surety acceptable to the Obligee, then this obligation shall be void; otherwise this obligation shall become due and payable.

_____ _____

PRINCIPAL (BIDDER) SURETY

BY:_____ BY:_____

AUTHORIZED OFFICER-OWNER-PARTNER AGENT OR ATTORNEY-IN-FACT (SEAL)

INDEMNIFICATION AGREEMENT

_____{Contractor/Lessee} agrees to protect, defend, indemnify, save, and hold harmless, the State of Louisiana, all State Departments, Agencies, Boards and Commissions, its officers, agents, servants, employees, and volunteers, from and against any and all claims, damages, expenses, and liability arising out of injury or death to any person or the damage, loss or destruction of any property which may occur, or in any way grow out of, any act or omission of Contractor/Lessee, its agents, servants, and employees, or any and all costs, expenses and/or attorney fees incurred by Contractor/Lessee as a result of any claims, demands, suits or causes of action, except those claims, demands, suits, or causes of action arising out of the negligence of the State of Louisiana, all State Departments, Agencies, Boards, Commissions, its officers, agents, servants, employees and volunteers.

Contractor/Lessee agrees to investigate, handle, respond to, provide defense for and defend any such claims, demands, suits, or causes of action at its sole expense and agrees to bear all other costs and expenses related thereto, even if the claims, demands, suits, or causes of action are groundless, false or fraudulent. The State of Louisiana may, but is not required to, consult with the Contractor in the defense of claims, but this shall not affect the Contractor's responsibility for the handling of and expenses for all claims.

Accepted by _____
Company Name

_____
Signature

_____
Title

Date Accepted _____

Is Certificate of Insurance Attached? _____Yes _____No

Contract No. 50006-074 for University of Louisiana at Monroe
State Agency Name

PURPOSE OF CONTRACT: Warhawk Baseball Stadium HVAC Renovation

LIQUIDATED DAMAGES:

The undersigned agrees that the Owner may retain the sum of three hundred dollars ($300.00) from the amount of the Compensation to be paid him for each day after the above stated completion date, Sundays and Holidays included, that the work remains incomplete. This amount is agreed upon as the proper measure of Liquidated Damages which the Owner will sustain per day by the failure of the undersigned to complete the work at the stipulated time and is not to be construed in any sense as a penalty.

If this proposal shall be accepted and the undersigned shall fail to execute the contract and furnish performance bond as herein provided, then the proposal guarantee shall become the property of the University; otherwise, the said proposal guaranty shall be returned to the undersigned.

Bidder certifies that he has visited the job site at The University of Louisiana at Monroe, and is fully aware of what is expected of the successful bidder (s).

_____
Louisiana Contractor's License Number

_____
Firm Name

_____
Authorized Signature

_____
Title

_____
Phone/Fax Numbers

_____
Date

STATE OF LOUISIANA NAME_____

PARISH OF OUACHITA LOCATION_____

AFFIDAVIT OF COMPLIANCE

Before me, the undersigned authority, duly commissioned and qualified within and for the state and parish aforesaid, personally came and appeared_____

representing_____who, being by me first duly sworn deposed and said that he has read this affidavit and does hereby agree under oath to comply with all provisions herein as follows:

PART I

Section 2224 of Part II of Chapter 10 to Title 38 of the Louisiana Revised Statutes of 1950 as amended.

A. (1) That affiant employed no person, corporation, firm, association, or other organization, either directly or indirectly, to secure the public contract under which he received payment, other than persons regularly employed by the affiant whose services in connection with the construction of the public building or project or in securing the public contract were in the regular course of their duties for affiant; and

A. (2) That no part of the contract price received by affiant was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by the affiant whose services in connection with the construction of the public building or project were in the regular course of their duties for affiant.

B. No public contract shall be granted to any person, corporation, firm, association, or other organization refusing to execute the affidavit required by Subsection A above.

PART II

Section 2190 of Part I of Chapter 10 of Title 38 of the Louisiana Revised Statutes of 1950 as amended.

The affiant, if he be an architect or engineer, or representative thereof, does not own a substantial financial interest, either directly or indirectly, in any corporation, firm, partnership, or other organization which supplied materials for the construction of a public building or project when the architect or engineer has performed architectural or engineering services, either directly or indirectly, in connection with the public building or project for which the materials are being supplied.

For the purpose of this Section, a "substantial financial interest" shall exclude any interest in stock being traded on the American Stock Exchange or the New York Stock Exchange.

That affiant, if subject to the provisions of this section, does hereby agree to be subject to the penalties involved for the violation of this section.

PART III

That affiant does hereby state that he has read and agrees to comply with and be subject to the provisions of Part V of Chapter 10 of Title 38 of the Louisiana Revised Statutes of 1950, being Sections 2290 through 2296 of Title 38 as amended.

Signature of Affiant: _____

SWORN TO AND SUBSCRIBED BEFORE ME THIS_____DAY OF_____, 2025.

Signature of Notary: _____

E-VERIFY AFFIDAVIT

STATE OF LOUISIANA

PARISH OF OUACHITA

BEFORE ME, the undersigned Notary Public PERSONALLY CAME AND APPEARED,

I,_____, the owner/authorized representative of

_____

Company/Individual/Legal Entity Name

who hereby personally and as the authorized representative of the above identified legal person executes this affidavit, as the undersigned Contractor verification of its current and future compliance with LA R.S. 38:2212.10, stating affirmatively that it and each individual, firm or corporation associated with it and engaged in the physical performance of services in the State of Louisiana, under a contract with the University of Louisiana Monroe has registered with, is participating in, and shall continue to participate in a federal work authorization program designated as such under the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, as amended, which is operated by the United States Department of Homeland Security, known as the "E-Verify" program. The Contractor hereby verifies the legal status of all existing and new employees in the State of Louisiana by attesting herein that each is a citizen of the United States or legal aliens as defined by now effective immigration laws of the United States of America.

Contractor shall not assign this Contract or any monies due or to become due hereunder, or subcontract any part of the Work without the prior written consent of University of Louisiana Monroe.

Contractor verifies that Contractor will collect an affidavit in this form from any approved subcontractor and forward a copy to: University of Louisiana Monroe, Purchasing Office 700 University Avenue; Coenen Hall 140; Monroe, LA 71209-2250, no later than five business days of contracting with its subcontractor; however, in no instance shall the affidavit be received after commencement of work by the subcontractor.

_____ _____

Signature of Authorized Signatory **Date E-Verify ID Assigned**

_____ _____

Printed Name of Signatory **E-Verify ID**

_____

Title of Authorized Signatory

SUBSCRIBED AND SWORN BEFORE ME ON THIS THE DAY OF_____, 20_____

Notary Signature: _____

Notary Printed Name: _____

Notary/Bar Roll Number: _____

My Commission is For/Expires: _____

PAST CRIMINAL CONVICTIONS ATTESTATION (LA R.S. 39:2192)

STATE OF LOUISIANA

PARISH OF _____

BEFORE ME, the undersigned Notary Public PERSONALLY CAME AND APPEARED,

I,_____ (Appearer) the owner/authorized representative of

_____

Company / Individual / Legal Entity Name

Appearer, as a Bidder on the herein named Project, does hereby attest that:

A. No sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a five percent (5%) ownership in the bidding entity named herein, including any silent or dormant owner or manager, has been convicted of, or has entered a plea of guilty or nolo contendere to, any of the following state crimes or equivalent federal crimes:

(a) Public bribery (R.S. 14:118)
(b) Corrupt influencing (R.S. 14:120)
(c) Extortion (R.S. 14:66)
(d) Money laundering (R.S. 14:230)

B. For five years prior to the project bid date, no sole proprietor or individual partner, incorporator, director, manager, officer, organizer, or member who has a minimum of a ten percent (10%) ownership in the bidding entity named herein, including any silent or dormant owner or manager, has been convicted of, or has entered a plea of guilty or nolo contendere to any of the following state crimes or equivalent federal crimes, during the solicitation or execution of a contract or bid awarded pursuant to the provisions of Chapter 10 of Title 38 of the Louisiana Revised Statutes:

(a) Theft (R.S. 14:67)
(b) Identity Theft (R.S. 14:67.16)
(c) False accounting (R.S. 14:70)
(d) Contractor's misapplication of payments (R.S. 14:202)
(e) Bank fraud (R.S. 14:71.1)
(f) Forgery (R.S. 14:72)
(g) Issuing worthless checks (R.S.14:71)
(h) Malfeasance in office (R.S. 14:134)

_____ _____

Name of Bidder | Signature of Authorized Signatory of Bidder

Bid 50006-074 Warhawk Baseball Stadium HVAC Renovation _____

Project Name/Number | Title of Authorized Signatory

SUBSCRIBED AND SWORN BEFORE ME ON THIS THE DAY OF_____, 2025

Notary Signature: _____

Notary Printed Name: _____

Notary/Bar Roll Number: _____

My Commission is For/Expires: _____

University of Louisiana Monroe
NON-SOLICITATION AND UNEMPLOYMENT AFFIDAVIT
(Pursuant to LA R.S. 38:2224 and LA R.S. 23:1726(B))

STATE OF LOUISIANA

PARISH OF _____

BEFORE ME, the undersigned Notary Public PERSONALLY CAME AND APPEARED,

I,_____ (Appearer) the owner/authorized representative of

_____
Company / Individual / Legal Entity Name

who, being first duly sworn, deposed and state that I personally and as an authorized representative of the above identified legal person executes this continuing affidavit stating that neither the above named Contractor nor a person acting on its behalf, either directly or indirectly, employed, paid, nor promised any gift, consideration or commission to any person or legal entity to procure or assist in procuring this public contract, other than persons regularly employed by Contractor whose services were in the regular course of their duties for Contractor in connection with the construction, alteration or demolition of a public building or project.

The above named Contractor, if awarded, continually affirms that no part of the contract price received by Contractor was paid or will be paid to any person, corporation, firm, association, or other organization for soliciting the contract, other than the payment of their normal compensation to persons regularly employed by the affiant whose services were in the regular course of their duties for Contractor. The above named Contractor has neither in the past three years received a final determination that the named Contractor has knowingly or willfully failed to properly classify an individual as an employee nor failed to pay unemployment.

The above named Contractor hereby attests and certifies that it does not have any unpaid assessment or penalty levied against it regarding unemployment compensation and currently does and will continue to properly classify each employee. Contractor verifies that Contractor will collect an affidavit in this form from any approved subcontractor and forward a copy to: University of Louisiana Monroe, 700 University Avenue; Purchasing Office, Coenen Hall 140; Monroe, LA 71209-2250 no later than five business days after contracting with its subcontractor; however, in no instance shall the affidavit be received after commencement of work by the subcontractor.

_____ Signature of Authorized Signatory	SUBSCRIBED AND SWORN BEFORE ME ON THIS _____DAY OF_____2025 .
_____ Printed Name of Signatory	_____ Notary Signature
_____ Title of Authorized Signatory	Printed Notary Name: _____
Bid 50006-074Warhawk Baseball Stadium HVAC Renovation Project Name/Number	Notary/Bar Roll Number: _____ My Commission is for/expires on: _____

RELATING TO THE PROHIBITION OF DISCRIMINATORY BOYCOTTS OF ISRAEL IN STATE PROCUREMENT STATEMENT

As stated in Executive Order number JBE 2018-15 Relating to the Prohibition of Discriminatory Boycotts of Israel in State Procurement, for bids over $100,000, and for vendors with greater than five (5) employees:

Consistent with existing Louisiana non-discrimination provisions and regulations governing purchases, executive branch agencies may not execute a procurement contract with a vendor if that vendor is engaging in a boycott of Israel. Further, executive branch agencies shall reserve the right to terminate any procurement contract with a vendor that engages in a boycott of Israel during the term of the contract.

By submitting a response to this solicitation, the bidder or proposer certifies and agrees that the following information is correct: In preparing its response, the bidder or proposer has considered all proposals submitted from qualified, potential subcontractors and suppliers, and has not, in the solicitation, selection, or commercial treatment of any subcontractor or supplier, refused to transact or terminated business activities, or taken other actions intended to limit commercial relations, with a person or entity that is engaging in commercial transactions in Israel or Israeli-controlled territories, with the specific intent to accomplish a boycott or divestment of Israel. The bidder also has not retaliated against any person or other entity for reporting such refusal, termination, or commercially limiting actions. The state reserves the right to reject the response of the bidder or proposer if this certification is subsequently determined to be false, and to terminate any contract awarded based on such a false response

The Contractor certifies to The University of Louisiana at Monroe that:

a. it is not engaging in a boycott of Israel; and
b. it will, for the duration of its contractual obligations, refrain from a boycott of Israel.

_____
Firm Name

_____
Authorized Signature

_____
Printed Name

_____
Title

_____
Date

_____ Initial here if the bid is less than $100,000, or your firm has fewer than five employees

The University of Louisiana at Monroe

Monroe, Louisiana

This Agreement, made and executed, on this day of the month_____in the year of our Lord, TWO THOUSAND and TWENTY FIVE, by and through _____ , The University of Louisiana at Monroe, the Party of the First Part, and hereinafter designated as "University" and_____, Contractor, domiciled and doing business in _____ , Party of the Second Part, and hereinafter designated as Contractor.

WITNESSETH, That, in consideration of the covenants and agreements herein contained to be performed by the parties hereto and of the payments hereinafter agreed to be made, it is mutually agreed as follows:

The Contractor shall and will provide and furnish all materials, equipment and labor and perform the work required to complete in a thorough and workmanlike manner, to the satisfaction of the University, project entitled, in strict accordance with the Plans and Specifications which are on file in the Purchasing Department at The University of Louisiana at Monroe. The bid on this project, numbered Bid 50006-000, was opened on_____, at _____2:00 p.m. The plans and specifications and the Proposal Form are made a part hereof as fully as if set out herein and hereby become a part of this contract. Contract amount is $_____.

It is agreed and understood between the parties hereto that the Contractor agrees to accept and the University agrees to pay for the work at the price stipulated in said Proposal, such payment to be in lawful money of the United States, and the payment shall be made at the time and the manner set forth.

The State may terminate this Agreement at any time by giving thirty (30) days written notice to contractor of such termination or negotiating with the Contractor an effective date.

The State may terminate this agreement for cause based upon the failure of Contractor to comply with the terms and/or conditions of the Agreement provided that the State shall give the Contractor written notice specifying the Contractor's failure. If within thirty (30) days after receipt of such notice, the Contractor shall not have corrected such failure or, in the case of failure which cannot be corrected in thirty (30) days, begun in good faith to correct such failure and thereafter proceeded diligently to complete such correction, then the State may, at its option, place the Contractor in default and the Agreement shall terminate on the date specified in such notice.

The Contractor may exercise any rights available to it under Louisiana law to terminate for cause upon the failure of the State to comply with the terms and conditions of this agreement, provided that the Contractor shall give the State written notice specifying the State's failure and a reasonable opportunity for the State to cure the defect.

Any claim or controversy arising out of the agreement shall be resolved by the provisions of LA R.S. 39:1672.2-1672.4.

This Contract shall be governed by and interpreted in accordance with the laws of the State of Louisiana, including but not limited to LA R.S. 39:1551-1736; rules and regulations; executive orders; standard terms and conditions, special terms and conditions, and specifications listed in the RFP (if applicable); and this Contract. Venue of any action brought, after exhaustion of administrative remedies, with regard to this Contract shall be in the Fourth Judicial District Court, Parish of Ouachita, State of Louisiana.

Contractor acknowledges and agrees to comply with the provisions of LA R.S. 38:2212.10 and federal law pertaining to E-Verify in the performance of services under this Contract.

The continuation of this contract is contingent upon the appropriation of funds to fulfill the requirements of the contract by the legislature. If the legislature fails to appropriate sufficient monies to provide for the continuation of the contract, or if such appropriation is reduced by the veto of the Governor or by any means provided in the appropriations act to prevent the total appropriation for the year from exceeding revenues for that year, or for any other lawful purpose, and the effect of such reduction is to provide insufficient monies for the continuation of the contract, the contract shall terminate on the date of the beginning of the first fiscal year for which funds are not appropriated.

The contractor agrees to abide by the requirements of the following as applicable: Title VI of the Civil Rights Act of 1964 and Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972, Federal Executive Order 11246 as amended, the Rehabilitation Act of 1973, as amended, the Vietnam Era Veteran's Readjustment

Assistance Act of 1974, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, the Fair Housing Act of 1968 as amended, and contractor agrees to abide by the requirements of the Americans with Disabilities Act of 1990.

Contractor agrees not to discriminate in its employment practices, and will render services under this contract without regard to race, color, religion, sex, national origin, veteran status, political affiliation, or disabilities. Any act of discrimination committed by Contractor, or failure to comply with these statutory obligations when applicable shall be grounds for termination of this contract.

Contractor has a continuing obligation to disclose any suspensions or debarment by any government entity, including but not limited to General Services Administration (GSA). Failure to disclosed may constitute grounds for suspension and/or termination of the Contract and debarment from future Contracts.

Contractor, and each tier of Subcontractors, shall certify that it is not on the List of Parties Excluded from Federal Procurement or Nonprocurement Programs promulgated in accordance with E.O.s 12549 and 12689, "Debarment and Suspension," as set forth at 24 CFR part 24.

The State Legislative auditor, federal auditors and internal auditors of the State, or others so designated by the State, shall have the option to audit all accounts directly pertaining to the contract for a period of five (5) years after project acceptance or as required by applicable State and Federal Law. Records shall be made available during normal working hours for this purpose.

The complete Agreement between the parties with respect to the subject matter and all prior discussions and negotiations are merged into this contract. This Agreement is entered into with neither party relying on any statement or representation made by the other party not embodied in this Agreement and there are no other agreements or understanding changing or modifying the terms. This Agreement shall become effective upon final statutory approval.

No amendment or variation of the terms of this Agreement shall be valid unless made in writing, signed by the parties and approved as required by law. No oral understanding or agreement not incorporated in the contract is binding on any of the parties.

If any term or condition of this Agreement, or the application thereof, is held invalid, such invalidity shall not affect other terms, conditions or applications which can be given effect without the invalid term, condition or application; to this end the terms and conditions of this Agreement are severable.

Performance shall not begin until issuance of Notice to Proceed and Purchase Order.

The University of Louisiana at Monroe	Contractor
Signature: _____	Signature: _____
Title: _____	Title: _____

INSTRUCTIONS TO BIDDERS

ARTICLE 1

DEFINITIONS

1.1 The Bidding Documents include the following:

a. Advertisement for Bids
b. Instructions to Bidders
c. Bid Form
d. Bid Bond
e. Affidavit of Compliance with LA R.S. 38
f. General Requirements
g. Supplementary Conditions
h. Technical Specifications
i. Addenda issued during bid period must be acknowledged on returned bid form

1.2 Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the bidding documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Contract is executed.

ARTICLE 2

BIDDER'S REPRESENTATION

2.1 Each bidder by submitting a bid represents that s/he has read and understands the bidding documents.

2.2 Each bidder by making a bid represents that s/he has visited the site and familiarized themselves with the local conditions under which the work is to be performed.

2.3 Each bidder by submitting a bid understands they must be fully qualified under any state or local licensing law for Contractors in effect at the time and at the location of the project before submitting a bid. In the State of Louisiana; only the bids of contractors and sub-contractors duly licensed under LA R.S. 37:2150, et. seq., will be considered, if applicable. The Contractor shall be responsible for ensuring all Sub-contractors or prospective Sub-contractors are duly licensed in accordance with the statute above.

2.4 Each bidder submitting a bid understands that ULM's Public Works Policy related to contractor licensure is that a contractor's license is required for any/all projects with an anticipated/bid cost greater than $50,000

ARTICLE 3

BIDDING PROCEDURES

3.1 Each responsive bid package must be received by the University by the date and time stated in the Advertisement for Bid or Invitation to Bid in this Bid Packet, and include, at a minimum the following documents.

a. Bid Form
b. Bid Security or Bid Bond
c. Acknowledgement of Addenda
d. Base Bid
e. Alternates Bid (if applicable)
f. Signature of Bidder
g. Name, Title, and Address of Bidder
h. Name of Firm or Joint Venture
i. Corporate Resolution or written evidence of the authority of the person signing the bid
j. Louisiana's Contractor's License Number
k. Unit Prices, where required, including a description for each unit

3.2 The following items must be provided by the apparent lowest bidder not later than ten (10) calendar days after bid opening, however, it is strongly encouraged that these items be returned with the bid packet. If the apparent lowest bidder was not in attendance at the bid opening, the University Purchasing Department will notify apparent lowest bidder by email, if provided. This will not be the notification of award. If Bidder has not heard from the University within three (3) days, the Bidder should contact the University Purchasing Department. In no instance will the ten (10) days be waived or altered.

a. Notarized Contractor's Affidavit
b. E-Verify Affidavit
c. Past Criminal Convictions Affidavit
d. Non-Solicitation and Unemployment Affidavit
e. Insurance Certificate
f. Resolution, if incorporated

3.3 Once the above items from 3.1 and 3.2 have been received by the University, the University will soon thereafter provide the Bidder with three (3) executed contract originals. The following items must then be promptly returned to the University:

a. One (1) original, fully-executed contract
b. Payment & Performance Bond
c. Proof of filing with the Ouachita Parish Clerk of Court

3.4 Upon receipt of all of the items listed in section 3.1, 3.2 and 3.3 above, the University will issue the Purchase Order (PO) and Notice to Proceed.

3.5 Bids must be prepared on the forms provided by the Owner and submitted in accordance with the Instructions to Bidders.

3.6 A bid will be considered invalid if not deposited at the designated location prior to the time and date for receipt of bids indicated in the Advertisement or Invitation to bid, or prior to any extension thereof issued to the bidders.

3.7 Unless otherwise provided in any supplement to these Instructions to Bidders, no bidder shall modify, withdraw or cancel his bid or any part thereof for thirty (30) days after the receipt of bids. However, written request (letter or email) for the withdrawal of a bid or any part thereof will be granted if the request is received prior to the specified time of opening. Formal bids, amendments thereto or request for withdrawal of bids or any part thereof received after time specified for bid opening will not be considered whether delayed in the mail or for any other cause whatsoever.

3.8 Bids are to be sealed and will be received until the time specified and at the place specified in the advertisement for bids. It shall be the specific responsibility of the Bidders to deliver sealed bids to The University of Louisiana at Monroe at the appointed place and prior to the announced time for the opening of bids. Late delivery of a bid for any reason including late delivery by the United States Mail shall disqualify the bid.

3.9 Prior to the receipt of bids, Addenda, if any, will be mailed or delivered (hard copy or email) to each person or firm recorded by the Owner as having received the bidding documents and will be available for inspection wherever the bidding documents are kept available for that purpose. Addenda issued after receipt of bids will be mailed or delivered only to the sealed bidder.

3.10 **Bids for Public Works will not be considered or accepted unless the bid is accompanied by bid security in an amount of not less than five percent (5%) of the sum of the Base Bid and any Alternates.** The bid security shall be in the form of a certified check drawn on a bank insured by the Federal Deposit Insurance Corporation, or a bid bond written by a surety company licensed to do business in Louisiana, accompanied by appropriate power of attorney and in favor of The University of Louisiana at Monroe.

3.11 All Bids and Sureties must be signed by a duly authorized person of the firm or corporation and be accompanied by legal evidence authorizing the signature as valid.

3.12 Any interpretation, correction or change of the Bidding Documents will be made by Addendum. Interpretations, corrections or changes of the Bidding Documents made in any other manner will not be binding, and bidders shall not rely upon such interpretations, corrections and changes.

3.13 If bidding other than as specified, an indication must be made on the bid form, stating manufacturer's name and model number(s) being submitted for bid. Detailed specifications, drawings, pictures, brochures, diagrams or any other literature or information necessary to determine the equality of the bid response must be included with the bid form.

ARTICLE 4

EXAMINATION OF BIDDING DOCUMENTS

4.1 Each bidder shall examine the bidding documents carefully and, not later than seven days prior to the date for receipt of bids, shall make written request to the Owner for interpretation or correction of any ambiguity, inconsistency or error therein which he may discover. Any interpretation or correction will be issued as an Addendum by the Owner. Only a written interpretation or correction by Addendum shall be binding. No bidder shall rely upon any interpretation or correction given by any other method.

ARTICLE 5

SUBSTITUTIONS

5.1 Each bidder represents that his bid is based upon the materials and equipment described in the bidding documents.

MANUFACTURER'S NUMBERS OR TRADE NAMES:

5.2 Where a manufacturer's product is named or specified, it is understood that "or equal" shall apply, whether stated or not. Such name and number is meant to establish the standard of quality desired and does not restrict bidders to the specific brand, make, manufacturer, or specification named; and are set forth and convey to prospective bidders the general style, type, character, and quality of product desired; and that equal products will be acceptable. The University of Louisiana at Monroe shall be sole judge as to whether or not the material is equal to that specified.

ARTICLE 6

REJECTION OF BIDS

6.1 The Bidder acknowledges the right of the University to reject any or all bids and to waive any informality or irregularity in any bid received. In addition, the bidder recognizes the right of the University to reject a bid if the Bidder failed to furnish any required bid security, or to submit the data required by the bidding documents, or if the bid is in any way incomplete or irregular.

ARTICLE 7

AWARDS

7.1 Awards may not be made to any person, firm, or company in default of any contract. Said person, firm, or company shall be considered non-responsible bidders and may be reinstated and awards made to them only after they have given evidence of good faith and have satisfactorily completed their obligations.

PUBLICIZING AWARDS

7.2 Written notice of award shall be sent to the successful bidder. In procurement over $25,000, each unsuccessful bidder shall be notified of the award provided that he/she submitted with his/her bid a self-addressed envelope requesting this information. Notice of award will be made a part of the procurement file.

RIGHT TO PROTEST

7.3 Any person who is aggrieved in connection with the solicitation or award of a contract shall protest to the Director Purchasing. Protests with respect to a solicitation shall be submitted in writing at least two days prior to the opening of bids on all matters except housing of state agencies, their personnel, operations, equipment, or activities pursuant to R.S. 39:1643 for which such protest shall be submitted at least ten days prior to the opening of bids. Protests with respect to the award of a contract shall be submitted in writing within fourteen days after contract award.

AUTHORITY TO RESOLVE PROTESTS:

7.4 Prior to the commencement of an action in court concerning any controversy, the Director of Purchasing or his/her designee shall have the authority, to resolve the protest of any aggrieved person concerning the solicitation or award of a contract. This authority shall be exercised in accordance with regulations.

ARTICLE 8

PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

8.1 Performance and Payment Bonds shall be required on Public Works projects with an expected cost greater than $50,000. Performance and Payment Bonds, when required, shall be provided in an amount of 50% of the contract price. Performance and Payments Bonds shall be required by the successful bidder. Any surety bond required shall be written by a surety or insurance company currently on the U. S. Department of the Treasury Financial Management Service list of approved bonding companies which is published annually in the Federal Register. For any Public Works projects, no surety or insurance company shall write a bond which is in excess of the amount indicated as approved by the U. S. Department of the Treasury Financial Management Service list. The surety bond written for a Public Works project shall be written by a surety or insurance company that is currently licensed to do business in the State of Louisiana.

8.2 The bidder shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney indicating the monetary limit of such power.

RECORDING OF BOND AND CONTRACT

8.3 The Contractor shall record the Contract and Performance Bond with the Clerk of Court in Ouachita Parish and provide the Purchasing Department with proof of filing.

ARTICLE 9

PAYMENT

9.1 Payment will be made by The University of Louisiana Monroe.

9.2 The contractor will be required to provide a Clear Lien Certificate from the Ouachita Parish Clerk of Court, a process that may take an average 45 days for final payment.

ARTICLE 10

TAXES

10.1 Applicable taxes are to be included in lump sum bid.

ARTICLE 11

GUARANTEE

11.1 The materials and labor under this contract, as described in the specifications, shall be guaranteed by the Contractor for a period of one year from date of its acceptance against defects of materials or workmanship. Any defects which develop during this period shall be properly repaired or replaced without cost to the Owner as soon as possible.

ACCEPTANCE

11.2 The guarantee covering materials and labor under this contract will begin the date a Notice of Acceptance is issued to the Contractor by The University of Louisiana at Monroe.

ARTICLE 12

CHANGES IN THE WORK

12.1 A Change Order is a written order to the Contractor signed by the Owner, issued after execution of the Contract, authorizing a Change in the Work or an adjustment in the Contract Sum or the Contract Time. The Contract Sum and the Contract Time may be changed only by Change Order. A Change Order signed by the Contractor indicates his agreement therewith, including the adjustment in the Contract Sum or the Contract Time. Any Change Order not signed by the Owner will be considered null and void.

12.2 The Owner, without invalidating the Contract, may order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and the Contract Time being adjusted accordingly. All such changes in the Work shall be authorized by Change Order, and shall be performed under the applicable conditions of the Contract Documents.

12.3 When the Change Order is negotiated it shall be fully documented and itemized as to cost, including material quantities, material costs, insurance, employee benefits, other related costs, profit and overhead, and will be process in accordance with LA R.S. 38:2222.

SUPPLEMENTARY CONDITIONS

ARTICLE 1

CONTRACTOR

CONTRACTOR'S LICENSE

1.1 On any bid amounting to $50,000 or more, the Contractor shall certify that s/he is licensed under Act 377 of the 1976 Louisiana Regular Legislative Session and show the contractor license number and the bid number on the front portion of the envelope; except projects financed, partially or wholly, with Federal Funds, provided that any successful Bidder before signing Contract thereon, files application for a license and pays the fee as provided in this Act and complies with all terms and provisions of this Act and with the rules and regulations of the Licensing Board.

1.2 A subcontractor who wishes to bid or perform commercial work where the total cost of the project including labor and materials for the following must be licensed:

- $50,000 or more for major and specialty classifications
- $10,000 or more for electrical, mechanical, and plumbing
- $1 or more for hazardous

CONTRACTOR'S AFFIDAVIT

1.3 In accordance with the Louisiana R.S. 38:2190 -2220, if the Contract is awarded to the successful Bidder, the Bidder shall, at the time of the signing of the Contract, execute the Contractor's Affidavit included in the Contract Documents.

INTEREST

1.4 There shall be no payment of interest on money owed.

ARTICLE 2

PAYMENTS AND COMPLETION

SUBSTANTIAL COMPLETION

2.1 The Owner will issue a NOTICE OF ACCEPTANCE for the Contractor to record with the Clerk of Court in Ouachita Parish.

FINAL COMPLETION AND FINAL PAYMENT

2.2 The Contract is to provide that the contractor is not to be paid more than ninety percent (90%) of the amount of the contract upon completion of the work. The Contractor shall record the NOTICE OF ACCEPTANCE with the Ouachita Parish Clerk of Court and shall furnish a CLEAR LIEN CERTIFICATE from the Clerk of Court within forty-five days after recordation of NOTICE OF ACCEPTANCE. At that time, the remaining ten percent (10%) will be paid.

LIQUIDATED DAMAGES

2.3 The Owner will suffer financial loss if the Project is not substantially complete on the date set forth in the CONTRACT DOCUMENTS. The Contractor (and/or Surety) shall be liable for and shall pay to the Owner Liquidated Damages for each calendar day of delay until the work is Substantially Complete.

The Completion Time stated in Consecutive Calendar Days and the Liquidated Damages stated in Dollars per Day are listed in the PROPOSAL FORM

ARTICLE 3

INSURANCE

INSURANCE REQUIREMENTS FOR CONTRACTORS

The Contractor shall purchase and maintain for the duration of the contract insurance against claims for injuries to persons or damages to property which may arise from or in connection with the performance of the work hereunder by the Contractor, its agents, representatives, employees or subcontractors.

A. MINIMUM SCOPE AND LIMITS OF INSURANCE

1. **Workers Compensation**

Workers Compensation insurance shall be in compliance with the Workers Compensation law of the State of the Contractor's headquarters. Employers Liability is included with a minimum limit of $1,000,000 per accident/per disease/per employee. If work is to be performed over water and involves maritime exposure, applicable LHWCA, Jones Act, or other maritime law coverage shall be included. A.M. Best's insurance company rating requirement may be waived for workers compensation coverage only. The insurance shall cover any claim(s) for incident(s) made during the policy period.

2. **Commercial General Liability**

Commercial General Liability insurance, including Personal and Advertising Injury Liability and Products and Completed Operations, shall have a minimum limit per occurrence of $1,000,000 and a minimum general annual aggregate of $2,000,000. The Insurance Services Office (ISO) Commercial General Liability occurrence coverage form CG 00 01 (current form approved for use in Louisiana), or equivalent, is to be used in the policy. Claims-made form is unacceptable.

3. **Automobile Liability**

Automobile Liability Insurance shall have a minimum combined single limit per accident of $1,000,000. ISO form number CA 00 01 (current form approved for use in Louisiana), or equivalent, is to be used in the policy. This insurance shall include third-party bodily injury and property damage liability for owned, hired and non-owned automobiles.

4. **Professional Liability (Errors and Omissions)**

Professional Liability (Error & Omissions) insurance, which covers the professional errors, acts, or omissions of the Contractor, shall have a minimum limit of $1,000,000 per claim. Claims-made coverage is acceptable. The date of the inception of the policy must be no later than the first date of the anticipated work under this contract. It shall provide coverage for the duration of this contract and shall have an expiration date no earlier than 30 days after the anticipated completion of the contract. The policy shall provide an extended reporting period of at least 24 months, with full reinstatement of limits, from the expiration date of the policy, if policy is not renewed.

5. **Cyber Liability**

Cyber liability insurance, including first-party costs, due to an electronic breach that compromises the State's confidential data shall have a minimum limit per occurrence of $1,000,000. Claims-made coverage is acceptable. The date of the inception on the policy must be no later than the first date of the anticipated work under this contract. It shall provide coverage for the duration on this contract and shall have an expiration date no earlier than 30 days after the anticipated completion of the contract. The policy shall provide an extended reporting period of not less than 24 months from the expiration date of the policy, if the policy is not renewed. The policy shall not be cancelled for any reason, except non-payment of premium.

B. DEDUCTIBLES AND SELF-INSURED RETENTIONS

Any deductibles or self-insured retentions must be declared to and accepted by the Agency. The Contractor shall be responsible for all deductibles and self-insured retentions.

C. OTHER INSURANCE PROVISIONS

The policies are to contain, or be endorsed to contain, the following provisions:

1. Commercial General Liability and Automobile Liability Coverages

   a. The Agency, its officers, agents, employees and volunteers shall be named as an additional insured as regards negligence by the contractor. ISO Forms CG 20 10 (for ongoing work) AND CG 20 37 (for completed work) (current forms approved for use in Louisiana), or equivalents, are to be used when applicable. The coverage shall contain no special limitations on the scope of protection afforded to the Agency.

   b. The Contractor's insurance shall be primary as respects the Agency, its officers, agents, employees and volunteers for any and all losses that occur under the contract. Any insurance or self-insurance maintained by the Agency shall be excess and non-contributory of the Contractor's insurance.

2. Workers Compensation and Employers Liability Coverage

   To the fullest extent allowed by law, the insurer shall agree to waive all rights of subrogation against the Agency, its officers, agents, employees and volunteers for losses arising from work performed by the Contractor for the Agency.

3. All Coverages

   a. All policies must be endorsed to require 30 days written notice of cancellation to the Agency. Ten-day written notice of cancellation is acceptable for non-payment of premium. Notifications shall comply with the standard cancellation provisions in the Contractor's policy. In addition, Contractor is required to notify Agency of policy cancellations or reductions in limits.

   b. The acceptance of the completed work, payment, failure of the Agency to require proof of compliance, or Agency's acceptance of a non-compliant certificate of insurance shall not release the Contractor from the obligations of the insurance requirements or indemnification agreement.

   c. The insurance companies issuing the policies shall have no recourse against the Agency for payment of premiums or for assessments under any form of the policies.

   d. Any failure of the Contractor to comply with reporting provisions of the policy shall not affect coverage provided to the Agency, its officers, agents, employees and volunteers.

D. ACCEPTABILITY OF INSURERS

1. All required insurance shall be provided by a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located. Insurance shall be placed with insurers with an A.M. Best's rating of **A- :VI or higher**. This rating requirement may be waived for workers compensation coverage only.

2. If at any time an insurer issuing any such policy does not meet the minimum A.M. Best rating, the Contractor shall obtain a policy with an insurer that meets the A.M. Best rating and shall submit another Certificate of Insurance within 30 days.

E. VERIFICATION OF COVERAGE

1. Contractor shall furnish the Agency with Certificates of Insurance reflecting proof of required coverage. The Certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf. The Certificates are to be received and approved by the Agency before work commences and upon any contract renewal or insurance policy renewal thereafter.

2. The Certificate Holder Shall be listed as follows: University of Louisiana at Monroe
   Agency Name, Its Officers, Agents, Employees and Volunteers
   Address, City, State, Zip
   Project or Contract #:

3. In addition to the Certificates, Contractor shall submit the declarations page and the cancellation provision for each insurance policy. The Agency reserves the right to request complete certified copies of all required insurance policies at any time.

4. Upon failure of the Contractor to furnish, deliver and maintain required insurance, this contract, at the election of the Agency, may be suspended, discontinued or terminated. Failure of the Contractor to purchase and/or maintain any required insurance shall not relieve the Contractor from any liability or indemnification under the contract.

F. SUBCONTRACTORS

Contractor shall include all subcontractors as insureds under its policies OR shall be responsible for verifying and maintaining the Certificates provided by each subcontractor. Subcontractors shall be subject to all of the requirements stated herein. The Agency reserves the right to request copies of subcontractor's Certificates at any time. Failure of contractor to comply with this clause does not waive the contractor responsibility to indemnify or defend Agency due to subcontractor's failure to acquire proper insurance.

G. WORKERS COMPENSATION INDEMNITY

In the event Contractor is not required to provide or elects not to provide workers compensation coverage, the parties hereby agree that Contractor, its owners, agents and employees will have no cause of action against, and will not assert a claim against, the State of Louisiana, its departments, agencies, agents and employees as an employer, whether pursuant to the Louisiana Workers Compensation Act or otherwise, under any circumstance. The parties also hereby agree that the State of Louisiana, its departments, agencies, agents and employees shall in no circumstance be, or considered as, the employer or statutory employer of Contractor, its owners, agents and employees. The parties further agree that Contractor is a wholly independent contractor and is exclusively responsible for its employees, owners, and agents. Contractor hereby agrees to protect, defend, indemnify and hold the State of Louisiana, its departments, agencies, agents and employees harmless from any such assertion or claim that may arise from the performance of this contract.

H. INDEMNIFICATION/HOLD HARMLESS AGREEMENT

1. Contractor/Subcontractor/Other responsible party agrees to protect, defend, indemnify, save, and hold harmless, the State of Louisiana, all State Departments, Agencies, Boards and Commissions, its officers, agents, servants, employees, and volunteers, from and against any and all claims, damages, expenses, and liability arising out of injury or death to any person or the damage, loss or destruction of any property which may occur, or in any way grow out of, any act or omission of Contractor, its agents, servants, and employees, or any and all costs, expenses and/or attorney fees incurred by Contractor as a result of any claims, demands, suits or causes of action, except those claims, demands, suits, or causes of action arising out of the negligence of the State of Louisiana, all State Departments, Agencies, Boards, Commissions, its officers, agents, servants, employees and volunteers.

2. Contractor agrees to investigate, handle, respond to, provide defense for and defend any such claims, demands, suits, or causes of action at its sole expense and agrees to bear all other costs and expenses related thereto, even if the claims, demands, suits, or causes of action are groundless, false or fraudulent. The State of Louisiana may, but is not required to, consult with the Contractor in the defense of claims, but this shall not affect the Contractor's responsibility for the handling of and expenses for all claims.

ARTICLE 4

QUALITY

STANDARD OF QUALITY

1.1 Where catalog numbers and/or manufacturer's names are referred to in the specifications, they are used for the purpose of conveying to the prospective bidders the type and design of equipment, or supplies desired; but it shall be understood that bidders may submit on other makes in lieu of that mentioned, providing such other item is similar in design and equal in quality. It is not expected that the items of all manufacturers shall conform exactly to every detail and dimension mentioned in the specifications; but the essential features of the items mentioned shall be provided in the items to be furnished.

University of Louisiana at Monroe (ULM)

ULM Bid 50006-074 Warhawk Baseball Stadium HVAC Renovation

1. PROJECT SUMMARY

   The University of Louisiana at Monroe (ULM) is requesting bids from qualified, Louisiana licensed Municipal and Public Works Construction contractors. The scope of work for this project consists of replacement of Warhaw Baseball HVAC Renovation and other work, as further described in the bid documents. The contractor shall fully complete all work during 360 consecutive calendar days. Work can begin upon receipt of a notice to proceed.

2. PROJECT LOCATION

   The project location is on the main campus of the University of Louisiana at Monroe, Monroe, Louisiana, 71209. Refer to the attached plans and drawings for the exact location.

3. BID DELIVERY INSTRUCTIONS

   ULM requires that one copy of the entire bid be submitted. The bid shall contain electronic signatures or scans of original signatures of those company officials or agents who are duly authorized to sign on behalf of the organization. An electronic signature as provided by LAC 4:I.701 et seq. is considered an original signature. A certified copy of a board resolution granting such authority should be submitted if the bidder is a corporation. All other forms, attestations, acknowledgements, etc., required per the bid documents and all addenda must be included with the submission.

   Sealed bids be mailed or hand delivered to the Purchasing Department of The University of Louisiana Monroe, Coenen Hall 140, 4014 LaSalle St., Monroe, LA 71209, until the Due Date and time. Bids must be sealed in an envelope with the BID NUMBER, BID OPENING DATE, COMPANY NAME, and CONTRACTOR'S LICENSE clearly displayed on the outside of the envelope.

4. SCOPE OF WORK TO BE COMPLETED BY CONTRACTOR

   Contractor shall refer to full set of Contract Documents for full Scope of Work for the project.

5. RECOMMENDED PRE-BID SITE VISIT

   Site visits are recommended for all potential Bidders. Visits may be scheduled by contacting Michael Davis, Director of Facilities & EHS, at 318.342.5171, or via email to mdavis@ulm.edu.

   Each Bidder is solely responsible for a prudent and complete personal inspection, examination and assessment of the facilities and any other existing condition, factor, or item that may affect or impact the performance of service described and required by the Contractual Requirements.

   Bidders are strongly encouraged to advise the University, prior to the scheduled tour of the facilities, of any special accommodations for disabled personnel who will be attending the tour(s) so that these accommodations can be made.

6. SUBMISSION FOR APPROVAL OF "OR EQUAL" PRODUCTS

   Procurement Substitution Request must be made in writing in compliance with the following requirements:
   a. Requests for substitution of materials and equipment will be considered if received no later than 7 business days prior to date of bid opening.
   b. Submittal Format: Submit 1 copy of each written Procurement Substitution Request, using CSI Substitution Request Form 1.5C.
   c. Procurement Substitution Request may be submitted via email in PDF format or mailed. Faxed requests

will not be accepted.

i. Contact: Thomas Sanders
ii. Phone: 318.318.425.4500
iii. Mailing Address: 9441 Stevens Road Ste 200, Shreveport La 71106

7. QUESTIONS / REQUESTS FOR CLARIFICATION

All questions and requests for clarification shall be submitted in writing to the ULM purchasing office at least seven (7) days prior to the bid date. If necessary, ULM will issue an addendum to provide answers and clarifications.

8. AREA OF WORK – Safety and Protection

The contractor shall post warning signs and barriers as necessary to ensure that students, faculty, staff, and the general public avoid the work area. The contractor may store materials on site provided the materials are stored in a location and manner that does not interfere with the University and does not damage existing facilities (grounds, grass, sidewalks, parking lots, etc.)

The contractor should coordinate with University personnel to approve the laydown / material storage areas at the pre-construction meeting and before any material are delivered.

This building will remain open and the business will maintain normal operations. The contractor needs to insure that the safety of the students, faculty, staff, and general public remain the first priority during this job. The contractor shall in no way impede the day-to-day operations of the business.

9. CONSTRUCTION SCHEDULE / OUTAGES

The University should be given a notice of 48 hours before any outages are scheduled should there need to be any.

10. LIQUIDATED DAMAGES

The University will assess liquidated damages to the contractor for failure to comply with the schedule of the work. Liquidated damages shall be assessed at the rate of $300.00 per day for each additional day required to fully complete the scope of work. The contractor shall fully complete all work 360 consecutive calendar days in accordance with the project specifications.

11. DAMAGES TO FACILITIES

Contractor shall be responsible for all damages to the existing site, facilities, furniture, and equipment that are caused by this project. The contractor shall carefully document existing site conditions and existing damages prior to commencing work. The contractor shall repair all damage to its original, undamaged condition prior to completing this project.

12. COMPLIANCE AND SAFETY REQUIREMENTS

Contractor shall be required to adhere to all University safety and health policies. Contractor shall fully comply with all applicable laws, rules, regulations, permits, etc. This includes but is not limited to the following: the contractor must use an OSHA approved lockout / tag out program that meets or exceeds the University's policy, the contractor shall properly label all chemical containers used during the project, the contractor shall have a material safety data sheet (MSDS) for each product used during the project, etc. All employees shall wear fall protection equipment as required when working at elevated levels. All employees will not be allowed to use tobacco products on the project site. Contractor, subcontractors, material suppliers and all employees must be properly trained and fully comply with occupational safety and health regulations. Any accidents, incidents, near

misses, etc. will be reported to the University project coordinator immediately and the University may investigate these events. The University reserves the right to require the contractor to remove any employee from the project if the employee is observed violating safety rules, regulations, policies, etc.

13. CYBERSECURITY TRAINING

    a. In accordance with La. R.S. 42:1267(B)(3) and the State of Louisiana's Information Security Policy, if the Contractor, any of its employees, agents, or subcontractors will have access to State government information technology assets, the Contractor's employees, agents, or subcontractors with such access must complete cybersecurity training annually, and the Contractor must present evidence of such compliance annually and upon request. The Contractor may use the cybersecurity training course offered by the Louisiana Department of State Civil Service without additional cost or may use any alternate course approved in writing by the Office of Technology Services.

    b. For purposes of this Section, "access to State government information technology assets" means the possession of credentials, equipment, or authorization to access the internal workings of State information technology systems or networks. Examples would include but not be limited to State-issued laptops, VPN credentials to credentials to access the State network, badging to access the State's telecommunications closets or systems, or permissions to maintain or modify IT systems used by the State. Final determination of scope inclusions or exclusions relative to access to State government information technology assets will be made by the Office of Technology Services.

14. PROFESSIONAL CONDUCT

    The contractor, sub-contractors, material suppliers, and all workers associated with the project shall conduct themselves in a professional manner at all times. All employees shall wear identification that clearly identifies them as a contract employee. This could be a uniform shirt or name badge. Shirts shall be neatly tucked into trousers. Contractors shall not be allowed to wear sleeveless shirts, tank tops, etc. No profanity will be allowed for any reason. The University reserves the right to require the contractor to remove any employee from the job immediately for failure to comply with these requirements and / or for failure to comply with University policies and procedures, and all other applicable laws, rules, and requirements.

15. USE OF UNIVERSITY FACILITIES

    The contractor, sub-contractors, material suppliers, and all workers associated with the project shall not use University facilities such as restrooms, break rooms, vending machines, etc. The contractor shall supply a portable restroom for their employees to use.

16. USE OF TOBACCO PRODUCTS

    Tobacco use will only be allowed in personal vehicles. See ULM's tobacco use policy for detailed information at http://www.ulm.edu/tobaccouse/

17. DISPOSAL

    Contractor shall dispose of all construction debris, trash, and other materials in compliance with all applicable laws, rules, regulations, permits, etc.

Project Manual & Drawings to Follow

SPECIFICATION INDEX

SECTION 01 10 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Work Covered by Contract Documents.
Contract Method.
Contractor use of site and premises.
Owner occupancy.

1.2 WORK COVERED BY CONTRACT DOCUMENTS:

Work of this contract comprises the general construction for the Warhawk Baseball Stadium HVAC Renovation – University of Louisiana Monroe, 700 University Avenue, Monroe, Louisiana, 71209.

1.3 CONTRACT METHOD:

Construct the work under a single lump sum contract.

1.4 CONTRACTOR USE OF SITE AND PREMISES:

Use of site and premises for construction operations.

1.5 OWNER OCCUPANCY:

Owner will occupy portions of the premises during entire period of construction.

1.6 WORK INCLUDES

A. Certain items of work included herewith are set forth to call attention to items which may or may not be fully described in other sections of the specifications.

    1. Demolition of the existing chillers, pumps, boilers, hydronic air handling units and exhaust fans as shown on the mechanical demolition plans.
    2. Furnish and install new hydronic air handling units, chiller, boiler, pumps and exhaust fans.
    3. Place all systems into operation, including Testing and Balancing of HVAC System
    4. Removal of debris and turning over to Owner a complete operating facility, (broom clean) and with glass areas washed.
    5. Work included in paragraphs included herewith and in any section of the specifications shall not in any way limit responsibility of Contractor to perform all work and furnish all materials required by the contract documents.

1.7 CONSTRUCTION PRECAUTIONS

A. The Contractor is to take all necessary precautions during construction to protect the building and its occupants from the development of Mold. This shall include the construction of all necessary temporary weather and air barriers between conditioned and unconditioned areas and at exterior openings. The Contractor shall refer to the following documents:

"Managing the Risk of Mold in the Construction of Buildings" published by the Associated General Contractors, March 2003.

Prior to the start of construction in the building, the contractor shall perform a visible mold survey of the entire building. Any visible signs or evidence of mold detected in the structure shall be brought to the attention of the owner and the Engineer immediately. Mold remediation shall be the sole responsibility of the Owner in a fashion similar to other hazardous materials.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 19 00

CONTRACT CONSIDERATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Schedule of Values.
Application for Payment.
Change procedures.

1.2 RELATED SECTIONS:

Section 01 33 00 - Submittals: Schedule of Values.
Section 01 60 00 - Material and Equipment: Product substitutions and alternates.

1.3 SCHEDULE OF VALUES:

1.3.1 Submit typed schedule on AIA Form G702 found in the front-end documents.

1.3.2 Submit Schedule of Values in duplicate at the pre-construction meeting. Applications for payment will not be reviewed until the Schedule of Values has been submitted.

1.3.3 Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bond and insurance.

1.3.4 Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.

1.3.5 Include within each line item, a direct proportional amount of Contractor's overhead and profit.

1.3.6 Revise schedule to list approval Change Orders, with each Application For Payment.

1.4 APPLICATIONS FOR PAYMENT:

1.4.1 Submit three copies of each application on AIA Form G702 - Application and Certificate for Payment.

1.4.2 Content and Format: Utilize Schedule of Value for listing items in Application for Payment.

1.4.3 Payment Period: Applications for payment will be submitted to the Engineer by the 24th of each month.

1.4.4 Waiver of Liens.

1.4.5 No application and Certificate of Payment will be considered until all items required under section 10391, 1.5.3.1 have been received.

1.5 CHANGE PROCEDURES:

1.5.1 The Engineer will advise of minor changes in the Work not involving an adjustment to Contract Sum/Price or Contract Time as authorized by AIA A201, 1987 Edition, Article 7.4 by issuing supplemental instructions on AIA Form G710.

1.5.2 The Engineer may issue Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within seven days.

1.5.3 The Contractor may propose changes by submitting a request for change to the Engineer, describing the proposed change and its full effect on the work. Include a statement describing the reason for the change, and the effect on the Contract Sum/Price and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.

1.5.4 Construction Change Authorization: Engineer may issue a directive signed by the Owner, instructing the Contractor to proceed with a change in the work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute the change.

1.5.5 Change Order Forms: State provided in front-end documents.

1.5.6 Execution of Change Orders: Contractor will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 20 00

ALTERNATES

PART 1 - GENERAL

1.1 ADD ALTERNATE NO. 1: Replace Heating Water System, Including Boiler, Pumps, Piping and Accessories

A. Related Sections/Drawings:
    1. Section 23 05 03 – HVAC Piping
    2. Section 23 35 00 – HVAC Equipment
    3. Sheet MD1.1 – First Floor Plan – Mechanical Demolition
    4. Sheet MD1.2 – Second Floor Plan – Mechanical Demolition
    5. Sheet MH1.1 – First Floor Plan – Mechanical
    6. Sheet MH1.2 – Second Floor Plan - Mechanical
    7. Sheet MH7.2 – Mechanical Details
    8. Sheet MH8.1 – Mechanical Schedules
    9. Sheet MH9.1 – Piping Diagrams

1.2 ADD ALTERNATE NO. 2: Replace Air Handling Units AHU-2 and AHU-3, and Replace Exhaust Fans EF-1 and EF-3

A. Related Sections/Drawings:
    1. Section 23 05 23 – HVAC Piping
    2. Section 23 30 00 – HVAC Air Distribution
    3. Section 23 35 00 – HVAC Equipment
    4. Sheet MD1.1 – First Floor Plan – Mechanical Demolition
    5. Sheet MD1.2 – Second Floor Plan – Mechanical Demolition
    6. Sheet MH1.1 – First Floor Plan – Mechanical
    7. Sheet MH1.2 – Second Floor Plan - Mechanical
    8. Sheet MH7.1 – Mechanical Details
    9. Sheet MH7.1 – Mechanical Details
    10. Sheet MH8.1 – Mechanical Schedules
    11. Sheet MH9.1 – Piping Diagrams

1.3 ADD ALTERNATE NO. 3: Replace Air Handling Unit AHU-4, Replace Exhaust Fans EF-2 and EF-4, and Replace Press Box Fan-Coil Units

B. Related Sections/Drawings:
    1. Section 23 05 23 – HVAC Piping
    2. Section 23 30 00 – HVAC Air Distribution
    3. Section 23 35 00 – HVAC Equipment
    4. Sheet MD1.2 – Second Floor Plan – Mechanical Demolition
    5. Sheet MH1.2 – Second Floor Plan - Mechanical
    6. Sheet MH7.1 – Mechanical Details

7. Sheet MH7.1 – Mechanical Details
8. Sheet MH8.1 – Mechanical Schedules
9. Sheet MH9.1 – Piping Diagrams

1.4 It is the intent of the Contract Documents that the Contractor provides a complete project ready for occupancy by the Owner. The drawings and specification sections referenced above are to call attention to specific items required to complete the additive alternates. The Contractor is responsible for complying with and or providing all items, whether specifically mentioned above or not, that form a part of the Contract Documents.

PART 2 - PRODUCTS

Not Used

PART 3 -EXECUTION

Not Used

END OF SECTION

SECTION 01 30 00

COORDINATION AND MEETINGS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Coordination
Preconstruction conference
Progress meetings

1.2 COORDINATION:

1.2.1 Coordinate scheduling, submittals, and Work of the various Sections of specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

1.2.2 Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

1.2.3 Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Following routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

1.2.4 In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

1.2.5 Coordinate completion and clean up of Work of separate Sections in preparation for Substantial Completion.

1.2.6 After Owner occupancy of premises, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRE-BID CONFERENCE

A pre-bid conference shall be held at the project site, as noted in the "Advertisement for Bids". All contractors wishing to bid are invited to attend.

1.4 PRECONSTRUCTION CONFERENCE:

1.4.1 Engineer will schedule a conference after Notice of Award.

1.4.2 Attendance Required: Engineer, Owner, General Contractor and major sub-contractors.

1.4.3 Agenda:

1. Contractor shall prepare and present the following information at the preconstruction meeting:
   a. Construction Schedule
   b. Schedule of Values
   c. List of Subcontractors and major suppliers
   d. All items noted in Section 7.1.4 of the Supplementary Conditions.
   e. Labor Burden breakdown for all parties which potentially could request labor costs as part of a change order. (The Labor Burden costs which are allowed are identified in the front end documents. Note that the Project Superintendant is expected to be on the site 100% of the time that work is being performed. Labor Burden the costs (hourly, daily, weekly, etc.) for any equipment which might be included in a change order should be included).
2. Data will be distributed and discussed on at least the following items:
   a. Organizational arrangement of contractors' forces and personnel and those of subcontractors and engineer.
   b. Channels and procedures for communication.
   c. Construction schedule, including sequence of critical work.
   d. Contract documents.
   e. Processing of shop drawings and other data submitted to Engineer for review.
   f. Review of Schedule of Values (AIA Document G703), processing of pay requests (AIA document G702), field decisions and change orders.
   g. Rules and regulations governing performance of the work.
   h. Procedures for safety and first aid, security, quality control, housekeeping and related matters.
3. Establish date of progress meetings.

1.5 PROGRESS MEETING:

1.5.1 Attendance Required: Engineer, Owner, General Contractor, Sub-contractors, materials suppliers and others may be invited to attend those progress meetings in which their aspect of the work is involved.

1.5.2 Agenda:

1. Review, revise as necessary, and approve minutes of previous meetings.
2. Field observations, problems, and decisions.
3. Identification of problems which impede planned progress.
4. Review of submittals, schedule of status of submittals.
5. Review of off-site fabrication and delivery schedules.
6. Planned progress during succeeding work period.
7. Maintenance of quality and work standards.
8. Effect of proposed changes on progress schedule and coordination.
9. Other business relating to Work.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 31 00

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:

1.2.1 This Section includes administrative and procedural requirements for cutting and patching.

1.2.2 Related Sections: The following Sections contain requirements that relate to this Section:

A. Divisions 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.

B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 23 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

1.3 QUALITY ASSURANCE:

1.3.1 Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.

A. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:

1. Foundation construction.
2. Bearing and retaining walls.
3. Structural concrete.
4. Structural steel.
5. Lintels.
6. Timber and primary wood framing.
7. Structural decking.
8. Stair systems.
9. Miscellaneous structural metals.
10. Equipment supports.
11. Piping, ductwork, vessels, and equipment.

1.3.2 Operational Limitations: Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

A. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:

1. Primary operational systems and equipment.
2. Air or smoke barriers.
3. Water, moisture, or vapor barriers.
4. Membranes and flashings.
5. Fire protection systems.
6. Noise and vibration control elements and systems.
7. Control systems.
8. Communication systems.
9. Conveying systems.
10. Electrical wiring systems.
11. Operating systems of special construction.

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

1.4 WARRANTY:

Existing Warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

PART 2 - PRODUCTS

2.1 WARRANTY:

2.1.1 Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION:

3.1.1 Examine surfaces to be cut and patched and conditions under which cutting and patching is

to be performed before cutting. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

A. Before proceeding, meet at the Project Site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

3.2 PREPARATION:

3.2.1 Temporary Support: Provide temporary support of work to be cut.

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

3.2.3 Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.2.4 Avoid cutting existing pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE:

3.3.1 General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

A. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

3.3.2 Cutting: Cut existing construction using methods least likely to damage elements retained or adjoining construction. Where possible, review proposed procedures with the original Installer; comply with the original Installer's recommendations.

A. In general, where cutting, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

B. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

C. Cut through concrete and masonry using a cutting machine, such as a Carborundum saw or a diamond-core drill.

D. Where services are required to be removed, relocated, or abandoned, by-pass utility services, such as pipe or conduit, before cutting. Cut-off pipe or conduit in the walls or the partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

3.3.3 Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

A. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

B. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

C. Where removing walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

1. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken surface containing the patch after the area has received primer and second coat.

3.4 CLEANING:

Clean areas and spaces where the cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar items. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

3.5 CUTTING AND PATCHING:

3.5.1 Employ skilled and experienced installer to perform cutting and patching.

3.5.2 Submit written request in advance of cutting or altering elements which affects:

1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

3.5.3 Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:

1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.

4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

3.5.4 Execute work by methods which will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.

3.5.5 Cut rigid materials using masonry saw or core drill.

3.5.6 Restore Work with new products in accordance with requirements of Contract Documents.

3.5.7 Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

3.5.8 Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

3.5.9 Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

3.5.10 Identify any hazardous substance or condition exposed during the Work to the Engineer for decision or remedy.

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Submittal procedures
Proposed products list
Shop drawings
Product data
Samples
Manufacturer's instructions
Manufacturer's certificates

1.2 RELATED SECTIONS:

Section 01 40 00 - Quality Control: Manufacturers' field services and reports.

Section 01 70 00 - Contract Closeout: Contract warranty and manufacturer's certificates, and closeout submittals.

1.3 SUBMITTAL PROCEDURES:

1.3.1 Transmit each submittal with Engineer accepted form.

1.3.2 Sequentially number the transmittal forms. Resubmittals are to have original number with an alphabetic suffix.

1.3.3 Identify Project, Contractor, Subcontractor or supplier; pertinent Drawing sheet and detail number(s), and specification Section number, as appropriate.

1.3.4 Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

1.3.5 Schedule submittals to expedite the Project, and deliver to Engineer at business address. Coordinate submission of related items.

1.3.6 Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.

1.3.7 Provide space for Contractor and Engineer review stamps.

1.3.8 Revise and resubmit submittals as required, identify all changes made since previous submittal.

1.3.9 Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.4 PROPOSED PRODUCTS LIST:

1.4.1 Within 7 days after date of Owner-Contractor Agreement, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each products.

1.4.2 For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.5 SHOP DRAWINGS:

1.5.1 Submit the number of opaque reproductions which Contractor requires, plus one copy which will be retained by Engineer.

1.5.2 After review, reproduce and distribute in accordance with Article of Procedures above and for Record Documents described in Section 01 70 00 - Contract Closeout.

1.6 PRODUCT DATA:

1.6.1 Submit the number of copies which the Contractor requires, plus one copy which will be retained by Engineer.

1.6.2 Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information unique to this Project.

1.6.3 After review, distribute in accordance with Article on Procedures above and provide copies for Record Documents described in Section 01 70 00 - Contract Closeout.

1.7 MANUFACTURER'S INSTRUCTIONS:

1.7.1 When specified in individual specification Sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.7.2 Identify conflicts between manufacturers' instructions and Contract Documents.

1.8 MANUFACTURER'S CERTIFICATES:

1.8.1 When specified in individual specification Sections, submit manufacturers' certificate to Engineer for review, in quantities specified for Product Data.

1.8.2 Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.

1.8.3 Certificates may be recent or previous test results on material or Product, but must be acceptable for Engineer.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 40 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Quality assurance
References
Field samples

1.2 RELATED SECTIONS:

Section 01 33 00 - Submittals: Submission of Manufacturers' Instructions and Certificates.

Section 01 60 00 - Material and Equipment: Requirements for material and product quality.

1.3 QUALITY ASSURANCE/CONTROL OF INSTALLATION:

1.3.1 Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

1.3.2 Comply fully with manufacturers' instructions, including each step in sequence.

1.3.3 Should manufacturers' instructions conflict with Contract Documents, notify owner before proceeding.

1.3.4 Comply with specified standards as a minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.3.5 Perform work by persons qualified to produce workmanship of specified quality.

1.3.6 Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

1.4 REFERENCES:

1.4.1 Conform to reference standard by date of issue current on date of Contract Documents.

1.4.2 Obtain copies of standards when required by Contract Documents.

1.4.3 The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by mention or interference otherwise in any reference document.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Temporary Electrical service
Barriers
Progress Cleaning

1.2 RELATED SECTION:

Section 01 70 00 - Contract Closeout: Final Cleaning.

1.3 TEMPORARY ELECTRICITY:

Connect to existing power supply at each site with construction type power cords. Owner will pay cost of energy use.

1.4 BARRIERS:

1.4.1 Provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.

1.4.2 Contractor shall provide dust barriers, walk off mats, etc for the protections of Owner employees, and equipment.

1.5 PROGRESS CLEANING:

1.5.1 Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition at all times.

1.5.2 Remove waste materials, debris, and rubbish from site daily and dispose off-site.

1.6 USE OF EXISTING FACILITIES:

1.6.1. The contractor will coordinate temporary facilities and utilities with the user agency and designate special areas and utilities for the contractor's use.

1.6.3 Any facilities used by the contractor will be returned to the condition in which they were found at the start of the work.

1.6.3 Contractor shall note and record the condition of the facilities before the work starts.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 60 00

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Products
Transportation and handling
Storage protection
Product options
Substitutions

1.2 RELATED SECTIONS:

Section 01 40 00 - Quality Control: Product quality monitoring.

1.3 PRODUCTS:

1.3.1 Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work. Does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

1.3.2 Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

1.3.3 Provide interchangeable components of the same manufacturer, for similar components.

1.4 TRANSPORTATION AND HANDLING:

1.4.1 Transport and handle products in accordance with manufacturer's instructions.

1.4.2 Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.

1.4.3 Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.5 STORAGE AND PROTECTION:

1.5.1 Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight, climate controlled enclosures.

1.5.2 Provide off-site storage and protection when site does not permit on-site storage or protection.

1.5.3 Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation.

1.5.4 Arrange storage of products to permit access for inspection. Periodically inspect to assure products are undamaged and are maintained under specified conditions.

1.6 PRODUCT OPTIONS:

1.6.1 Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

1.6.2 Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

1.6.3 Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

1.7 SUBSTITUTIONS:

1.7.1 Substitutions may be considered when a product becomes unavailable through no fault of the Contractor.

1.7.2 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

1.7.3 A request constitutes a representation that the Bidder:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the Substitution as for the specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner for review or redesign services associated with re-approval by authorities.

1.7.4 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents

1.7.5 Substitution Submittal Procedure:

1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence.
3. The Owner will notify Contractor, in writing, of decision to accept or reject request.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 70 00

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 SECTION INCLUDES:

Closeout procedures
Final cleaning
Project record documents
Warranties

1.2 RELATED SECTIONS:

Section 01 50 00 - Construction Facilities and Temporary Controls: Progress cleaning.

1.3 CLOSEOUT PROCEDURES:

1.3.1 Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's inspection.

1.3.2 Note that project will not be considered substantially complete until all temperature controls work including programming and campus interface has been completed, and has been reviewed and approved by the owner and Engineer. Test and Balance work must also be completed and the final report submitted before substantial completion will be awarded.

1.3.3 Provide submittals to Engineer that are required by governing or other authorities.

1.3.4 Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3.5 Owner will occupy all portions of the building as specified in Section 01 30 00 and 01 10 00.

1.4 FINAL CLEANING:

1.4.1 Execute final cleaning prior to final inspection.

1.4.2 Final cleaning of all walls, floors, furniture, equipment, etc. shall be performed by an independent professional cleaning service. Submit proposed cleaning service to be used along with credentials for review by owner and Engineer.

1.4.3 Clean site; sweep paved areas, rake clean landscaped surfaces.

1.4.4 Remove waste and surplus materials, rubbish, and construction facilities from the site.

1.5 PROJECT RECORD DOCUMENTS:

1.5.1 Maintain on site, one set of the following record documents; record actual revisions to the Work. Record documents shall be available for inspection by the Engineer at any time.

1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other Modifications to the Contract.
5. Reviewed shop drawings, product data, and samples.

1.5.2 Store Record Documents separate from documents used for construction.

1.5.3 Record information concurrent with construction progress.

1.5.4 Specifications: Legibly mark and record at each Product section description of actual Products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and Modifications.

1.5.5 Record Documents and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
3. Field changes of dimension and detail.
4. Details not on original Contract Drawings.

1.5.6 Delete Engineer title block and seal from all documents.

1.5.7 Submit documents to Engineer with claim for final Application for Payment.

1.6 WARRANTIES:

1.6.1 Provide duplicate notarized copies.

1.6.2 Execute and assemble documents for Subcontractors, suppliers, and manufacturers.

1.6.3 Provide Table of Contents and assemble in three D size ring binder with durable plastic cover.

1.6.4 Submit prior to final Application for Payment.

1.6.5 For items of Work delayed beyond date of Substantial Completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

SECTION 01 75 03

TEMPORARY FACILITIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division-1 Specification Sections, apply to work of this section.

1.2 DESCRIPTION OF REQUIREMENTS

General: Provide temporary connection to existing building utilities or provide temporary facilities as required herein or as necessary to carry out the work.

1.3 SUBMITTALS

1.3.1 Before Start of Work: Submit the following to the Owner's Representative for review. Begin no work until these submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use.

1.3.2 Scaffolding: Submit list of rolling and fixed scaffolding intended for use on the project. Submit sufficient detail to indicate compliance with applicable worker safety regulations or other requirements.

1.3.3 Ground Fault Circuit Interrupters (GFCI): Submit product data.

1.3.4 Lamps and Light Fixtures: Submit product data.

1.3.5 Temporary Heating Units: Provide product data.

1.3.6 Temporary Cooling Units: Provide product data and installation instructions.

1.3.7 First Aid Supplies: Provide type of first aid kit.

1.3.8 Fire Extinguishers: Provide product data. Submit location at job site.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

General: Provide new or used materials and equipment that are undamaged and in serviceable condition. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

2.2 SCAFFOLDING

Provide all scaffolding, ladders and/or staging, etc. as necessary to accomplish the work of this contract. The type, erection and use of all scaffolding shall comply with all applicable federal regulations.

2.3 WATER SERVICE

2.3.1 Temporary Water Service Connection: All connections to the Owner's water system shall include backflow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered.

After completion of use, connections and fittings shall be removed without damage or alteration to existing water piping and equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water will not damage existing finishes or equipment.

2.3.2 Water Hoses: Employ heavy-duty abrasion-resistant hoses with a pressure rating greater than the maximum pressure of the water distribution system to provide water into each work area and to each Decontamination Unit. Provide fittings as required to allow for connection to existing wall hydrants or spouts, as well as temporary water heating equipment, branch piping, showers, shut-off nozzles and equipment.

2.3.3 Hot Water: Hot water may be secured from the building hot water system, provided backflow protection is installed at point of connection as described in this section under Temporary Water Service connection, and if authorized in writing by the Owner's Representative.

2.4 ELECTRICAL SERVICE

2.4.1 General: Comply with applicable NEMA, NECA and UL standards and governing regulations for materials and layout of temporary electric service.

2.4.2 Temporary Power: Provide service to Decontamination Unit subpanel with minimum 60-amp, 110-volt, 2-pole circuit breaker or fused disconnect connected to the buildings main distribution panel. Subpanel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work.

2.4.3 Voltage Differences: Provide identification warning signs at power outlets that are other than 110-120 volt power. Provide polarized outlets for plug-in type outlets, to prevent insertion of 110-120 volt plugs into higher voltage outlets. Dry type transformers shall be provided where required to provide voltages necessary for work operations.

2.4.4 Ground Fault Protection: Equip all circuits for any purpose entering Work Area with ground fault circuit interrupters (GFCI). Locate GFCI's exterior to Work Area so that all circuits are protected prior to entry to Work Area. Provide circuit breaker type ground fault circuit interrupters (GFCI) equipped with test button and reset switch for all circuits to be used for any

purpose in work area, decontamination units, exterior, or as otherwise required by national electrical code or other authority. Locate in panel exterior to Work Area.

2.4.5 Electrical Power Cords: Use only grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Use single lengths or use waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas of work.

2.4.6 Lamps and Light Fixtures: Provide general service incandescent lamps or fluorescent lamps of wattage indicated or required for adequate illumination as required by the work or this section. Protect lamps with guard cages or tempered glass enclosures, where fixtures are exposed to breakage by construction operations. Provide vapor tight fixtures in work area and decontamination units. Provide exterior fixtures where fixtures are exposed to the weather or moisture.

2.5 TEMPORARY HEAT

Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the fuel being consumed.

2.6 FIRST AID

First Aid Supplies: First Aid supplies must comply with applicable regulations.

2.7 FIRE EXTINGUISHERS

Fire Extinguishers: Provide Type "A" fire extinguishers for temporary offices and similar spaces where there is minimal danger of electrical or grease-oil-flammable liquid fires. In other locations provide type "ABC" dry chemical extinguishers, or a combination of several extinguishers of NFPA recommended types for the exposures in each case.

PART 3 – EXECUTION

3.1 SCAFFOLDING

During the erection and/or moving of scaffolding, care must be exercised so that the existing building floor and floor covering is not damaged.

Clean as necessary debris from non-slip surfaces.

3.2 INSTALLATION, GENERAL

General: Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

Require that tradesmen accomplishing this work be licensed as required by local authority for the work performed.

Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the project.

3.3 WATER SERVICE

General: Water connection (without charge) to Owner's existing potable water system is limited to one 3/4" pipe-size connection, and a maximum flow of 10 gpm each to hot and cold water supply. Install using vacuum breakers or other backflow preventer as required by local authority. Hot water shall be supplied at a minimum temperature of 100° F. Maintain hose connections and outlet valves in leakproof condition. Where finish work below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize the possibility of water damage. Drain water promptly from pans as it accumulates.

3.4 ELECTRICAL SERVICE

General: Provide a weatherproof, grounded temporary electric power service and distribution system of sufficient size, capacity, and power characteristics to accommodate performance of work during the construction period. Install temporary lighting adequate to provide sufficient illumination for safe work and traffic conditions in every area of work.

Lockout: Lockout all existing power to or through the work area as described below. Unless specifically noted otherwise existing power and lighting circuits to the Work Area are not to be used. All power and lighting to the Work Area and Decontamination facilities are to be provided from temporary electrical panel described below.

> Lockout power to Work Area by switching off all breakers serving power or lighting circuits in work area. Power shall be locked out in accordance with applicable regulations.

Temporary Electrical Panel: Provide temporary electrical panel sized and equipped to accommodate all electrical equipment and lighting required by the work. Connect temporary panel to existing building electrical system. Protect with circuit breaker or fused disconnect. Locate temporary panel as directed by Owner or Owner's Representative.

Power Distribution System: Provide circuits of adequate size and proper characteristics for each use. In general run wiring overhead, and rise vertically where wiring will be at least exposed to damage from construction operations.

Circuit Protection: Protect each circuit with a ground fault circuit interrupter (GFCI) of proper size located in the temporary panel. Do not use outlet type GFCI devices.

Temporary Wiring: in the Work Area shall be type UF non-metallic sheathed cable located overhead and exposed for surveillance. Do not wire temporary lighting with plain, exposed (insulated) electrical conductors. Provide liquid tight enclosures or boxes for wiring devices.
Number of Branch Circuits: Provide sufficient branch circuits as required by the work. All branch circuits are to originate at temporary electrical panel.

3.5 TEMPORARY LIGHTING

Lockout: Lock out all existing power to lighting circuits in Work Area as described in section 17526 Temporary Enclosures. Unless specifically noted otherwise existing lighting circuits to the Work Area are not to be used. All lighting to the Work Area and Decontamination facilities is to be provided from temporary electrical panel described above.

Number of Lighting Circuits: Provide sufficient lighting circuits as required by the work. All lighting circuits are to originate at temporary electrical panel.

Circuit Protection: Protect each circuit with a ground fault circuit interrupter (GFCI) of proper size located in the temporary panel.

3.6 TEMPORARY HEAT

General: Provide temporary heat where indicated or needed for performance of the Work.

3.7 SANITARY FACILITIES

Toilets: Contractor may utilize the toilet facilities on the second floor but shall be responsible for the cleaning of the toilet facilities and for protection of the existing fixtures, floors, finishes, etc. The Contractor may, at their option, provide their own temporary toilet facilities.

3.8 FIRE EXTINGUISHERS

Fire Extinguishers: Comply with the applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers". Locate fire extinguishers where they are most convenient and effective for their intended purpose, but provide not less than one extinguisher in each Work Area in Equipment Room and One outside Work Area in Clean Room.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Suspended metal grid ceiling system.

1.1.2 Acoustical units.

1.2 REFERENCE STANDARDS

1.2.1 ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2009b.

1.2.2 ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2008.

1.2.3 ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.

1.3 SUBMITTALS

1.3.1 See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.3.2 Product Data: Provide data on suspension system components and acoustical units.

1.4 FIELD CONDITIONS

1.4.1 Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 60 percent prior to, during, and after acoustical unit installation.

1.5 PROJECT CONDITIONS

1.5.1 Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

1.5.2 Install acoustical units after interior wet work is dry.

1.6 EXTRA MATERIALS

1.6.1 Provide 40 square feet of each type of acoustical unit for Owner's use in maintenance of project.

PART 2 PRODUCTS

2.1 ACOUSTICAL UNITS

2.1.1 Manufacturers:
a. Armstrong World Industries, Inc: www.armstrong.com.
b. CertainTeed Corporation: www.certainteed.com.
c. Chicago Metallic: www.chicagometallic.com.
d. United States Gypsum Company: www.usg.com.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2.1.2 Acoustical Tile Type ACT-1: Paintedmineral fiber, ASTM E 1264 Type III, Form 2 with the following characteristics:
a. Size: 24 x 24 inches.
b. Thickness: 5/8 inches.
c. Composition: Wet felted.
d. Edge: Square.
e. Surface Color: White.
f. Surface Pattern: Medium Texture.
g. Product: 1728 Fine Fissured by Armstrong World Industries Inc..
h. Product: 2110 Radar by USG United States Gypsum Company

2.2 SUSPENSION SYSTEM

2.2.1 Manufacturers:
a. Armstrong World Industries, Inc: www.armstrong.com.
b. Chicago Metallic Corporation: www.chicagometallic.com.
c. USG: www.usg.com.
d. Substitutions: See Section 01 60 00 - Product Requirements.

2.2.2 Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, and perimeter moldings as required.

2.2.3 Exposed Suspension System Type ACT-1: Formed steel, commercial quality cold rolled; intermediate-duty.
a. Profile: Tee; 15/16 inch wide face.
b. Construction: Double web.
c. Finish: White painted.
d. Product: Prelude XL by Armstrong World Industries, Inc.
e. Product: Donn DX by USG United States Gypsum

2.3 ACCESSORIES

2.3.1 Support Channels and Hangers: Primed steel; size and type to suit application and ceiling system flatness requirement specified.

2.3.2 Perimeter Moldings: Same material and finish as grid.

a. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

2.3.3 Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Verify existing conditions before starting work.

3.1.2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

3.2.1 Install suspension system in accordance with ASTM C 636 and manufacturer's instructions and as supplemented in this section.

3.2.2 Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

3.2.3 Locate system on room axis according to reflected plan.

3.2.4 Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

3.2.5 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

3.2.6 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

3.2.7 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

3.2.8 Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

3.2.9 Do not eccentrically load system or induce rotation of runners.

3.2.10 Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
a. Use longest practical lengths.
b. Miter corners.

3.3 INSTALLATION - ACOUSTICAL UNITS

3.3.1 Install acoustical units in accordance with manufacturer's instructions.

3.3.2 Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

3.3.3 Fit border trim neatly against abutting surfaces.

3.3.4 Install units after above-ceiling work is complete.

3.3.5 Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

3.3.6 Install hold-down clips on panels within 20 ft of an exterior door.

3.4 TOLERANCES

3.4.1 Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.4.2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 SECTION INCLUDES

1.1.1 Surface preparation.

1.1.2 Field application of paints and other coatings.

1.1.3 Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
a. Mechanical and Electrical:
(1) Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

1.1.4 Do Not Paint or Finish the Following Items:
a. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
b. Items indicated to receive other finishes.
c. Items indicated to remain unfinished.
d. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
e. Marble, granite, slate, and other natural stones.

1.2 REFERENCE STANDARDS

1.2.1 ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2011.

1.2.2 ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials; 2007.

1.2.3 SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings; Fourth Edition.

1.3 DEFINITIONS

1.3.1 Conform to ASTM D 16 for interpretation of terms used in this section.

1.4 SUBMITTALS

1.4.1 See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.4.2 Product Data: Provide data on all finishing products, including VOC content.

1.4.3 Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.5 MOCK-UP

1.5.1 See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

1.5.2 Provide one wall of each color, minimum 6 feet long, illustrating each coating color, texture, and finish. Obtain approval for each color prior to ordering balance of materials, or proceeding with application of painted finishes.

1.5.3 Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

1.6.2 Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

1.6.3 Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.7 FIELD CONDITIONS

1.7.1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

1.7.2 Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

1.7.3 Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1.7.4 Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

1.7.5 Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

1.7.6 Provide lighting level of 80 ft candles measured mid-height at substrate surface. Provide temporary supplemental lighting if permanent room lighting is not operational at the time of paint application.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.1.1 Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.

2.1.2 Paints:

a. Coronado Paint Company: www.coronadopaint.com
b. Glidden Professional: www.gliddenprofessional.com.
c. Benjamin Moore & Co: www.benjaminmoore.com.
d. PPG Architectural Finishes, Inc: www.ppgaf.com.
e. Sherwin-Williams Company: www.sherwin-williams.com

2.2 PAINTS AND COATINGS - GENERAL

2.2.1 Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.

a. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
b. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
c. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
d. Supply each coating material in quantity required to complete entire project's work from a single production run.
e. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.

2.2.2 Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

2.2.3 Chemical Content: The following compounds are prohibited:

a. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
b. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

2.2.4 Colors: Match existing building colors and textures.

2.3 PAINT SYSTEMS - INTERIOR

2.3.1 Paint WI-OP-3A - Wood, Opaque, Alkyd, 3 Coats:
a. One coat alkyd primer sealer.
b. Semi-gloss: Two coats of alkyd enamel.

2.3.2 Paint WI-TR-VS - Wood, Transparent, Varnish, Stain:
a. One coat of stain; color to match existing cabinets.
b. One coat clear sanding sealer.
c. Gloss: One coat of varnish; interior alkyd- or polyurethane based, clear.

2.3.3 Paint MI-OP-2A - Ferrous Metals, Primed, Alkyd, 2 Coats:
a. Touch-up with alkyd primer.
b. Semi-gloss: Two coats of alkyd enamel.

2.3.4 Paint GI-OP-3LA - Gypsum Board/Plaster, Latex-Acrylic, 3 Coats:
a. One coat of latex primer sealer.
b. Satin: Two coats of latex-acrylic enamel.
c. Flat: Two coats of latex enamel-acrylic.

2.3.5 Paint GI-OP-3E - Gypsum Board, Epoxy, 3 Coats:
a. One coat of latex primer sealer.
b. Semi-gloss: Two costs of interior semi-gloss epoxy.

2.4 ACCESSORY MATERIALS

2.4.1 Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.

2.4.2 Patching Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Do not begin application of coatings until substrates have been properly prepared.

3.1.2 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

3.1.3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.1.4 Test shop-applied primer for compatibility with subsequent cover materials.

3.1.5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply

finishes unless moisture content of surfaces are below the manufacturer's recommended maximum.
a. Gypsum Wallboard: 12 percent.
b. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

3.2.1 Clean surfaces thoroughly and correct defects prior to coating application.

3.2.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.2.3 Remove or repair existing coatings that exhibit surface defects.

3.2.4 Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

3.2.5 Surfaces: Correct defects and clean surfaces which affect work of this section.

3.2.6 Seal surfaces that might cause bleed through or staining of topcoat.

3.2.7 Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.2.8 Gypsum Board Surfaces to be painted: Fill minor defects with filler compound. Spot prime defects after repair. Texture surfaces to match adjacent walls.

3.2.9 Galvanized Surfaces to be painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

3.2.10 Corroded Steel and Iron Surfaces to be painted: Prepare using at least SSPC-PC 2 (hand tool cleaning) or SSPC-SP 3 (power tool cleaning) followed by SSPC-SP 1 (solvent cleaning).

3.2.11 Uncorroded Uncoated Steel and Iron Surfaces to be painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

3.2.12 Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.2.13 Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and

cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.2.14 Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

3.3 APPLICATION

3.3.1 Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

3.3.2 Apply products in accordance with manufacturer's instructions.

3.3.3 Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

3.3.4 Apply each coat to uniform appearance.

3.3.5 Sand wood and metal surfaces lightly between coats to achieve required finish.

3.3.6 Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

3.3.7 Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

3.3.8 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

3.4.1 Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

3.5.1 Protect finished coatings until completion of project.

3.5.2 Touch-up damaged coatings after Substantial Completion.

3.6 SCHEDULE - SURFACES TO BE FINISHED

3.6.1 Do Not Paint or Finish the Following Items:
a. Items fully factory-finished unless specifically noted.
b. Fire rating labels, equipment serial number and capacity labels.

c. Stainless steel items.

3.6.2 Paint the surfaces described below under Schedule - Paint Systems.

3.6.3 Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
a. Paint all insulated and exposed pipes occurring in finished areas to match background surfaces, unless otherwise indicated.
b. Paint shop-primed items occurring in finished areas.
c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
d. Paint dampers exposed behind louvers, grilles, to match face panels.

3.7 SCHEDULE - PAINT SYSTEMS

3.7.1 Concrete, Concrete Block, Brick Masonry: Finish all surfaces exposed to view (match existing color/texture).
a. Interior: CI-OP-3E, semi-gloss.

3.7.2 Gypsum Board: Finish all surfaces exposed to view (match existing color/texture).
a. Interior Ceilings and Bulkheads: GI-OP-3LA, flat.
b. Interior Walls: GI-OP-3LA, satin.
c. Interior Walls at toilet areas: GI-OP-3E, semi-gloss.

3.7.3 Wood: Finish all surfaces exposed to view.
a. Interior cabinet infill areas: WI-TR-VS, gloss.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SCOPE:

The scope of the plumbing phase of this project shall include all labor, materials, equipment, etc., required to fulfill the intent of the Contract Documents and shall include the work specified under the subsequent sections of Division 15 of these specifications.

1.2 RELATED DOCUMENTS:

All applicable provisions of Divisions 0 and 1 govern work under this Division. Refer to these articles in the specifications for additional information.

1.3 REFERENCED STANDARDS:

1.3.1 All work shall be performed in full accord with the latest editions of the applicable state, and national building codes and local ordinances.

1.3.2 Refer to each section for applicable codes and reference standards.

1.4 FEES, PERMITS AND TAXES:

This Contractor shall make arrangements for and pay for all inspection fees, connection fees and permits required by local authorities. The Contractor shall also pay all taxes levied for labor and materials associated with work under this Division.

1.5 SUBMITTALS:

1.5.1 The symbol "<S>" indicates a requirement for submittals.

1.5.2 Refer to AIA General Conditions.

1.5.3 In addition to the requirements of the above referenced portions of this specification, all Subcontractors proposing to do work under this Division shall comply with the following additional requirements:

A. These specifications and drawings are intended to indicate a standard of quality for materials and equipment which is established by the listing of manufacturer's names and catalog numbers and/or by referenced standards. Materials and equipment that do not comply with these standards of quality will not be considered for substitution.

B. As soon as practicable and within thirty (30) days after the award of the contract and

before beginning the fabrication of any material or the installation of any equipment, data shall be submitted for approval on equipment and materials where noted. Materials (pipe, fittings, etc.) may be listed with the name of the manufacturer and identifying catalogue numbers. Data for equipment shall include manufacturer's name, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer for evaluation.

C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalogue number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product material, fixture, form or type of construction which in the judgment of the Engineer expressed in writing, is equal to that specified.

D. All data shall be carefully examined and shall be forwarded for approval with a signed certification to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.

E. Point out in writing all deviations between the plans and specifications and the materials submitted.

F. It is understood that proof of equality is the responsibility of the Contractor and/or supplier and that it is not the responsibility of the Engineer to prove the inequality of the proposed substitutions. Furthermore the decisions of the Engineer are final.

1.5.4 While it is not the intention of the Engineer to discriminate against any manufacturer of equipment which is equal to specified equipment, a strict interpretation of such equality will be exercised by the Engineer in considering any equipment offered as a substitute for equipment named in the specification. It shall be the responsibility of the Contractor to submit with each request for approval of substitute material or equipment, sufficient data to show conclusively that it is equal to the material or equipment specified.

1.5.5 Each Contractor shall submit shop drawings and/or diagrams for approval and for job coordination in all cases where significant deviations from the contract drawings are contemplated because of job conditions, interferences, or substitutions of equipment, or when requested by the Engineer for purposes of clarification of the Contractor's intent. He shall also submit detailed shop drawings, rough-in sheets, etc., for all special or custom built items of equipment.

1.5.6 Submittal of shop drawings shall be made in sufficient quantities to provide one (1) copy of all data to be retained by the Engineer; two (2) copies of all data to be accumulated for the Owner; one (1) copy of all data to be retained by the Contractor; one (1) copy of all data to be retained by the Engineer.

1.5.7 Should any substitute items be submitted and disapproved, then those items must be furnished exactly as described herein.

1.5.8 The Engineer's review of shop drawings and/or submittal data shall not relieve the Contractor of responsibility for deviations from the contract drawings or specifications.

1.5.9 The size of plumbing equipment shown on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Engineer or Owner to indicate a suitable arrangement.

1.5.10 Prior to ordering any equipment, the contractor shall furnish to the electrical contractor an itemized list of all equipment, motors, actuators, etc. requiring electrical power. The list shall include the item and its location, voltage, phase, horsepower and amperage. A copy of the list shall be submitted to the engineer.

1.6 PRIOR APPROVAL:

Where the contractor wishes to substitute equipment or materials under an "or equal" clause, he shall submit via U.S. Mail or hand delivery to the Engineer in written hard copy form at least seven (7) work days prior to bid opening lists of proposed substitutions which, from published manufacturer's data, cover the salient features of the proposed substitution. Contractor shall indicate in writing all differences between specified equipment or materials and proposed substitution. Approvals will be issued in writing by addendum.

1.7 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS:

1.7.1 The symbol "<OM>" indicates a requirement for operating and maintenance manuals to be furnished.

1.7.2 The Owner's operating personnel shall be instructed by the Contractor on how to start and operate each item of equipment. Safety features shall be pointed out, particularly the possible troubles which might cause the safety controls to operate and what might be done to remedy the trouble.

1.7.3 Provide (4) four copies of operating and maintenance manuals. Manuals shall be bound in large ring, loose-leaf binders and contain the following:

A. Manufacturer's instructions and/or installation manual.

B. Manufacturer's service manual.

C. Manufacturer's lubrication chart listing types of lubricant to be used on each item of equipment and recommended frequency of lubrication.

D. Parts lists and identifying part numbers with prices of each part. The name and address of the nearest distributor from which parts can be obtained.

1.8 WARRANTY:

This contractor shall warrant all workmanship, material, equipment systems, etc., provided by him for a period of one year after substantial completion of the project. This warranty means that this contractor shall make good to the Owner, at no cost, any defects that become apparent during the year following substantial completion. This warranty is in addition to any other guarantees or warranties and is not intended to limit such other guarantees or warranties.

1.9 DEFINITIONS: The following words and phrases as used herein are hereby defined:

1.9.1 "provide": Furnish and install all material and labor required for a complete installation ready for operation in accordance with the intent of the Contract Documents.

1.9.2 "as required": Indicates that the Contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions; and in accordance with applicable codes or regulations; and in a workmanlike manner as defined by good local practice.

1.9.3 "or equal": Indicates that the Contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and/or described are, in the judgment of the Engineer, adequate. Submittals for approval are required where indicated.

1.9.4 "contractor": Where the word(s) "Contractor" or "this Contractor" is/are used, they refer to the Contractor engaged to execute the work under this division of the specifications only, even though he may be technically described as a sub-contractor.

1.9.5 "intent of the Contract Documents": The specific intent of these documents is to provide to the Owner, in a thoroughly functional condition, all the various systems, equipment, etc., indicated herein. Final authority over interpretation of the "intent" shall rest with the Engineer.

1.9.6 "shall": Indicates a mandatory requirement.

1.10 INSPECTION OF THE SITE:

1.10.1 The drawings are prepared from the best information available and reflect all conditions commensurate with this information. However, the contractor shall visit the site prior to submitting a proposal and should verify the locations, sizes, depths, pressures, etc., of all existing utilities and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, the Engineer should be notified in writing.

1.10.2 All proposals shall take these existing conditions and any revisions required into consideration.

1.11 CONSTRUCTION REQUIREMENTS:

1.11.1 The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions and to conform to the details of the installation supplied by the manufacturer of the equipment to be installed. Furnish all necessary pilot lines and control lines whether indicated on the drawings or not. The drawings do not give exact details as to elevations of pipe lines nor do they show exact locations of pipe to scale. Piping elevations shall be handled by giving precedence to pipes which require a stated grade for proper operation. Devices necessary for installation and support of pipes, and equipment (such as sleeves, inserts, etc.) shall be located and installed as the construction progresses in order to allow completion of each phase of the work in the proper sequence.

1.11.2 Drawings showing the extent and arrangement of the work of a particular trade shall be used together with drawings showing extent and arrangement of work of other trades to insure that the Contractor in laying out and installing his work shall do so in a manner such that the work of the several trades may progress in the most direct, workmanlike and harmonious manner.

1.11.3 The Contractor shall be responsible for the proper location and size of slots, holes or openings in the building structure pertaining to his work, and for the correct location of pipe sleeves. The drawings indicate the extent and general arrangement of the various systems, but if any departures from these drawings are deemed necessary by the contractor, detailed drawings and descriptions of these departures and a statement of the reasons therefore shall be submitted to the Engineer as soon as practicable. No departures from the arrangements shown on the drawings shall be made without prior written approval of Engineer.

1.11.4 In general, piping in finished areas of the building shall be run concealed unless noted and directed otherwise. Should any conditions arise which would cause any piping to be exposed in finished areas, it shall be immediately called to the Engineer's attention. In unfinished spaces such as equipment rooms, all pipe shall be run as high as possible, shall be run to a continuous grade and shall be grouped wherever it is feasible to do so.

1.11.5 All pipe etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All pipes run exposed in equipment rooms shall be installed parallel to the building planes except that the lines shall be sloped to obtain the proper pitch. Piping run above furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed during construction until the systems are closed with final connections.

1.11.6 The trades shall thoroughly acquaint themselves with the existing site conditions before submitting their bid as no allowance will be made because of unfamiliarity with these conditions. All required inserts shall be "drilled-in" and all openings required through concrete or masonry shall be "saw-cut" or "core drilled" with tools specifically designed for this purpose. Explosive or compression driven inserts shall only be allowed for use as approved by SMACNA and the manufacturer of these devices. All concealed lines shall be installed as required by the pace of the job to precede the general construction.

1.11.7 The plumbing plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building and in cooperation with other trades. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

1.11.8 All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. The trade furnishing the equipment shall be responsible prior to ordering same in the event that equipment specified and/or approved is incompatible with this requirement.

1.12 SLEEVES AND PENETRATIONS:

1.12.1 Refer to AIA General Conditions.

1.12.2 Each and every pipe and duct, regardless of material, which passes through a concrete slab, (except slab on grade), masonry wall, roof or other portion of the building structure shall be free from the structure and shall pass through a sleeve furnished and installed by the Subcontractor responsible for the work involved.

1.12.3 Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel and shall be flush on both sides of wall surface penetrated. The sleeves shall be sized to allow free passage of the pipe to be inserted, and when this pipe is to be insulated, the sleeves shall be large enough to pass the insulation. Floor sleeves located in pipe chases shall extend up two inches (2") above the floor slab.

1.12.4 Sleeves passing through walls or floors on or below grade and/or in moist areas shall be constructed of galvanized steel, schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be caulked to insure a waterproof penetration. Fire ratings of rated walls and floors shall be maintained by the use of approved materials.

1.12.5 All penetrations through fire rated ceilings, walls or floors shall be fire stopped using approved materials to maintain the fire rating of the ceiling, wall or floor structure. Fire stop shall be equal to BIO Fireshield, Inc., BIOTHERM 200 or BIO K-2 mortar as applicable. Penetrations shall meet or exceed the requirements set forth in the U.L. Fire Resistance Directory, Volumes I and II.

1.12.6 After installation of pipe and duct through sleeves, all sleeves shall be sealed with materials suitable for maintaining thermal resistance, acoustic properties, and weatherproofing of walls, roofs, etc. Refer to Architectural specifications.

1.13 ISOLATION:

Transmission of perceptible vibration, structure-borne noise, or objectional air borne noise to occupied areas by equipment installed under this contract will not be permitted.

1.14 CONSTRUCTION SAFETY:

This contractor assumes all responsibility regarding the safety of his personnel on the project during construction. The Contract Documents do not include materials, procedures, components, etc., required to insure construction safety. Refer to General Conditions and Supplementary General Conditions for additional information.

1.15 DAMAGE:

1.15.1 This Contractor shall be responsible for damage to project caused by this Contractor's failure to recognize hazards associated with items such as leaks, scheduling of work, inexperienced workmen, excessive cutting, etc.

1.15.2 This Contractor shall repair, at no expense to the Owner, any such damage.

1.15.3 This contractor shall familiarize himself with working conditions to the extent that he shall be responsible for damage to concealed piping, wiring and other equipment to remain and shall repair any damage caused by his negligence at no cost to the Owner.

1.16 FLOOR, CEILING AND WALL PLATES:

1.16.1 Refer to AIA General Conditions.

1.16.2 In addition to the requirements of the above referenced portions of this specification, all Subcontractors shall furnish a chromium plated sectional escutcheon in each finished space on each pipe or hanger rod penetrating a wall, floor or ceiling. Escutcheons shall be sized to fit snugly to all lines and where the lines are insulated, the escutcheons shall be fit snugly over the insulation. These plates shall be provided with set screws so that they fit snugly against the finished surface. All equipment rooms are classified as finished space.

1.17 EQUIPMENT NAME PLATE:

Each piece of equipment shall have a metal nameplate engraved with the manufacturer's name, the equipment's model number, and the equipment's serial number. The metal nameplate shall also be engraved with the equipment's capacity, voltage, horsepower, manufactured date and the equipment designation (i.e. WH-1, HWC-1, etc.) corresponding with the plans. This metal nameplate shall be fastened to the equipment with pop rivets. Plastic or stick-on type labels will not be acceptable.

1.18 IDENTIFICATION:

1.18.1 Each piece of equipment; every valve whose service and/or duty is not readily apparent; every piping system except cast iron sewer lines, shall be permanently and clearly identified.

1.18.2 Equipment and valves shall be provided with laminated phenolic nameplates, appropriately engraved with proper identification correlated to the designation shown on the drawings. Punched

plastic tape will not be acceptable. Insulated equipment may have identification taped on as for piping system.

1.18.3 Piping systems shall have designation on ten foot (10'-0") centers and closer where required to provide adequate identification, using Brady "all temperature permacode" pipe markers with direction of flow and service indication.

1.18.4 All these pipe markers shall conform to ANSI-A-13 "Scheme for the Identification of Piping Systems". Arrow markers must have the same ANSI background colors as their companion pipe markers. All marks shall be as manufactured by Brady or approved equal.

1.19 STORAGE OF MATERIALS:

Each contractor shall provide space for storage of materials, equipment or tools at ground level. Any storage contemplated within the building will be allowed only upon specific approval of the Engineer.

1.20 LOCAL CUSTOMS:

Each Sub-contractor shall comply with local customs as to which particular trade shall install any part or parts of any work or equipment specified herein.

1.21 MANUFACTURER'S DIRECTIONS:

The manufacturers' published directions shall be followed in the delivery, storage, protection, installation, piping and wiring of all equipment and material. The Contractor shall promptly notify the Engineer in writing of any conflict between the requirements of the contract documents and the manufacturers' directions and shall obtain the Engineer's instructions before proceeding with the work. Any such work performed that does not comply with the manufacturers' directions shall have deficiencies corrected at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS:

All materials shall be new and free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials.

2.2 MANUFACTURER'S REQUIREMENTS:

When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer does not have to meet the full requirements of the specifications or that his standard cataloged item will be acceptable.

2.3 SERVICE AND REPAIR PARTS:

All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts.

2.4 FLAME SPREAD PROPERTIES OF MATERIALS:

All materials and adhesives used for air conditioning filters, acoustical lining, and insulation shall conform to NFPA and UL life, safety and flame spread properties of materials. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating for these classifications as listed for the basic materials. The finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

2.5 ACCESS PANELS:

Provide flush mounted metal access panels and frames with concealed hinges and key actuated locks for all concealed and otherwise inaccessible valves, parts, fittings, equipment, filters, etc. and as required for inspection or service.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

3.1.1 All work shall be done by experienced craftsmen skilled in the applicable trade.

3.1.2 Unprofessional and incomplete work shall be rejected and corrected at no additional expense.

3.2 PROTECTION OF EQUIPMENT:

The Contractor shall continuously maintain adequate protection of both stored and installed materials and equipment. Fixtures and equipment, whether located inside or outside, shall be tightly covered with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust, moisture and abuse from other trades. Adequate air circulation shall be provided under any protective sheet to prevent condensate build up. Materials and equipment shall not be stored directly on the ground, floor, or roof deck. Piping and equipment shall not be used by other trades as supports for scaffolds or personnel. At the completion of the work, equipment, fixtures, exposed supports and piping shall be cleaned of dirt, construction debris, overspray, etc., to the satisfaction of the Engineer. Repairs made necessary by damage shall be paid for by the Contractor.

3.3 PROTECTION OF STRUCTURE:

Each Contractor in performing his work shall take particular care not to damage the structure. All finished floors and step treads shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building. In addition, each Contractor shall protect any materials on the job site whether a part of this contract or the property of another Contractor.

3.4 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES:

3.4.1 The drawings are not to be construed as shop drawings, but indicate the extent, general location, arrangement, etc., of piping systems and equipment. This Contractor shall refer to other sections of the specifications and other drawings such as electrical, structural, architectural, etc., in order to eliminate conflicts and undue delays in the progress of the work. Where other Contractors furnish items requiring piping connections by this Contractor, they will be held responsible for providing roughing-in drawings and assistance upon request.

3.4.2 Each trade shall so harmonize its work with that of the other trades so that the work may be done in the most direct and workmanlike manner without hindering the other trades. Piping interference shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall be observed:

A. Existing building lines

B. Existing structural members

C. Existing soil and drain piping

D. Existing vent piping

E. New and existing refrigerant piping

F. New and existing condensate piping

G. New and existing supply ductwork

H. New and existing exhaust ductwork

I. New and existing return ductwork

J. Existing domestic water

K. Existing electrical conduit

L. Existing natural gas piping

3.4.3 In the event of conflicts between specifications and drawings, drawings shall take precedence over specifications except in matters pertaining to quality, applications, and coordination between trades, which shall be governed by specifications.

3.4.4 Plans, specifications and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically indicated, such supportive or required items or work is consistent with what is indicated, is reasonably inferable from what is indicated, and/or is common construction procedure or knowledge with regard to what is indicated.

3.4.5 In the event of conflict between codes, as interpreted by the authority having jurisdiction and the contract documents, the codes shall govern.
3.4.6 In the event of conflict between manufacturer's installation instructions and the drawings, the manufacturer's installation instructions shall govern.

3.4.7 Should discrepancies be found between the documents and/or an interpretation is required, and a decision or interpretation to the contractor is not rendered by the Engineer, it shall be assumed the contractor has reviewed all the documents to find the most costly method for items in question which then shall be required. One document does not take precedence over another when interpreting a discrepancy.

3.5 CUTTING AND PATCHING:

3.5.1 All cutting required by the installation of sleeves, piping, equipment, etc., shall be coordinated with the General Contractor, but performed by this Contractor. Patching shall be by the General Contractor. This Contractor shall not cut any structural element or any finished work without permission from the Engineer.

3.5.2 This Contractor shall cut and patch all paving as required by the installation of buried piping, including utilities.

3.6 PAINTING:

3.6.1 All painting except "touch-up", gas piping and equipment/mechanical room piping shall be provided under the painting sections unless noted otherwise. All exposed piping, equipment, etc., shall be left clean and free from rust or grease and ready for the painter.

3.6.2 Where equipment finishes are damaged, this Contractor shall obtain matching color touch-up paint from the equipment's manufacturer and paint as required.

3.7 TRENCHING AND BACKFILL:

3.7.1 All necessary excavation and backfill for the installation of plumbing, heating, air conditioning and ventilating work shall be accomplished by each trade Subcontractor under his phase of the

work. All such work shall be included regardless of the type of materials encountered in the excavation.

3.7.2 Trenches for all underground piping shall be excavated to the required depths. The banks of trenches shall be kept as nearly vertical as practicable and where required shall be properly formed and braced. Trenches shall be not less than 12" wider than the outside diameter of the pipe to be laid therein. The bottoms of the trenches shall be tamped hard and graded to secure proper fall. Bell holes shall be excavated to a depth 6" below the bottom of the pipe and shall be backfilled to the proper grade with pea gravel or sand thoroughly tamped. Pipe laid in trenches dug in fill shall be supported down to load bearing undisturbed soil. After the pipes have been tested, inspected and approved by inspecting authorities, the trenches shall be backfilled.

3.7.3 The trenches beneath and within six feet of the building shall be carefully backfilled with pea gravel or approved river sand depth of six (6) inches above the top of the pipe. The next layer and subsequent layers of backfill may be excavated materials if of earth, loam, sand or gravel free of large clods and with rocks no larger than 1-1/2" in diameter. Backfill shall be installed in layers 6" deep, adequately tamped and wetted down before the next layer of earth is laid in place. This additional material required for backfilling shall be furnished and any excess materials and debris shall be removed from the site. Any special backfill material shall be provided as specified or shown on the drawings.

3.7.4 All excavating and backfilling shall be done in a manner so as not to disturb adjacent structures and any shoring required shall be provided.

3.8 EQUIPMENT CONNECTION:

This Contractor shall bring required services to equipment items furnished under other sections of this specification or by the Owner, make final connections, and leave equipment ready for operation. Where it is necessary for Contractors performing work covered by this section to make final connections to items of equipment being furnished by Contractors under other sections, all such work shall be performed in a neat and workmanlike manner and all materials shall be of quality and finish normally used for such installation.

3.9 OPERATION PRIOR TO COMPLETION:

When any piece of mechanical or electrical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so providing that he properly cleans the equipment, installs clean filter media, properly adjusts and completes all punch list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

3.10 EXECUTION OF WORK:

The Contractor shall plan, schedule and execute his work and that of any of his Sub-contractors so as not to interfere with the work of other trades or Contractors in the building or on the premises.

3.11 FLASHING AND WATERPROOFING:

All building penetrations to outside shall be flashed and counter flashed as required to eliminate leaks.

3.12 TESTS:

All tests shall be made by this Contractor and repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests have been made and approvals obtained. Notify the Engineer four days prior to tests to allow for scheduling. Test the piping systems as indicated in applicable articles, and as required by applicable codes and standards as a minimum.

3.13 CLEAN-UP:

3.13.1 It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment, any surplus materials and remove all debris caused by his portion of the work.

3.13.2 When all work has been finally tested, the Contractor shall clean all work installed by him, including all fixtures, equipment, pipes, and all exposed work. All pipes shall be flushed out and left free of all obstructions. All plates, fixtures, and other finished products shall be thoroughly cleaned and polished.

3.14 FINAL OBSERVATIONS:

3.14.1 It shall be the duty of the Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance, before calling upon the Engineer to make a final observation.

3.14.2 In order not to delay final acceptance of the work, the Contractor shall have all necessary bonds, guarantees, receipts, affidavits, etc., called for in the various articles of this specification, prepared and signed in advance, and together with a letter of transmittal listing each paper included, and shall deliver the same to the Engineer at or before the time of the final observations. The Contractor is cautioned to check over each bond, receipt, etc., before preparing same for submission to see that the items check with the requirements of the specification.

3.15 DEMOLITION AND SALVAGE:

3.15.1 Where demolition of equipment or materials is required this Contractor shall minimize cutting and exercise all due caution to leave undamaged surfaces, material and equipment meant to remain.

3.15.2 All existing items that are to be removed shall remain the property of the Owner unless declared as unsalvageable. Unsalvageable materials shall become the property of the Contractor and be removed from the site. Items declared as Owner's property shall be neatly stored on the site as directed by the Owner.

END OF SECTION

SECTION 22 05 03

PLUMBING PIPING

PART 1 - GENERAL

1.1 SCOPE:

Work in this section shall include piping, fittings, accessories etc., to be used in piping systems in accordance with the intent of the Contract Documents and shall include the following principal items:

Piping
Valves
Piping Accessories

1.2 REFERENCED STANDARDS:

National Bureau of Standards (NBS).
Cast Iron Soil Pipe Institute (CISPI).
American Society of Testing & Materials (ASTM).
American Water Works Association (AWWA).
National Fire Protection Association (NFPA).
Factory Mutual Engineering Corporation (FM).
American Society of Mechanical Engineers (ASME).

1.3 SUBMITTALS:

Submittals are required as indicated only. Submittal of pipe and fittings is not required unless a deviation from the specification is proposed.

PART 2 - PRODUCTS

2.1 DRAIN AND RELIEF PIPING:

2.1.1 Auxiliary drain piping, equipment drains, appliance drain piping and water heater relief piping shall be type "L" hard drawn copper piping with cast and/or wrought copper fittings per ASTM B-88, 95/5 solder. Provide pipe supports at specified intervals with only copper-plated, copper or brass in contact with copper piping.

2.1.2 All drain piping shall be installed with a minimum fall of 1/8" per foot unless noted otherwise on plan.

2.2 GAS PIPING:

2.2.1 Furnish and install a system of gas piping as shown on the plans. All gas piping within the building shall be run exposed unless specifically shown otherwise. Any gas piping concealed within the building shall be properly vented to the outside.

2.2.2 All gas piping shall be standard weight black steel pipe per ASTM A-53. All intermediate pressure pipe and all pipe larger than 1-1/ 2" shall be welded joints. Low Pressure fittings 1-1/2" and smaller shall be standard weight black malleable iron screwed per ASTM A-197-65. Intermediate pressure fittings and fittings larger than 1-1/2" shall be "Tube-Turn" forged welding type, or approved equal. Screw thread joints shall be made with an approved compound & shall comply with ANSI Standard for Pipe Threads, B2.1-1968.

2.2.3 Care shall be taken to keep the inside of piping dry and free of dirt, cutting burrs and other foreign substances. All threaded piping shall be reamed smooth after cutting and shall be threaded with true, sharp dies to insure a proper joint make-up.

2.2.4 All equipment connections shall be preceded by a manual stop cock or full-port ball valve, union and 12" drip leg.

2.2.5 Gas cocks 2" and smaller shall be Crane Company No. 324, all iron with brass square head plug; cocks larger than 2" shall be Walworth, or equal, lubricated plug cocks, 150 psi wog. Gas ball valves shall be U.L. listed equal to Nibco K-590 with Teflon seat, 150 psi wog.

2.2.6 Unions 2-1/2" and smaller shall be Grinnell 463, or equal, black malleable iron, ground joint, brass to iron seat unions. Unions 3" and larger shall be Crane Company Standard malleable iron gasket type flange unions with proper gasket.

2.2.7 All exposed gas piping whether interior or exterior to the building shall be painted with one coat of primer and two coats of black rust preventative paint. Primer and first coat of paint shall not be the same color. Piping exposed on the building exterior shall be painted with a coat to match the building finish.

2.2.8 Provide 17 pound magnesium anodes by Standard Magnesium Corporation, located as indicated in an augured hole five feet from the pipe. The electrode wire shall be brazed or thermite welded to the pipe and coated with mastic. Provide a dielectric union at each location where the piping enters the building to electrically isolate the gas utility distribution system.

2.2.9 A DC voltage reading shall be made to test the effectiveness of the isolating unions. A minimum reading of 0.2 volts (measured across the union) shall be required. Repair or replace unions until this voltage can be obtained.

2.2.10 Provide a lubricated plug cock and union in the inlet and discharge piping of each gas pressure regulator. Extend schedule 40 threaded galvanized steel pipe vents from each interior regulator and terminate through the roof or through the exterior wall with watertight flashing,

gooseneck and birdscreen. Vents shall be the full size of the regulator vent connection and shall extend through the roof/wall undiminished in size.

2.2.11 Provide epoxy-coated flexible stainless steel braided connectors at all radiant heaters and unit heaters. Provide all required adaptors, reducers, etc. for equipment connections.

2.3 PIPING ACCESSORIES GENERAL:

2.3.1 Flanges shall be slip-on or butt welding standard weight 1/16" raised face type with gaskets.

2.3.2 Unions shall be all bronze for copper systems and malleable iron with ground joint for steel piping systems. Provide dielectric unions for joining dissimilar metallic piping systems.

2.3.3 Weldolets and threadolets shall be steel per ANSI B16.9.

2.3.4 Escutcheons shall be single piece, set screw type, chrome plated (stainless steel for exterior and non-conditioned space applications) and shall cover the opening and sleeve.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

3.1.1 The piping systems required under the Plumbing division of these specifications shall be installed in a neat and workmanlike manner. All pipe hangers shall be of the type mentioned in this section and shall be so spaced and installed as to maintain a rigid piping system, adequately supported both laterally and vertically.

3.1.2 At each piece of equipment, full-port ball valves or lubricated gas cocks shall be furnished and installed by this Contractor so that these pieces of equipment may be isolated from accessible locations. Provide General Contractor with locations of all access doors. Access doors required for these valves shall be furnished by this Contractor.

3.1.3 Each of the piping systems shall be installed to provide for expansion and contraction and the joints shall be soldered at such time that the system is not under strain.

3.1.4 Necessary spring pieces and offsets shall be furnished by this Contractor as required.

3.1.5 Each of the piping systems shall be concealed in chases and above ceilings and in walls in all finished areas and shall be run exposed only as specifically specified or as shown on the drawings in machinery spaces or unfinished areas.

3.1.6 Exposed piping shall be held close to the walls and ceilings and necessary fittings shall be provided and installed to allow for offsets to hold the piping close to wall and ceilings. Where these lines run exposed a clearance shall be obtained from the Engineer in writing before making the installation.

3.1.7 All valves shall be so located as to make the removal of their bonnets possible. All flanged valves shown in the horizontal positions shall be mounted with valve stem inclined one bolt hole above the horizontal lines shall be "made-up" with valve stem inclined at an angle of thirty (30) degrees above the horizontal position. All valve stems must be true and straight at the time the system is tested for final acceptance.

3.1.8 Pipe shall be cut accurately to measurements established at the site and worked into place without springing or forcing.

3.1.9 Provide clearance for installation of insulation and for access to valves, drains and unions.

3.1.10 Provide a 1/2" thick foam plastic insulating sleeve-protector on all copper and plastic piping penetrations of concrete slab-on-grade prior to pouring of concrete.

3.1.11 Locate and suspend piping in such a manner so as to minimize transmission of vibration and noise.

3.1.12 All piping penetrations through fire rated ceilings, walls or floors shall be fire stopped using approved materials to maintain the fire rating of the ceiling, wall or floor structure. Fire stop shall be equal to BIO Fireshield, Inc., BIOTHERM 200 or BIO K-2 mortar as applicable.

3.1.13 All piping connections to equipment and fixtures shall contain flanges or unions to allow easy removal whether or not shown on the plans.

3.1.14 Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe installed underground. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.15 Air gaps for all indirect waste connections (open-site) shall be at least twice the effective drain piping diameter and in no case less than 2".

3.2 PIPING JOINTS:

3.2.1 Screwed joints shall have full cut pipe threads. Joints shall be assembled with an approved compound applied to only the male threads. A minimum of three pipe threads shall remain exposed when the joint is assembled.

3.2.2 Welded pipe joints shall be fusion welded by a metallic arc welding process. The welding operations shall conform to the current recommendations of the American Welding Society. This Contractor's welder, employed on this project, shall have passed qualification tests as prescribed by the National Pipe Welding Bureau or other reputable testing laboratory using qualification procedures as recommended by the ASME Boiler Construction Code or American Welding Standards.

3.3 SECURING AND SUPPORTING OF PIPE:

3.3.1 All pipe shall be supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grade and pitch, prevent vibration and provide for expansion/contraction.

3.3.2 All hangers shall be secured to approved inserts wherever possible and practicable. Hanger inserts shall be set in place before concrete is poured. Where hangers attach to the structural steel framing, approved beam clamps shall be employed. Where required, the Mechanical Subcontractor shall install channels to span between framing members. In no case shall spacing of hangers for horizontal piping be greater than indicated on the following schedule:

FERROUS (SCHEDULE 40) PIPING

NOMINAL PIPE SIZE (MAXIMUM)	HANGER SPACING
1/2"	5'-0"
3/4"	6'-0"
1"	7'-0"
1-1/2"	8'-0"
2" and larger	10'-0"

3.3.3 Vertical lines shall be adequately supported at their bases, either by a suitable hanger placed in the horizontal line near the riser, or by a base fitting set on a pedestal or foundation and from each floor slab by means of approved clamp type support bearing on the slab or beam. In no case shall the spacing of supports for vertical piping be greater than indicated on the following schedule:

FERROUS (SCHEDULE 40) PIPING

NOMINAL PIPE SIZE (MAXIMUM)	SUPPORT SPACING
All pipe sizes	At the base and at each story level, not exceeding 30'-0" intervals

3.3.4 Hangers for piping 2" and smaller shall be of the split cast ring type with fastening device. Hangers for piping larger than 2" shall be of the adjustable clevis hanger type. Hanger rods shall be minimum 3/8" diameter and shall have machine threads. Brackets of approved type may be used along walls. Hanger rods for individually suspended horizontal pipes shall be steel rods of size indicated on the following table:

NOMINAL PIPE SIZE (MAXIMUM)	ROD SIZE
1/2" to 2"	3/8"
2-1/2" to 3"	1/2"
4"	5/8"

3.3.5 Hangers for use with copper piping shall be copper plated ferrous sizes for copper tubing.

3.3.6 Hangers shall be installed within 2'-0" of each change in direction, either vertical or horizontal, or pipe tee and on each side of valves, strainers, etc.

3.3.7 Multiple horizontal pipes may be supported on trapeze hangers. Trapeze spacing shall be in accordance with the schedule for pipe spacing based upon the smallest pipe. The trapeze members shall be properly sized for the piping load they are to support.

3.3.8 Where "cold" pipes are insulated with a vapor sealing jacket, the hanger shall be oversized accordingly to accommodate the outside diameter of the insulation, and half-round 16 gauge galvanized steel shields, not less than 14" long, rolled to fit the insulation diameter, shall be provided between the insulation and the hanger.

3.3.9 Pipe supports shall be as manufactured by Erico/Caddy, Mapa, Miro, Fee and Mason, Grinnell, F&S Manufacturing, or prior-approved equal.

3.4 EQUIPMENT PLUMBING CONNECTIONS:

3.4.1 The Plumbing Subcontractor shall rough-in for connections to all miscellaneous equipment noted on the drawings. Final connections to the equipment shall be a part of this contract.

3.4.2 The Plumbing Subcontractor shall make final connections to all pieces of equipment furnished under this (general) contract that require natural gas, or drain, connections, furnishing all required shutoff cocks, valves, drain valves and traps unless specified or noted otherwise on plan.

3.4.3 System shall be capable of passing all Local Plumbing Code tests for conventional pipe and fittings.

3.5 GAS PIPING TESTING:

Gas piping shall be tested in strict accordance with NFPA 54.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SCOPE:

The scope of the mechanical phase of this project shall include all labor, materials, equipment, etc., required to fulfill the intent of the Contract Documents and shall include the work specified under the subsequent sections of Division 23 of these specifications.

1.2 RELATED DOCUMENTS:

All applicable provisions of Divisions 0 and 1 govern work under this Division. Refer to these articles in the specifications for additional information.

1.3 SUBMITTALS:

1.3.1 All work shall be performed in full accord with the latest editions of the applicable state, and national building codes and local ordinances.

1.3.2 Refer to each section for applicable codes and reference standards.

1.4 FEES, PERMITS AND TAXES:

This Contractor shall make arrangements for and pay for all inspection fees, connection fees and permits required by local authorities. The Contractor shall also pay all taxes levied for labor and materials associated with work under this Division.

1.5 SUBMITTALS:

1.5.1 The symbol "<S>" indicates a requirement for submittals.

1.5.2 Refer to Architectural specifications for additional information on submittals.

1.5.3 Refer to AIA General Conditions.

1.5.4 In addition to the requirements of the above referenced portions of this specification, all Subcontractors proposing to do work under this Division shall comply with the following additional requirements:

A. These specifications and drawings are intended to indicate a standard of quality for materials and equipment which is established by the listing of manufacturer's names and catalog numbers and/or by referenced standards. Materials and equipment that do not comply with these standards of quality will not be considered for substitution.

B. As soon as practicable and within thirty (30) days after the award of the contract and before beginning the fabrication of any material or the installation of any equipment, data shall be submitted for approval on equipment and materials where noted. Materials (pipe, fittings, etc.) may be listed with the name of the manufacturer and identifying catalogue numbers. Data for equipment shall include manufacturer's name, catalog data, diagrams, drawings and other descriptive data as required or requested by the Engineer for evaluation.

C. Notwithstanding any reference in the specifications to any article, device, product, material, fixture, form or type of construction by name, make or catalogue number, such references shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; and the Contractor, in such cases, may at his option use any article, device, product material, fixture, form or type of construction which in the judgment of the Engineer expressed in writing, is equal to that specified.

D. All data shall be carefully examined and shall be forwarded for approval with a signed certification to the effect that the data has been carefully checked and found to be correct with respect to dimensions and available space and that the equipment complies with all requirements of the specifications.

E. Point out in writing all deviations between the plans and specifications and the materials submitted.

F. It is understood that proof of equality is the responsibility of the Contractor and/or supplier and that it is not the responsibility of the Engineer to prove the inequality of the proposed substitutions. Furthermore the decisions of the Engineer are final.

1.5.5 While it is not the intention of the Engineer to discriminate against any manufacturer of equipment which is equal to specified equipment, a strict interpretation of such equality will be exercised by the Engineer in considering any equipment offered as a substitute for equipment named in the specification. It shall be the responsibility of the Contractor to submit with each request for approval of substitute material or equipment, sufficient data to show conclusively that it is equal to the material or equipment specified.

1.5.6 Each Contractor shall submit shop drawings and/or diagrams for approval and for job coordination in all cases where significant deviations from the contract drawings are contemplated because of job conditions, interferences, or substitutions of equipment, or when requested by the Engineer for purposes of clarification of the Contractor's intent. He shall also submit detailed shop drawings, rough-in sheets, etc., for all special or custom built items of equipment.

1.5.7 Submittal of shop drawings shall be made in sufficient quantities to provide one (1) copy of all data to be retained by the Engineer; two (2) copies of all data to be accumulated for the Owner; one (1) copy of all data to be retained by the Contractor; one (1) copy of all data to be retained by the Engineer.

1.5.8 Should any substitute items be submitted and disapproved, then those items must be furnished exactly as described herein.

1.5.9 The Engineer's review of shop drawings and/or submittal data shall not relieve the Contractor of responsibility for deviations from the contract drawings or specifications.

1.5.10 The size of mechanical equipment shown on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared when required by the Engineer or Owner to indicate a suitable arrangement.

1.5.11 Prior to ordering any equipment, the contractor shall furnish to the electrical contractor an itemized list of all equipment, motors, actuators, etc. requiring electrical power. The list shall include the item and it's location, voltage, phase, horsepower and amperage. A copy of the list shall be submitted to the engineer.

1.6 PRIOR APPROVAL:

Where the contractor wishes to substitute equipment or materials under an "or equal" clause, he shall submit to the Engineer in writing seven (7) work days prior to bid opening lists of proposed substitutions which, from published manufacturer's data, cover the salient features of the proposed substitution. Contractor shall indicate in writing all differences between specified equipment or materials and proposed substitution. Approvals will be issued in writing by addendum.

1.7 OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS:

1.7.1 The symbol "<OM>" indicates a requirement for operating and maintenance manuals to be furnished.

1.7.2 The Owner's operating personnel shall be instructed by the Contractor on how to start and operate each item of equipment. Safety features shall be pointed out, particularly the possible troubles which might cause the safety controls to operate and what might be done to remedy the trouble.

1.7.3 The Owner's operating personnel shall be thoroughly instructed in the operation of the control system. Instructions should include an explanation of the control system or system sequence of operation, the proper set points of each thermostat, etc., and how to change the settings to accommodate overheating and overcooling, or incorrect humidity. Instructions shall include an explanation of components which should not be tampered with or control settings which should not be changed except by authorized personnel of the Control Manufacturer. Thermostat keys shall be turned over to the Owner.

1.7.4 Relative to the air conditioning system, instruct the Owner's operating personnel in the following:

A. Removal of service access panels from equipment. If special tools are required, turn over to the Owner at least one set.

B. Method of removing air filters.

C. Method of cleaning permanent type air filters.

D. Location of concealed valves, traps, air splitters, automatic valves and dampers, etc., requiring periodic maintenance and location of access to them.

1.7.5 Provide (4) four copies of operating and maintenance manuals. Manuals shall be bound in large ring, loose-leaf binders and contain the following:

A. Manufacturer's instructions and/or installation manual.

B. Manufacturer's service manual.

C. Manufacturer's lubrication chart listing types of lubricant to be used on each item of equipment and recommended frequency of lubrication.

D. Electrical diagrams of each equipment "packaged" control system.

E. Diagrams of automatic temperature control systems, identifying each by name, location and number showing sequence of operation. Each component of a control system shall be identified. All diagrams shall be up-to-date, reflecting any on-the-job changes.

F. Parts lists and identifying part numbers with prices of each part. The name and address of the nearest distributor from which parts can be obtained.

1.8 WARRANTY:

This contractor shall warrant all workmanship, material, equipment systems, etc., provided by him for a period of one year after substantial completion of the project. This warranty means that this contractor shall make good to the Owner, at no cost, any defects that become apparent during the year following substantial completion. This warranty is in addition to any other guarantees or warranties and is not intended to limit such other guarantees or warranties.

1.9 DEFINITIONS: The following words and phrases as used herein are hereby defined:

1.9.1 "provide": Furnish and install all material and labor required for a complete installation ready for operation in accordance with the intent of the Contract Documents.

1.9.2 "as required": Indicates that the Contractor shall perform the work or provide the material as indicated in accordance with manufacturer's installation instructions; and in accordance with applicable codes or regulations; and in a workmanlike manner as defined by good local practice.

1.9.3 "or equal": Indicates that the Contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and/or described are, in the judgment of the Engineer, adequate. Submittals for approval are required where indicated.

1.9.4 "contractor": Where the word(s) "Contractor" or "this Contractor" is/are used, they refer to the Contractor engaged to execute the work under this division of the specifications only, even though he may be technically described as a sub-contractor.

1.9.5 "intent of the Contract Documents": The specific intent of these documents is to provide to the Owner, in a thoroughly functional condition, all the various systems, equipment, etc., indicated herein. Final authority over interpretation of the "intent" shall rest with the Engineer.

1.9.6 "shall": Indicates a mandatory requirement.

1.10 INSPECTION OF THE SITE:

1.10.1 The drawings are prepared from the best information available and reflect all conditions commensurate with this information. However, the contractor should visit the site prior to submitting a proposal and should verify the locations, sizes, depths, pressures, etc., of all existing utilities and familiarize himself with working conditions, hazards, existing grades, soil conditions, obstructions, etc. If it becomes evident that existing site conditions will impair the proper operation of the utilities, the Engineer should be notified in writing.

1.10.2 All proposals shall take these existing conditions and any revisions required into consideration.

1.11 CONSTRUCTION REQUIREMENTS:

1.11.1 The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to provide proper grading of lines, to avoid all obstructions and to conform to the details of the installation supplied by the manufacturer of the equipment to be installed. Furnish all necessary pilot lines and control lines whether indicated on the drawings or not. The drawings do not give exact details as to elevations of pipe lines nor do they show exact locations of pipe to scale. Piping elevations shall be handled by giving precedence to pipes which require a stated grade for proper operation. Devices necessary for installation and support of pipes, and equipment (such as sleeves, inserts, etc.) shall be located and installed as the construction progresses in order to allow completion of each phase of the work in the proper sequence.

1.11.2 Drawings showing the extent and arrangement of the work of a particular trade shall be used together with drawings showing extent and arrangement of work of other trades to insure that the Contractor in laying out and installing his work shall do so in a manner such that the work of the several trades may progress in the most direct, workmanlike and harmonious manner.

1.11.3 The Contractor shall be responsible for the proper location and size of slots, holes or openings in the building structure pertaining to his work, and for the correct location of pipe

sleeves. The drawings indicate the extent and general arrangement of the various systems, but if any departures from these drawings are deemed necessary by the contractor, detailed drawings and descriptions of these departures and a statement of the reasons therefore shall be submitted to the Engineer as soon as practicable. No departures from the arrangements shown on the drawings shall be made without prior written approval of Engineer.

1.11.4 In general, piping and ductwork in finished areas of the building shall be run concealed unless noted and directed otherwise. Should any conditions arise which would cause any piping or ductwork to be exposed in finished areas, it shall be immediately called to the Engineer's attention. In unfinished spaces such as equipment rooms, all pipe and duct shall be run as high as possible, shall be run to a continuous grade and shall be grouped wherever it is feasible to do so.

1.11.5 All pipe, duct, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts and pipes run exposed in machinery and equipment rooms shall be installed parallel to the building planes except that the lines shall be sloped to obtain the proper pitch. Piping and ducts run above furred ceilings, etc., shall be similarly installed, except as otherwise shown. All pipe openings shall be kept closed during construction until the systems are closed with final connections.

1.11.6 The trades shall thoroughly acquaint themselves with the existing construction details of the building before submitting their bid as no allowance will be made because of unfamiliarity with these details. For existing construction, all required inserts shall be "drilled-in" and all openings required through concrete or masonry shall be "saw-cut" or "core drilled" with tools specifically designed for this purpose. Explosive or compression driven inserts shall only be allowed for use as approved by SMACNA and the manufacturer of these devices. All concealed lines shall be installed as required by the pace of the job to precede the general construction.

1.11.7 The mechanical plans do not give exact locations of outlets, fixtures, equipment items, etc. The exact location of each item shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building and in cooperation with other trades. Minor relocations necessitated by the conditions at the site or directed by the Owner shall be made without additional cost to the Owner.

1.11.8 All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. The trade furnishing the equipment shall be responsible prior to ordering same in the event that equipment specified and/or approved is incompatible with this requirement.

1.12 ISOLATION:

1.12.1 Transmission of perceptible vibration, structure-borne noise, or objectional air borne noise to occupied areas by equipment installed under this contract will not be permitted.

1.12.2 The isolation supplier shall be a firm or individual capable of dealing effectively with vibration and noise characteristics, effects and criteria and have facilities and capabilities for

measuring and evaluating such disturbances and the preparation of drawings and installation instructions.

1.13 CONSTRUCTION SAFETY:

This contractor assumes all responsibility regarding the safety of his personnel on the project during construction. The Contract Documents do not include materials, procedures, components, etc., required to insure construction safety. Refer to General Conditions and Supplementary General Conditions for additional information.

1.14 DAMAGE:

1.14.1 This Contractor shall be responsible for damage to project caused by this Contractor's failure to recognize hazards associated with items such as leaks, scheduling of work, inexperienced workmen, excessive cutting, etc.

1.14.2 This Contractor shall repair, at no expense to the Owner, any such damage.

1.14.3 This contractor shall familiarize himself with working conditions to the extent that he shall be responsible for damage to concealed piping, wiring and other equipment to remain and shall repair any damage caused by his negligence at no cost to the Owner.

1.15 SAFETY GUARDS:

Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

1.16 STORAGE OF MATERIALS:

Each contractor shall provide space for storage of materials, equipment or tools at ground level. Any storage contemplated within the building will be allowed only upon specific approval of the Engineer.

1.17 LOCAL CUSTOMS:

Each Sub-contractor shall comply with local customs as to which particular trade shall install any part or parts of any work or equipment specified herein.

1.18 MANUFACTURER'S DIRECTIONS:

The manufacturers' published directions shall be followed in the delivery, storage, protection, installation, piping and wiring of all equipment and material. The Contractor shall promptly notify the Engineer in writing of any conflict between the requirements of the contract documents and the manufacturers' directions and shall obtain the Engineer's instructions before proceeding with the work. Any such work performed that does not comply with the manufacturers' directions shall have deficiencies corrected at no cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS:

All materials shall be new and free from defects at the time of installation. Materials or equipment damaged in shipment or otherwise damaged prior to installation shall not be repaired at the job site, but shall be replaced with new materials.

2.2 MANUFACTURER'S REQUIREMENTS:

When a manufacturer's name appears in these specifications, it is not to be construed that the manufacturer does not have to meet the full requirements of the specifications or that his standard cataloged item will be acceptable.

2.3 SERVICE AND REPAIR PARTS:

All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts.

2.4 FLAME SPREAD PROPERTIES OF MATERIALS:

All materials and adhesives used for air conditioning filters, acoustical lining, and insulation shall conform to NFPA and UL life, safety and flame spread properties of materials. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating for these classifications as listed for the basic materials. The finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

2.5 ACCESS PANELS:

2.5.1 Provide flush mounted metal access panels and frames with concealed hinges and key actuated locks for all concealed and otherwise inaccessible valves, parts, fittings, equipment, filters, etc. and as required for inspection or service.

2.6 FLOOR, CEILING AND WALL PLATES:

2.6.1 Refer to AIA General Conditions.

2.6.2 In addition to the requirements of the above referenced portions of this specification, all Subcontractors shall furnish a chromium plated sectional escutcheon in each finished space on each pipe or hanger rod penetrating a wall, floor or ceiling. Escutcheons shall be sized to fit snugly to all lines and where the lines are insulated, the escutcheons shall be fit snugly over the insulation. These plates shall be provided with set screws so that they fit snugly against the finished surface. All equipment rooms are classified as finished space.

2.7 EQUIPMENT NAME PLATE:

Each piece of equipment shall have a metal nameplate engraved with the manufacturer's name, the equipment's model number, and the equipment's serial number. The metal nameplate shall also be engraved with the equipment's capacity, voltage, horsepower, manufactured date and the equipment designation (i.e. AHU-1, EF-1, etc.) corresponding with the plans. This metal nameplate shall be fastened to the equipment with pop rivets. Plastic or stick-on type labels will not be acceptable.

2.8 IDENTIFICATION:

2.8.1 Each piece of equipment; every valve whose service and/or duty is not readily apparent; each zone duct, outside air duct and return air duct whose duty is not immediately apparent; every piping system except cast iron sewer lines, shall be permanently and clearly identified.

2.8.2 Equipment, valves and duct shall be provided with laminated phenolic nameplates, with engraved letters on light background, appropriately engraved with proper identification correlated to the designation shown on the drawings. Punched plastic tape will not be acceptable. Insulated equipment may have identification taped on as for piping system.

2.8.3 Piping systems shall have designation on ten foot (10'-0") centers and closer where required to provide adequate identification, using Brady "all temperature permacode" pipe markers with direction of flow and service indication.

2.8.4 All these pipe markers shall conform to ANSI-A-13 "Scheme for the Identification of Piping Systems". Arrow markers must have the same ANSI background colors as their companion pipe markers. All marks shall be as manufactured by Brady or approved equal.

2.9 SLEEVES AND PENETRATIONS:

2.9.1 Refer to AIA General Conditions.

2.9.2 Each and every pipe and duct, regardless of material, which passes through a concrete slab, (except slab on grade), masonry wall, roof or other portion of the building structure shall be free from the structure and shall pass through a sleeve furnished and installed by the Subcontractor responsible for the work involved.

2.9.3 Above grade and dry location sleeves shall be constructed from 18 gauge galvanized steel and shall be flush on both sides of wall surface penetrated. The sleeves shall be sized to allow free passage of the pipe to be inserted, and when this pipe is to be insulated, the sleeves shall be large enough to pass the insulation. Floor sleeves located in pipe chases shall extend up two inches (2") above the floor slab.

2.9.4 Sleeves passing through walls or floors on or below grade and/or in moist areas shall be constructed of galvanized steel, schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the

sleeves, void space around the pipe shall be caulked to insure a waterproof penetration. Fire ratings of rated walls and floors shall be maintained by the use of approved materials.

2.9.5 All penetrations through fire rated ceilings, walls or floors shall be fire stopped using approved materials to maintain the fire rating of the ceiling, wall or floor structure. Fire stop shall be equal to BIO Fireshield, Inc., BIOTHERM 200 or BIO K-2 mortar as applicable. Penetrations shall meet or exceed the requirements set forth in the U.L. Fire Resistance Directory, Volumes I and II.

2.9.6 After installation of pipe and duct through sleeves, all sleeves shall be sealed with materials suitable for maintaining thermal resistance, acoustic properties, and weatherproofing of walls, roofs, etc. Refer to Architectural specifications.

2.9.7 Mechanical sleeve seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.9.8 Formed steel channel shall be galvanized 12 gauge thick steel, with holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 WORKMANSHIP:

3.1.1 All work shall be done by experienced craftsmen skilled in the applicable trade.

3.1.2 Unprofessional and incomplete work shall be rejected and corrected at no additional expense.

3.2 PROTECTION OF EQUIPMENT:

The Contractor shall continuously maintain adequate protection of stored materials and installed equipment. Fixtures and equipment, whether located inside or outside, shall be tightly covered with sheet polyethylene or waterproof tarpaulin as protection against dirt, rust, moisture and abuse from other trades. Adequate air circulation shall be provided under any protective sheet to prevent condensate build up. Materials and equipment shall not be stored directly on the ground. Ductwork, piping and equipment shall not be used by other trades as supports for scaffolds or personnel. At the completion of the work, equipment, fixtures, exposed supports and piping shall be cleaned of loose dirt, construction debris, overspray, etc., to the satisfaction of the Engineer. Repairs made necessary by damage shall be paid for by the Contractor.

3.3 PROTECTION OF STRUCTURE:

Each Contractor in performing his work shall take particular care not to damage the structure. All finished floors and step treads shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building. In addition, each Contractor shall protect any materials on the job site whether a part of this contract or the property of another Contractor.

3.4 FOUNDATIONS:

3.4.1 Concrete foundations required by mechanical equipment shall be constructed by this Contractor. See Concrete Work.

3.4.2 Equipment shall be set in place on the bases, leveled and aligned by means of shims, piped, then grouted in, in that order. After grouting, the forms shall be removed and the surfaces of the foundation shall be hand-rubbed with carborundum. Concrete work shall conform to the requirements of General Specifications, Concrete Work, of this specification.

3.5 CONFLICTS, INTERFERENCES AND COORDINATION BETWEEN TRADES:

3.5.1 The drawings are not to be construed as shop drawings, but indicate the extent, general location, arrangement, etc., of piping systems and equipment. This Contractor shall refer to other sections of the specifications and other drawings such as electrical, structural, architectural, etc., in order to eliminate conflicts and undue delays in the progress of the work. Where other Contractors furnish items requiring piping connections by this Contractor, they will be held responsible for providing roughing-in drawings and assistance upon request.

3.5.2 Each trade shall so harmonize its work with that of the other trades so that the work may be done in the most direct and workmanlike manner without hindering the other trades. Piping interference shall be handled by giving precedence to pipe lines which require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall be observed:

A. Building lines

B. Structural members

C. Soil and drain piping

D. Vent piping

E. Refrigerant piping

F. Condensate piping

G. Supply ductwork

H. Exhaust ductwork

I. Domestic water

J. Electrical conduit

K. Natural gas piping

3.5.3 In the event of conflicts between specifications and drawings, drawings shall take precedence over specifications except in matters pertaining to quality, applications, and coordination between trades, which shall be governed by specifications.

3.5.4 Plans, specifications and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically indicated, such supportive or required items or work is consistent with what is indicated, is reasonably inferable from what is indicated, and/or is common construction procedure or knowledge with regard to what is indicated.

3.5.5 In the event of conflict between codes, as interpreted by the authority having jurisdiction and the contract documents, the codes shall govern.

3.5.6 In the event of conflict between manufacturer's installation instructions and the drawings, the manufacturer's installation instructions shall govern.

3.5.7 Should discrepancies be found between the documents and/or an interpretation is required, and a decision or interpretation to the contractor is not rendered by the Engineer, it shall be assumed the contractor has reviewed all the documents to find the most costly method for items in question which then shall be required. One document does not take precedence over another when interpreting a discrepancy.

3.6 CUTTING AND PATCHING:

3.6.1 All cutting required by the installation of sleeves, piping, equipment, etc., shall be coordinated with the General Contractor, but performed by this Contractor. Patching shall be by the General Contractor. This Contractor shall not cut any structural element or any finished work without permission from the Engineer.

3.6.2 This Contractor shall cut and patch all paving as required by the installation of buried piping, including utilities.

3.7 CONCRETE WORK:

This Contractor shall provide all forming, reinforcing and concrete as indicated such as equipment bases, plumbing stack support, valve and cleanout pads, grease interceptors, catch basin and

headwalls. Work shall conform to applicable portion of specification for CONCRETE.

3.8 PAINTING:

3.8.1 All painting except "touch-up", mechanical room piping, gas piping, and prime painting for ferrous piping shall be provided under the painting sections (Division 9) unless noted otherwise. All exposed piping, equipment, etc., shall be left clean and free from rust or grease and ready for the painter.

3.8.2 Where equipment finishes are damaged, this Contractor shall obtain matching color touch-up paint from the equipment's manufacturer and paint as required.

3.9 LUBRICATION:

This Contractor shall provide all lubricants for the operation of all equipment until acceptance. The Contractor shall be required to protect all bearings during the installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. All equipment bearings requiring periodic lubrication shall be provided with proper fittings for this purpose. Where equipment requiring such lubrication is not readily accessible due to location, copper tubing extensions shall be provided in addition to lubrication fittings.

3.10 ELECTRICAL WORK:

3.10.1 Except for such items that are completely wired at their point of manufacture and so delivered and unless specifically noted to the contrary herein, the Electrical Contractor shall provide all electric wiring (120 VAC and above) for power supply. This includes mounting of all electrical devices furnished under this section (Mechanical) of these specifications.

3.10.2 Conduit and wiring (below 120 VAC) for all automatic controls, temperature control, temperature indication, and interlock shall be provided by the Temperature Controls Contractor. The furnishing of all disconnect switches as required for proper operation as shown on the drawings and required by code will be under Electrical Work, except where specifically designated on the plans. The furnishing of all starters for mechanical equipment will be done under this section (Mechanical) of these specifications, unless specifically scheduled otherwise on a starter schedule on the drawings.

3.10.3 Furnishing of complete wiring diagrams showing power wiring and interlock wiring shall be work under the trade supplying the equipment. Diagrams shall be based on approved equipment and shall be complete integral drawings, not a series of manufacturer's individual diagrams. After these diagrams have been approved by the Engineer, copies shall be furnished to the trades involved and they shall be followed in detail.

3.10.4 The electrical design and drawings are based on the equipment scheduled and shown on the drawings and should any mechanical equipment requiring changes to the electrical design be

approved, the required electrical changes shall be made at the expense of the trade furnishing the changed equipment and at no cost to the Owner.

3.11 EQUIPMENT CONNECTION:

This Contractor shall bring required services to equipment items furnished under other sections of this specification or by the Owner, make final connections, and leave equipment ready for operation. Where it is necessary for Contractors performing work covered by this section to make final connections to items of equipment being furnished by Contractors under other sections, all such work shall be performed in a neat and workmanlike manner and all materials shall be of quality and finish normally used for such installation.

3.12 OPERATION PRIOR TO COMPLETION:

When any piece of mechanical or electrical equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so providing that he properly cleans the equipment, installs clean filter media, properly adjusts and completes all punch list items before final acceptance by the Owner. The date of acceptance and the start of the warranty may not be the same date.

3.13 EQUIPMENT AND AIR INTAKE ARRANGEMENTS:

3.13.1 All equipment shall be installed in a manner to permit access to all surfaces requiring access. All valves, motors, drives, lubrication devices, filters and other necessary items shall be installed in a position to allow removal for service without disassembly of another part.

3.13.2 Outside air, ventilation and combustion air intakes shall be separated from exhaust air outlets, flues, plumbing vent stacks, etc. to avoid infiltration of odors, fumes and other contaminants. Separation shall be 15 ft. minimum.

3.14 EXECUTION OF WORK:

The Contractor shall plan, schedule and execute his work and that of any of his Sub-contractors so as not to interfere with the work of other trades or Contractors in the building or on the premises.

3.15 FLASHING AND WATERPROOFING:

All building penetrations to outside shall be flashed and counter flashed as required to eliminate leaks.

3.16 TESTS:

All tests shall be made by this Contractor and repeated until approved by the Engineer. Piping systems shall not be covered or otherwise concealed until tests have been made and approvals obtained. Notify the Engineer four days prior to tests to allow for scheduling. Test the piping systems as indicated in applicable articles.

3.17 CLEAN-UP:

3.17.1 It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment, any surplus materials and all debris caused by his portion of the work.

3.17.2 When all work has been finally tested, the Contractor shall clean all work installed by him, including all fixtures, equipment, pipes, ducts and all exposed work. All pipes shall be flushed out and left free of all obstructions. All plates, grilles, and other finished products shall be thoroughly cleaned and polished.

3.18 FINAL OBSERVATIONS:

3.18.1 It shall be the duty of the Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance, before calling upon the Engineer to make a final observation.

3.18.2 In order not to delay final acceptance of the work, the Contractor shall have all necessary bonds, guarantees, receipts, affidavits, etc., called for in the various articles of this specification, prepared and signed in advance, and together with a letter of transmittal listing each paper included, and shall deliver the same to the Engineer at or before the time of the final observations. The Contractor is cautioned to check over each bond, receipt, etc., before preparing same for submission to see that the items check with the requirements of the specification.

3.19 DEMOLITION AND SALVAGE:

3.19.1 Where demolition of equipment or materials is required this Contractor shall minimize cutting and exercise all due caution to leave undamaged surfaces, material and equipment meant to remain.

3.19.2 All existing items that are to be removed shall remain the property of the Owner unless declared as unsalvageable. Unsalvageable materials shall become the property of the Contractor and be removed from the site. Items declared as Owner's property shall be neatly stored on the site as directed by the Owner.

END OF SECTION

SECTION 23 05 03

HVAC PIPING

PART 1 - GENERAL

1.1 SCOPE:

Work in this section shall include piping, fittings, accessories etc., to be used in piping systems in accordance with the intent of the Contract Documents and shall include the following principal items:

Piping
Valves
Piping Accessories

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME).
B. American Society of Testing & Materials (ASTM).
C. American Welding Society.
D. American Water Works Association (AWWA).
E. National Fire Protection Association (NFPA).
F. National Bureau of Standards (NBS).

1.3 SUBMITTALS:

Submittals are required as indicated only. Submittal of pipe and fittings is not required unless a deviation from the specification is proposed.

1.4 QUALITY ASSURANCE

A. Perform work in accordance with ASME code for installation of piping systems and ASME Section IX for welding materials and procedures.

PART 2 - PRODUCTS

2.1 EQUIPMENT DRAINS, OVERFLOWS AND RELIEF PIPING:

2.1.1 Condensate drain piping, auxiliary drain piping, and equipment drain piping shall be type "L" hard drawn copper piping with cast and/or wrought copper fittings per ASTM B-88, 95/5 solder. Provide pipe supports at specified intervals with only copper-plated, copper or brass in contact with copper piping.

2.1.2 All drain piping shall be installed with a minimum fall of 1/8" per foot unless noted otherwise on plan.

2.1.3 The size of condensate drain piping from HVAC equipment shall be indicated on the plans. Where no size is shown, piping shall not be less than 3/4" and in no case less than in accordance with the following schedule:

Coil Nominal Tonnage	Copper Pipe Size
Up to 2	3/4"
2 1/2 to 5	1"
6 to 14	1 1/4"
15 to 30	1 1/2″

2.1.4 The HVAC Subcontractor shall provide all drain piping required for or related to HVAC equipment whether indicated on plan or not. Coordinate all termination points required with the Plumbing Subcontractor.

2.2 PIPE HANGERS AND SUPPORTS: <S>

A. Conform to ASME, ASTM and MSS SP requirements.
B. Hangers for pipe sizes ½ to 1-1/2 inches: carbon steel, adjustable swivel, split ring.
C. Hangers for cold pipe sizes 2-1/2 inches and larger: carbon steel, adjustable, clevis.
D. Hangers for hot pipe sizes 2 to 4 inches: carbon steel, adjustable, clevis.
E. Hangers for hot pipe sizes 6 inches and larger: adjustable steel yoke, cast iron roll, double hanger.
F. Multiple or trapeze hangers: steel channels with welded spacers and hanger rods.
G. Multiple or trapeze hangers for hot pipe sizes 6 inches and larger: steel channels with welded spacers and hanger rods, cast iron roll.
H. Wall support for pipe sizes 3 inches and smaller: cast iron hooks.
I. Wall support for pipe sizes 4 inches and larger: welded steel bracket and wrought steel clamp.
J. Wall Support for hot pipe sizes 6 inches and larger: welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
K. Vertical support: steel riser clamp.
L. Floor support for cold pipe: cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
M. Floor support for hot pipe 4 inches and smaller: cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
N. Floor support for hot pipe sizes 6 inches and larger: adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
O. Copper pipe support: carbon steel rings, adjustable, copper plated.
P. Hanger rods: mild steel threaded both ends, threaded on end, or continuous threaded.
Q. Inserts: malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.3 GAS PIPING:

2.3.1 Furnish and install a system of gas piping as shown on the plans. All gas piping within the building shall be run exposed unless specifically shown otherwise. Any gas piping concealed within the building shall be properly vented to the outside.

2.3.2 All gas piping shall be standard weight black steel pipe per ASTM A-53. All intermediate pressure pipe and all pipe larger than 1-1/ 2" shall be welded joints. Low Pressure fittings 1-1/2" and smaller shall be standard weight black malleable iron screwed per ASTM A-197-65. Intermediate pressure fittings and fittings larger than 1-1/2" shall be "Tube-Turn" forged welding type, or approved equal. Screw thread joints shall be made with an approved compound & shall comply with ANSI Standard for Pipe Threads, B2.1-1968.

2.3.3 All underground piping shall have factory applied covering conforming to Republic "X-Tru-Coat"; or General Paint Corporation Specification "TMA-2", and shall include the following layers (one coat Biturine Enamel, one wrapping of felt and a final wrapping of heavy kraft paper.) Fittings and joints shall be treated and wrapped as specified above, in field after lines have been tested.

2.3.4 Care shall be taken to keep the inside of piping dry and free of dirt, cutting burrs and other foreign substances. All threaded piping shall be reamed smooth after cutting and shall be threaded with true, sharp dies to insure a proper joint make-up.

2.3.5 All equipment connections shall be preceded by a manual stop cock or full-port ball valve, union and 12" drip leg.

2.3.6 Gas cocks 2" and smaller shall be Crane Company No. 324, all iron with brass square head plug; cocks larger than 2" shall be Walworth, or equal, lubricated plug cocks, 150 psi wog. Gas ball valves shall be U.L. listed equal to Nibco K-590 with Teflon seat, 150 psi wog.

2.3.7 Unions 2-1/2" and smaller shall be Grinnell 463, or equal, black malleable iron, ground joint, brass to iron seat unions. Unions 3" and larger shall be Crane Company Standard malleable iron gasket type flange unions with proper gasket.

2.3.8 All exposed gas piping whether interior or exterior to the building shall be painted with one coat of primer and two coats of black rust preventative paint. Primer and first coat of paint shall not be the same color. Piping exposed on the building exterior shall be painted with a coat to match the building finish.

2.3.9 Provide 17 pound magnesium anodes by Standard Magnesium Corporation, located as indicated in an augured hole five feet from the pipe. The electrode wire shall be brazed or thermite welded to the pipe and coated with mastic. Provide a dielectric union at each location where the piping enters the building to electrically isolate the gas utility distribution system.

2.3.10 A DC voltage reading shall be made to test the effectiveness of the isolating unions. A minimum reading of 0.2 volts (measured across the union) shall be required. Repair or replace unions until this voltage can be obtained.

2.3.11 <S> Underground gas piping, if approved by local code, may be yellow polyethylene plastic pipe per API 15LE ASTM D-2513 with fusion joints equal to PPI PE 2406 in lieu of the wrapping black steel pipe.

2.3.12 Provide anodeless riser at building service entrances and at meter set for transition from polyethylene plastic pipe to above ground piping. Metal pipe shall have factory conforming to Republic "X-TRU-COAT".

2.3.13 Provide a lubricated plug cock and union in the inlet and discharge piping of each gas pressure regulator. Extend schedule 40 threaded galvanized steel pipe vents from each interior regulator and terminate through the roof or through the exterior wall with watertight flashing, gooseneck and birdscreen. Vents shall be the full size of the regulator vent connection and shall extend through the roof/wall undiminished in size.

2.3.14 Provide epoxy-coated flexible stainless steel braided connectors at all radiant heaters and unit heaters. Provide all required adaptors, reducers, etc. for equipment connections.

2.4 CHILLED AND HEATING WATER PIPING AND FITTINGS:

2.4.1 Piping above ground shall be standard weight black steel Grade 53 Schedule 40 with welding type fittings per ASTM A-120-55 for 3" in size and larger. Piping 2-1/2" and smaller in size shall be the same material as stated above and shall be assembled with 125 psi screwed malleable iron fittings. At Contractor's option, Type "L" hard drawn copper with wrought copper solder joint fitting and bronze valves may be used for piping 2" and smaller.

2.4.2 <S> The Contractor shall have the option of using Victualic couplings, fittings, valves, and specialties to assemble the above ground piping in lieu of welded or threaded connections.

2.4.3 Valves shall be of first quality line equal to Nibco, Stockham or Crane Company. Valves shall be the same working pressure and materials as fittings specified for the service. Provide stem extensions for insulated valves equal to Nibco's Nib-Seal extended handle. (Reference Section 15250 for insulation thickness.) All valves shall be suitable for repacking under pressure and all valves shall not be designed for less than 200 psi working pressure.

2.4.4 Valves shall conform to MSSSP-80 and shall be provided as follows:<S>

A. Balancing cocks 2" and smaller shall be Homestead or Rockwell Figure 142 lubricated, screwed and shall be wrench operated. Balancing cocks larger than 2-1/2" shall be Homestead or Rockwell Figure 143, lubricated, bolted gland, semi-steel flanged type.

B. Strainers shall be McAlear No. 530 or equal, semi-steel "Y" type strainer. Strainers 1-1/4" and below shall be screwed. If strainers cannot be installed in a completely

accessible manner, then bucket type strainer equal to McAlear No. 528 shall be used.

B. Automatic flow control valves shall be automatic pressure compensating type. Valves shall be factory set and shall automatically limit the rate of flow to required capacity with ±5% accuracy. Variable orifice shall be stainless steel construction and shall be easily removed and replaced without removing the valve body from the pipe line. Provide a metal identification tag w/chain for each valve, marked w/unit identification, valve model number, and rated flow in GPM. Valves shall be as manufactured by Griswold or Autoflow, Inc.

2.5 GATE VALVES: <S>

A. 2-1/2 inches and smaller MSS SP 80, Class 125 equal to Nibco T-113 screwed or Nibco S-113 or Milwaukee 115 solder joint.
B. 3 inches and larger MSS SP 70, Class 125 equal to Nibco F-619 or Milwaukee F2882A cast iron body, bronze trim, bolted bonnet, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.6 BALL VALVES: <S>

A. 2 inches and smaller MSS SP 110, 600 psi, equal to Nibco S-585-70, solder joint, two-piece bronze body, chrome plated brass ball, reinforced TFE seats, blow-out proof stem, full-port quarter-turn.

0.7 PIPING ACCESSORIES GENERAL:

0.7.1 Flanges shall be slip-on or butt welding standard weight 1/16" raised face type with gaskets.

2.7.2 Unions shall be all bronze for copper systems and malleable iron with ground joint for steel piping systems. Provide dielectric unions for joining dissimilar metallic piping systems.

0.7.3 Escutcheons shall be single piece, set screw type, chrome plated and shall cover the opening and sleeve.

2.7.4 Weldolets and threadolets shall be steel per ANSI B16.9

2.8 HYDRONIC PIPING ACCESSORIES:

2.8.1 Flexible pipe connections <S> shall be neoprene double arch type rated at 150 psi flanged connection with back-up rings and control units.

2.8.2 Air vents <S> shall be automatic float type for all high points of the piping systems with brass stop cock.

2.9 TEST PLUGS:

2.9.1 Provide temperature and pressure test plugs where shown on drawings and where required for testing and balancing system.

2.9.2 Temperature and pressure test plugs shall consist of 1/4" NPT brass fittings with gaskets cap and Nordel core, rated for 1000 psi and 275 degrees F. The double valve self-sealing core shall be designed to receive a 1/8 inch O.D. temperature or pressure probe. Test plugs in insulated pipes shall be extended above insulation.

Acceptable manufacturers: Pete's Plumbing, R.E. Meyers TAP-110, Fairfax

2.7 PREINSULATED PIPING SYSTEM: <S> <OM>

2.7.1 General: Exterior buried chilled and heating water piping shall be factory fabricated, preinsulated piping assembly as specified herein and as indicated on the drawings.

2.7.2 Carrier Pipe: Schedule 40 ASTM A53 or A106 black steel, welded joints.

2.7.3 Insulation: Polyurethane foam with the following minimum characteristics: K Factor .14 at 70°F, Density -2 pcf, Closed Cell Content - 90-95% in conformance with MIL-I-24172 completely filling the annular space between the carrier pipe and the jacketing.

2.7.4 Jacketing Material: High impact, seamless Polyvinylchloride (PVC) class 12454-B compound conforming to ASTM D-1784, type 1, grade 1 through 12" diameter.

Pipe Size (Carrier)	Carrier Wall Thickness	Min. Insulation Thickness	Jacket Size
2"	.140"	.92"	4"
3"	.190"	1.20"	6"
4"	.240"	1.71"	8"
6"	.300"	1.64"	10"

2.7.5 End Seals: Each length of pre-insulated pipe shall be fitted with 3/4" thick compression E.P.D.M. end seal with ribs at jacket and pipe surfaces. All field cuts will be sealed with field applied end seals. The end seals shall be sealed with field applied end seals.

2.7.6 Anchors: Piping systems shall be anchored within five feet of connection point to preinsulated piping to eliminate any thrust, stress, or torque being transferred to the preinsulated piping.

2.7.7 Thrust Blocks: All changes of direction shall be poured in concrete thrust block to provide anchor points and direct expansion and contraction.

2.7.8 Manufacturer's Assistance: Pre-insulator shall provide to the contractor, a field service instructor on site to properly train the contractor's personnel in all phases of installation.

2.7.9 Backfill: Shall be tamped compactly in place so as to assure a stable surface. Place backfill 24 inches over the top of pipes in 6 inch layers and compact each layer to at least 95 percent minimum density. Coordinate requirements with pipe manufacturer.

2.7.10 All piping, fittings, field joints, etc. shall be installed in strict accordance with manufacturer's instructions and diagrams.

2.7.11 Manufacturer's Assistance: Pre-insulator shall provide to the contractor, a field service instructor on site to properly train the contractor's personnel in all phases of installation. Field service instructor shall provide written signed certification that piping system installation has been installed per the manufacturer's recommendations.

2.7.12 Acceptable Manufacturers: Thermal Pipe Systems, Thermacor, Perma-pipe.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

3.1.1 The piping systems required under the Mechanical division of these specifications shall be installed in a neat and workmanlike manner. All pipe hangers shall be of the type mentioned in this section and shall be so spaced and installed as to maintain a rigid piping system, adequately supported both laterally and vertically.

3.1.2 At each piece of equipment, shut-off valves shall be furnished and installed by this Contractor so that these groups of fixtures or pieces of equipment may be isolated from accessible locations. Provide General Contractor with locations of all access doors. Access doors required for these valves shall be furnished by this Contractor.

3.1.3 Each of the piping systems shall be installed to provide for expansion and contraction and the joints shall be soldered at such time that the system is not under strain.

3.1.4 Necessary spring pieces and offsets shall be furnished by this Contractor as required.

3.1.5 Each of the piping systems shall be concealed in chases and above ceilings and in walls in all finished areas and shall be run exposed only as specifically specified or as shown on the drawings in machinery spaces or unfinished areas.

3.1.6 Exposed piping shall be held close to the walls and ceilings and necessary fittings shall be provided and installed to allow for offsets to hold the piping close to wall and ceilings. Where these lines run exposed a clearance shall be obtained from the Engineer in writing before making the installation.

3.1.7 All valves shall be so located as to make the removal of their bonnets possible. All flanged valves shown in the horizontal positions shall be mounted with valve stem inclined one bolt hole above the horizontal lines shall be "made-up" with valve stem inclined at an angle of thirty (30)

degrees above the horizontal position. All valve stems must be true and straight at the time the system is tested for final acceptance.

3.1.8 Pipe shall be cut accurately to measurements established at the site and worked into place without springing or forcing.

3.1.9 Provide clearance for installation of insulation and for access to valves, air vents, drain and unions.

3.1.10 Slope piping as indicated and provide automatic air vent at all high points of the systems. Extend 1/4" soft copper extensions from vents to suitable drain where air vents are in inaccessible locations.

3.1.11 Provide a 1/2" thick foam plastic insulating sleeve-protector on all copper and plastic piping penetrations of concrete slab-on-grade prior to pouring of concrete.

3.1.12 Locate and suspend piping in such a manner so as to minimize transmission of vibration and noise.

3.1.13 All piping penetrations through fire rated ceilings, walls or floors shall be fire stopped using approved materials to maintain the fire rating of the ceiling, wall or floor structure. Fire stop shall be equal to BIO Fireshield, Inc., BIOTHERM 200 or BIO K-2 mortar as applicable.

3.1.14 All piping connections to equipment and fixtures shall contain flanges or unions to allow easy removal whether or not shown on the plans.

3.1.15 Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe installed underground. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.1.16 Air gaps for all indirect waste connections (open-sight) shall be at least twice the effective drain piping diameter and in no case less than 2".

3.2 PIPING JOINTS:

3.2.1 Screwed joints shall have full cut pipe threads. Joints shall be assembled with an approved compound applied to only the male threads. A minimum of three pipe threads shall remain exposed when the joint is assembled.

3.2.2 Welded pipe joints shall be fusion welded by a metallic arc welding process. The welding operations shall conform to the current recommendations of the American Welding Society. This Contractor's welder, employed on this project, shall have passed qualification tests as prescribed by the National Pipe Welding Bureau or other reputable testing laboratory using qualification procedures as recommended by the ASME Boiler Construction Code or American Welding Standards.

3.2.3 Mechanical coupling joints shall be assembled in strict accordance with the recommendations of the coupling joint manufacturer. The bolts, fasteners, gaskets and lubricants shall be a product of, or shall adhere rigidly to, the specification requirements of the joint manufacturer.

3.2.4 Solder joints shall be assembled with square cut pipe using a pipe cutter. Hack saw cut pipe ends shall be reamed to full size. Both the pipe and fittings shall be furnished absolutely clean. Brazing flux shall be applied to both the pipe and the fittings. The use of corrosive acid flux will not be permitted. During the brazing, the pipe and fittings must be charged with nitrogen gas.

3.3 SECURING AND SUPPORTING OF PIPE:

3.3.1 All pipe shall be supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grade and pitch, prevent vibration and provide for expansion/contraction.

3.3.2 All hangers shall be secured to approved inserts wherever possible and practicable. Hanger inserts shall be set in place before concrete is poured. Where hangers attach to the structural steel framing, approved beam clamps shall be employed. Where required, the Mechanical Subcontractor shall install channels to span between framing members. In no case shall spacing of hangers for horizontal piping be greater than indicated on the following schedule:

FERROUS (SCHEDULE 40) PIPING

NOMINAL PIPE SIZE (MAXIMUM)	HANGER SPACING
1/2"	5'-0"
3/4"	6'-0"
1"	7'-0"
1-1/2"	8'-0"
2" to 6"	10'-0"
8″	10'-0"

COPPER PIPING/TUBING

NOMINAL PIPE SIZE (MAXIMUM)	HANGER SPACING
Up to 1-1/2"	6'-0"
2" and larger	8'-0"

3.3.3 Vertical lines shall be adequately supported at their bases, either by a suitable hanger placed in the horizontal line near the riser, or by a base fitting set on a pedestal or foundation and from each floor slab by means of approved clamp type support bearing on the slab or beam. In no case shall the spacing of supports for vertical piping be greater than indicated on the following schedule:

FERROUS (SCHEDULE 40) PIPING

NOMINAL PIPE SIZE (MAXIMUM)	SUPPORT SPACING
All pipe sizes	At the base and at each story level, not exceeding 30'-0" intervals

COPPER PIPING/TUBING

NOMINAL PIPE SIZE (MAXIMUM)	SUPPORT SPACING
Up to 1-1/4"	4'-0"
1-1/2" and larger	At the base and at each story level, not exceeding 15'-0" intervals

3.3.4 Hangers for piping 2" and smaller shall be of the split cast ring type with fastening device. Hangers for piping larger than 2" shall be of the adjustable clevis hanger type. Hanger rods shall be minimum 3/8" diameter and shall have machine threads. Brackets of approved type may be used along walls. Hanger rods for individually suspended horizontal pipes shall be steel rods of size indicated on the following table:

NOMINAL PIPE SIZE (MAXIMUM)	ROD SIZE
1/2" to 2"	3/8"
2-1/2" to 3"	1/2"
4"	5/8"

3.3.5 Hangers for use with copper piping shall be copper plated ferrous sizes for copper tubing.

3.3.6 Hangers shall be installed within 2'-0" of each change in direction, either vertical or horizontal, or pipe tee and on each side of valves, strainers, etc.

3.3.7 Multiple horizontal pipes, smaller than 12" diameter pipe, may be supported on trapeze hangers. Trapeze spacing shall be in accordance with the schedule for pipe spacing based upon the smallest pipe. The trapeze members shall be properly sized for the piping load they are to support.

3.3.8 Where "cold" pipes are insulated with a vapor sealing jacket, the hanger shall be oversized accordingly to accommodate the outside diameter of the insulation, and half-round 16 gauge galvanized steel shields, not less than 14" long, rolled to fit the insulation diameter, shall be provided between the insulation and the hanger.

3.3.9 Pipe supports shall be as manufactured by Fee and Mason, Grinnell, F&S Manufacturing, or prior-approved equal.

3.4 INSTALLATION – INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches (100 mm) and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [above] [flush with top of] [recessed into and grouted flush with] slab.

3.5 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME, ASTM and MSS SP.

B. Support horizontal piping as scheduled.

C. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

F. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

G. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.

H. Provide copper plated hangers and supports for copper piping.

I. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.6 GAS PIPING TESTING:

Gas piping shall be tested in strict accordance with NFPA 54.

END OF SECTION

SECTION 23 05 48 - VIBRATION ISOLATION AND SOUND CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

The general provisions of the Contract, including General and Supplementary Conditions and general Mechanical/Electrical Requirements apply to the work specified in the Section.

1.2 NOISE CRITERIA:

The acoustical requirements of the project are mandatory. Mechanical system designs, equipment selections and Noise/Vibration Control hardware selections have been made to provide guidance for the required acoustical performance. However, it is the Contractor's responsibility to assure proper selection, placement and installation of equipment, duct systems and vibration isolation hardware to maintain airborne and structure-borne noise and vibration levels at or below the Noise Criterion as listed in the ASHRAE guide for applicable spaces as measured 4' above finished floor with ceiling, wall covering, drapes and specified floor covering installed.

1.3 SCOPE OF WORK:

1.3.1 The work under this Section shall include furnishing all labor, materials, tools, equipment, and performing operations necessary for the complete installation of noise and vibration isolation devices and systems as shown on the drawings and/or specified herein, to reduce noise and vibration to specified levels.

1.3.2 The types of vibration isolation work and sound control specified in this Section include the following items. Not all items will apply to every project.

A. Vibration Isolation Hardware for Mechanical and Electrical Equipment.

B. Inertia Base Frames and Structural Steel Bases used in conjunction with isolation hardware.

C. Flexible Connections in Piping System.

D. Vibration Hangers for certain equipment, piping, and ductwork.

E. Noise Control Barrier Duct Wrap

F. Isolation Pipe Sleeves.

1.3.3 Internal isolation provided by equipment manufacturers are not considered sufficient for total vibration control and will not be considered as a substitution for any hardware in this specification.

1.3.4 Seismic Controls and Restraints shall be furnished on all isolators to suit the project location code jurisdiction.

1.3.5 The type of isolator, base and minimum static deflection shall be as required for each specific equipment application as recommended by the isolator or equipment manufacturer but subject to minimum requirements indicated in the schedule at the end of this section.

1.4 SUBMITTALS:

1.4.1 Manufacturer's Data, Vibration Isolation and Sound Control:

A. Submit the required copies of specifications, detailed drawings, performance characteristics and installation instructions for each type of hardware to be used.

B. For spring isolators, show deflection capacity, spring diameter, free height, solid compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.

C. For pad-type units show free and operating heights plus the natural frequency of the material.

D. For Roof Top Isolation Systems, inertia bases, and rail base systems provide detailed drawings based on the actual isolated equipment indicating the equipment location on the system and the placement location of isolators.

1.4.2 Shop drawings, Vibration Isolation:

A. Submit shop drawings showing structural design and details of any other custom-fabricated work not covered by submitted data.

B. For isolated equipment, show isolator model number and its location under the equipment.

1.5 QUALITY ASSURANCE:

1.5.1 Product Qualifications - Provide each type of vibration isolation unit produced by a specialized manufacturer, with not less than five (5) years successful experience in the production of units similar to those specified for the project.

1.5.2 All isolators and isolating material shall be supplied by single source to insure total responsibility for vibration and objectionable noise. Isolation supplier shall be capable of furnishing necessary drawings and installation instructions required for project and shall possess necessary instruments to verify vibration and sound levels. Prior to acceptance of job by Owner, isolation supplier shall inspect the job and furnish Engineer with written certification that all isolation materials furnished by him are installed in proper manner. Any deviations from specifications shall be approved in writing by Engineer. Any deviations not approved by Engineer shall be corrected by Contractor at his own expense.

PART 2 - PRODUCTS

2.1 ISOLATION MOUNTS AND BASES:

2.1.1 Type 1 Mounts - Precompressed molded fiberglass isolation pads, neoprene-jacketed and stabilized during manufacture. Pads shall be sized for 40 to 200 psi loading with a constant natural frequency of approximately 10.5 Hz. Glass fibers shall be produced by a multiple flame attenuation process which generates nominal fiber diameters not to exceed .00018 inches. Where the equipment base does not provide a uniform load surface, suitable steel plates shall be bonded to the top of the pads.

2.1.2 Type 2 Mounts - Freestanding, unhoused, lateral stable spring mounts, incorporating leveling bolts and 1/4" thick noise isolation pads. To assure stability, the lateral spring stiffness shall be greater than 1.0 times the rated vertical stiffness. Springs shall have a minimum additional travel of 50% between the designed operation height and the solid height.

2.1.3 Type 3 Mounts - Freestanding, laterally stable spring isolators, similar to Type 2, but shall incorporate vertical limit stops to assure a constant operating height if the supported weight is removed, and to reduce movement due to wind loads. Limit stops shall be isolated from the housing to prevent short-circuiting. Outdoor mounts shall be non-rust construction.

2.1.4 Type 1 Hangers - Combination spring and fiberglass hangers, incorporating 2" thick neoprene-jacketed precompressed molded fiberglass inserts in series with springs, all encased in stamped welded steel brackets. The same stability and over load specifications as listed for Type 2 mounts shall apply. Hanger will allow support rod misalignment thru a 30° arc without short circuiting. Isolation brackets will carry a 500% overload without failure.

2.1.5 Type 2 Hangers - Neoprene coated, precompressed fiberglass hanger, encased in welded steel bracket with pad load plates. Same bracket and misalignment specs as Type 1.

2.1.6 Type 3 Hanger - Same as Type 1 except no fiberglass insert.

2.1.7 Type 4 Hanger - Same as Type 2 except designed for suspended ceiling.

2.1.8 Type 1 Bases - Structural steel bases, designed and supplied by the isolator manufacturer. The bases are designed with isolator brackets to reduce the mounting height of the equipment. To assure adequate stiffness, the height of the members shall be a minimum of 8% of the longest span between isolators, or at least 6".

2.1.9 Type 2 Bases - Reinforced concrete inertia bases, the steel members of which are designed and supplied by the isolator manufacturer. The concrete shall be poured into this welded steel channel frame, incorporating 1/2" diameter reinforcing bars on 8" centers each way. Recessed isolator mounting brackets shall be used to reduce the mounting height of the equipment bu yet remain within the confines of the base perimeter. The thickness of the bases shall be a minimum of 8% of the longest span between isolators, at least 6", or as indicated on the drawings. Where the inertia bases are used to mount pumps, the bases shall be large enough to support the pipe elbow.

2.1.10 Type 3 Bases - Same specifications as Type 1 Base, but supplied with factory welded cross members to form a structural frame.

2.1.11 Isolation Pipe Sleeves - Formed of fiberglass with 1" thick walls. Install in accordance with prevailing fire code.

2.1.12 Flexible Pipe Connectors -

A. Type 1

2" and larger shall be a double arch expansion joint of reinforced EPDM, furnished with zinc plated steel flanges and elongation control units. Units shall be suitable for 225 psig and 15 inches Hq. Of vacuum, 1 1/8" minimum Axial compression, 3/4" Axial elongation, and minimum of 3/4" lateral deflection. Units shall be 6" F/F through 2" I.D., and 9" F/F through 8" I.D. and 12" F/F thru 12" I.D. maximum temperature is 225°F.

B. Type 2

2" and under shall be double arch, and will be suitable for 140 psig and shall be furnished with galvanized female union. Length shall be 8" F/F, 7/8" compression, 1/4" elongation and 7/8" lateral deflection. Maximum temperature is 195°F.

C. Type 3

Steam Piping and Refrigerant Piping - Copper or stainless steel braided connectors suitable for pressures, temperatures and liquid/gases encountered.

2.1.13 DUCTWORK NOISE CONTROL BARRIER

All ductwork leaving the equipment through the roof or other ductwork areas indicated on the drawing shall be wrapped with a one (1) lb. per square foot loaded vinyl, limp mass, barrier material. Material shall be securely fastened over a layer of 2" fiberglass. At elbows or fittings material shall be pieced and taped to insure a complete and secure installation. Unless otherwise shown the material shall extend a minimum of 96 inches from equipment room wall or floor. Material fire rating shall be a minimum of: Flame out - 0 seconds, Afterglow - 0 seconds, Char length - 0.2 inches.

Sound Transmission Loss in DB (Frequency Hz)

125	250	500	1000	2000	4000	STC
15	19	21	28	33	37	27

2.2 PERFORMANCE OF ISOLATORS:

2.2.1 General - Comply with minimum operating static deflections scheduled.

2.2.2 Manufacturer's Recommendations - Except as otherwise indicated, comply with manufacturer recommendations on application and installation of vibration isolation materials and units.

2.3 APPLICATIONS:

2.3.1 General - Noise and vibration isolator types, minimum operating static deflections, and supplemental bases shall be provided for individual mechanical equipment units according to selection criteria as tabulated in the guidance schedule at the end of this section unless specified otherwise.

2.3.2 Ductwork Treatment:

Flexible Connections shall be incorporated in the ductwork adjacent to all air-moving units and will be suitable for the pressures involved. These are to be furnished by the sheet metal contractor.

2.3.3 Piping Treatment: - All piping over 1" three supports away from isolated mechanical equipment shall be isolated from the structure by means of vibration and noise isolators. Suspended piping shall be isolated with spring hangers in the supporting rods. Hangers shall be Type 3 hangers as specified. Floor mounted piping shall be supported directly on Type 2 spring mounts, as described above. Flexible connections shall be incorporated in the piping attached to all isolated equipment.

2.3.4 Equipment Room and Roof Penetrations - All piping, conduit ductwork, etc., penetrating floors, ceilings, or partitions of equipment rooms on roof shall be isolated using precompressed molded fiberglass pipe sleeves and tightly packed low density fiberglass shall be used in the case of ductwork. All penetrations shall be completely caulked airtight with suitable resilient sealant on both sides of penetration in accordance with prevailing fire code.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 General - Except as otherwise indicated, comply with isolation hardware manufacturer instructions for the installation and load application to vibration isolation materials and systems. Adjust to insure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points.
Remove space blocks and similar devices (if any) intended for temporary protection against overloading during installation.

A. Do not anchor and attach units to structure unless specifically stated on drawings or in manufacturers' installation instructions. Refer to applicable Seismic Code when required.

B. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units are required where leveling devices cannot be used to distribute loading properly.

C. Install inertia base frames on isolator units as indicated, so that a minimum of 2" clearance below base will result when frame is filled with concrete and supported equipment has been installed and loaded for operation.

3.2 EXAMINATION OF RELATED WORK:

3.2.1 Installer of vibration isolation work shall observe the installation of other work related to vibration isolation work, including work connected to vibration/isolation work, and after completion of other related work (but before equipment start up), shall furnish a written report to the Engineer listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:

A. Equipment installation (performed as work of other sections) on vibration isolators.

B. Piping connections including flexible connections.

C. Ductwork connections including flexible connections.

C. Passage of piping and ductwork which is to be isolated through walls and floors and roofs.

3.2.2 Do not Start Up equipment until inadequacies have been corrected in a manner acceptable to the vibration isolation supplier.

3.3 VIBRATION CONTROL SCHEDULE:

Provide vibration isolation control items as scheduled below unless specified otherwise or noted otherwise on plans:

LOCATION/SERVICE	BASE TYPE	ISOLATOR TYPE	MINIMUM DEFLECTION (in.)
AHU–1 through 5	Type 3	Type 2 Spring Mounts	2″
HWP -1,2	N/A	Type 1 Hangers	2″
FCU-1,2	N/A	Type 1 Hangers	2″

END OF SECTION

SECTION 23 05 90

CLEANING AND TESTING FOR HVAC

PART 1 - GENERAL

1.1 GENERAL:

Refer to Section 230500 Common Work Results for HVAC.

1.2 SCOPE:

1.2.1 This Contractor shall, at his own expense, before beginning work, during the progress of the work, or upon its completion, make such tests of his work as are herein specified in accordance with all laws, governing authorities, or as are required by Engineer or by state or municipal bureaus having jurisdiction and under their supervision. The Contractor shall provide all apparatus, temporary piping connections or any other requirements necessary for such tests. He shall take all due precautions to prevent damage to building or its contents incurred by such tests, as he will be required to repair and make good, at his own expense, any damage so caused. Any leaks, defects or deficiencies discovered as a result of the tests shall be immediately repaired or made good and test shall be repeated until the test requirements are fully complied with. No caulking of pipe joints to remedy leaks will be permitted.

1.2.2 No work of any nature shall be covered, enclosed or otherwise concealed until properly inspected, tested and approved. Any leaks which develop during any of the tests shall be corrected with new material and made as good as required; said tests shall be repeated until the work is satisfactory to Engineer and the mechanical inspectors in every way.

1.2.3 Each separate system with its various components shall be operated by this Contractor for a reasonable length of time to demonstrate the performance of all equipment and piping in accordance with the true intent and purpose of the plans and specifications. All necessary adjustments shall be made to the satisfaction of the Engineer.

1.2.4 All motor driven equipment shall be proved operable generally in accordance with the intent of these specifications.

1.2.5 All electrical power and water for testing of air conditioning and/or heating equipment systems shall be provided by the General Contractor.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TESTING AND ADJUSTING:

3.1.1 Heating, Ventilating and Air Conditioning Systems: Each and every phase of the new air conditioning, heating and ventilating systems shall be operated separately, or in conjunction with the others for a period of time to demonstrate to the satisfaction of the Engineer the ability of the equipment to meet the capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications. Heating and cooling capacities and performance for every system shall be checked in the winter and summer, respectively. Any adjustments and/or startup required shall be done at no additional cost to the owner. Any adjustments done during one season shall not affect capacities and performance during the other season. The volume of air at each outlet and inlet, air conditioning equipment performance data, etc., shall be tabulated and required balancing performed by engineering personnel skilled, trained and experienced in the performance of these functions. Previous to such performance tests, this Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system operating and maintaining design temperatures, humidity and air circulation throughout all areas of the building. This Contractor shall also at the proper time make such additional adjustments as may be required to obtain consistent temperatures throughout the project. See Section 23 05 93 of these specifications.

3.2 NOISE LEVEL:

3.2.1 All items of equipment shown on the plans and specified herein have been selected so that the anticipated noise level in the building from the air conditioning and other systems will not be above 30NC level.

3.2.2 If the Contractor wishes to make substitution of equipment from that selected, he must satisfy himself and the Engineer that the noise level in the building will not exceed 30NC.

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1- GENERAL

1.1 RELATED DOCUMENTS:

All division 23 specification sections, drawings, and general provisions of the contract apply to work of this section, as do other documents referred to in this section.

1.2 SCOPE OF WORK:

1.2.1 The Contractor shall obtain the services of an independent Test and Balance (TAB) Company which specializes in the testing and balancing of heating, ventilating and air conditioning (HVAC) systems to test, adjust and balance all HVAC systems in the building(s).

1.2.2 The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results. The testing, adjusting and balancing agency shall act as a reporting agency; that is, list and report each piece of equipment as to identification number, manufacturer, model number, serial number, proper location, specified performance, and report actual performance of all equipment as found during testing. The report is intended to be used during the life of the building as a ready reference indicating original conditions, equipment components, etc.

1.2.3 Representatives of the Test and Balance Company shall visit the job site during installation of the HVAC equipment, piping and ductwork as required.

1.2.4 Upon completion of the HVAC system installation, the Test and Balance Company shall perform all required testing and balancing with the full cooperation of the Contractor and his Sub-contractors. The Contractor shall make changes and/or adjustments to the HVAC system components that are required by the Test and Balance Company to accomplish proper balancing. The TAB agency shall not supply or install any materials or balancing devices, such as pulleys, drives, belts, etc. All of this work is by the Contractor and shall be performed at no additional cost to the Owner.

1.2.5 The test and balance report complete with a summary page listing all deficiencies shall be submitted to the Architect for review by his Mechanical Engineer. If the Mechanical Engineer agrees with the report, he shall sign it and return it to the Architect. The test and balance report must be complete and must be accepted by the Engineer prior to acceptance of the project. Any outstanding test and balance items shall be placed on the punch list and a monetary value shall be assigned to them.

1.2.6 After all deficiencies have been corrected the Mechanical Engineer shall sign the testing and balancing report, and the Test and Balance Company shall supply four (4) copies of the final and complete report to the Architect for inclusion in the Operation and Maintenance Manuals.

1.2.7 The items requiring testing, adjusting, and balancing include (but are not restricted to) the following:

AIR SYSTEMS:
Supply Fan AHU
Return Fans
Exhaust Fans
Zone branch and main ducts
VAV systems
Diffusers, Registers, Grilles and Dampers
Coils (Air Temperatures)
Valves
Vibration Isolators

HYDRONIC SYSTEMS:
System Mains and Branches
Coils

1.3 DEFINITIONS, REFERENCES, STANDARDS:

All work shall be in accordance with the latest edition of the Associated Air Balance Council (AABC) National Standards or the latest standards of the National Environmental Balancing Bureau (NEBB). If these contract documents set forth more stringent requirements than the AABC National Standards or the NEBB Standards, these contract documents shall prevail.

1.4 QUALIFICATIONS:

Agency Qualifications: The TAB Agency shall be a current member of the AABC or the NEBB and must be in good standing with FP&C. A list of these firms shall be obtained from FP&C. Falsification of a TAB report shall be grounds for removal from the FP&C list and the firm's actions shall be reported to the appropriate certifications agency. The contractor may use any FP&C approved TAB firm on a state project.

1.5 SUBMITTALS:

1.5.1 Procedures and Agenda: The TAB agency shall submit the TAB procedures and agenda proposed to be used.

1.5.2 Sample Forms: The TAB agency shall submit sample forms, which shall include the minimum data required by the AABC National Standards or the NEBB Standards.

1.6 TAB PREPARATION AND COORDINATION:

1.6.1 Shop drawings, submittal data, up-to-date revisions, change orders, fan curves, pump curves and other data required for planning, preparation, and execution of the TAB work shall be

provided when available and no later than 30 days after the Designer has returned the final approved submittal data to the Contractor.

1.6.2 System installation and equipment startup shall be complete prior to the TAB agency's being notified to begin.

1.6.3 The building control system (BCS) contractor shall provide and install the control system, including all temperature, pressure and humidity sensors. These shall be calibrated for accurate control. If applicable, the BCS contractor shall install all necessary computers and computer programs, and make these operational. Assistance shall be provided as required for reprogramming, coordination, and problem resolution.

1.6.4 All test points, balancing devices, identification tags, etc., shall be accessible and clear of insulation and other obstructions that would impede TAB procedures.

1.6.5 Qualified installation or startup personnel shall be readily available for the operation and adjustment of the systems. Assistance shall be provided as required for coordination and problem resolution.

1.7 REPORTS:

1.7.1 Final TAB Report - The TAB agency shall submit the final TAB report for review by the Architect. On plans provided, all outlets, devices, HVAC equipment, etc., shall be identified (including manufacturer, model number, serial number, motor manufacturer, HP, drive type, fan and motor sheaves and belt number), along with a numbering system corresponding to report unit identification. The TAB agency shall submit an AABC "National Project Performance Guaranty" (or similar NEBB Guaranty) assuring that the project systems were tested, adjusted and balanced in accordance with the project specifications and AABC National Standards (or similar NEBB Standards). The Designer shall certify his approval on the Performance Guaranty.

1.7.2 Submit 4 copies of the Final TAB Report to the Architect for inclusion in the Operation and Maintenance Manuals.

PART 2 - INSTRUMENTATION

All instruments used for measurements shall be accurate and calibrated. Calibration and maintenance of all instruments shall be in accordance with the requirements of AABC National Standards (or similar NEBB Standards).

PART 3 - EXECUTION

3.1 GENERAL:

3.1.1 The specified systems shall be reviewed and inspected for conformance to design documents.

Testing, adjusting and balancing on each identified system shall be performed. The accuracy of measurements shall be in accordance with AABC National Standards (or similar NEBB Standards). Adjustment tolerances shall be + or - 10% unless otherwise stated.

3.1.2 Equipment settings, including manual damper quadrant positions, valve indicators, fan speed control levers, and similar controls and devices shall be marked to show final settings.

3.1.3 All information necessary to complete a proper TAB project and report shall be per AABC or NEBB standards unless otherwise noted. The descriptions of work required, as listed in this section, are a guide to the minimum information needed.

3.1.4 TAB contractor shall cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. Upon completion, patch insulation, ductwork, and housings using materials identical to those removed. Seal insulation to reestablish integrity of the vapor barrier.

3.1.5 TAB work shall include additional inspection and adjustment of components during the season following the initial balance to include re-balance of any items influenced by seasonal changes or as directed by the Owner.

3.2 AIR SYSTEMS:

3.2.1 The TAB agency shall verify that all ductwork, splitters, extractors, dampers, grilles, registers, and diffusers have been installed per design, are functional and set full open. Any leakage in the ductwork shall be repaired prior to the test. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards or NEBB Standards:

For supply fans:

1. Fan Speeds - Test and adjust fan RPM to achieve design CFM requirements.

2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main supply and return ducts, as applicable to obtain total CFM. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.

4. Outside Air - Test and adjust the outside air on applicable equipment using a Pitot-tube traverse. If a traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical use the mixed-air temperature method if the inside and outside temperature differences is at least 20 degrees Fahrenheit or use the difference between Pitot-tube traverse of the supply and return air ducts.

5. Static Pressure - Test and record system static pressure, including the static pressure profile of each supply fan.

For return fans:

1. Fan Speeds - Test and adjust fan RPM to achieve design CFM requirements.

2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

3. Pitot-Tube Traverse - Perform Pitot-tube traverse of the main return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.

4. Static Pressure - Test and record system static pressure, including the static pressure profile of each return fan.

For exhaust fans:

1. Fan Speeds - Test and adjust fan RPM to achieve design CFM requirements.

2. Current and Voltage - Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.

3. Pitot-Tube Traverse - Perform a Pitot-tube traverse of main exhaust ducts to obtain total CFM. If a Pitot-tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet.

4. Static Pressure - Test and record system static pressure, including the static pressure profile of each exhaust fan.

For zone, branch and main ducts:

1. Adjust ducts to within design CFM requirements. As applicable, at least one zone balancing damper shall be completely open. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.

For VAV systems:

1. Identify the type, location, and size of each terminal box. This information shall be recorded on terminal box data sheets.

2. Test, adjust and record the maximum and minimum box air quantities for each VAV box.

3. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.

4. Test and record entering and leaving air temperature of hot water coils with full heating air flow and water flow.

5. Insure the entering static pressure is sufficient for normal, proper box operation.

For diffusers, registers and grilles:

1. Tolerances - Test, adjust, and balance each diffuser, grille, and register to within 10% of design requirements. Minimize drafts. Include required CFM, initial test CFM and final CFM.

2. Identification - Identify the type, location, and size of each grille, diffuser, and register. This information shall be recorded on air outlet data sheets.

For coils:

1. Air Temperature - Once air flows are set to acceptable limits, take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

3.3 HYDRONIC SYSTEMS:

The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; and that all balancing valves (except bypass valves) are set full open. Examine water in system and determine if it has been treated and cleaned. As applicable, it shall check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards (or similar NEBB Standards):

For system mains and branches:

1. Adjust water flow in pipes to within design GPM requirements. As applicable, at least one branch balancing valve shall be completely open.

For coils:
1. Tolerances - Test, adjust, and balance all chilled-water and hot-water coils within 10% of design requirements.

2. Verification - Verify the type, location, final pressure drop and GPM of each coil. This information shall be recorded on coil data sheets.

For control valves:

1. Check operation of automatic valves.

2. Test and record pressure drop and flow across control valves at full flow.

3.4 SOUND TESTING

The TAB agency shall conduct sound testing in the following areas per AABC National Standards or NEBB Standards and to the criteria listed, using sound meter with octave band analyzer:

TEST AREA	NUMBER OF LOCATIONS	ACCEPTABLE NC LEVEL

Classrooms	2	30-35
Offices	2	25-30
Gymnasium	2	40-45
Auditorium	2	25-30

3.5 VIBRATION TESTING

The TAB agency shall conduct vibration testing on the following equipment per AABC National Standards (or similar NEBB Standards). Test deflection in mils and velocity in inches per second shall be measured and the results compared to requirements in equipment specification sections.

EQUIPMENT:

Air Handling Units
Fans

3.6 INDOOR AIR QUALITY VERIFICATION

The TAB agency shall take measurements at minimum outside air. It shall measure temperature and humidity uniformity throughout the space, check filter installation for proper fit, seal, and operation, and verify condensate drain operation. The TAB agency shall note any water damage or obvious contamination sources from inside or outside.

The TAB agency shall conduct the following air sampling tests using TWA limits shown in ASHRAE Standard 62-1989, Table C-1:

1. Carbon dioxide
2. Carbon monoxide
3. Ozone
4. Nitrogen oxides
5. Formaldehyde

The TAB agency shall prepare a short report showing the results and location of each test, a summary of the HVAC operating conditions, and a listing of any discrepancies.

3.7 ADDITIONAL TAB SERVICES

3.7.1 Job Site Inspections:
During construction, the TAB agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the HVAC systems as required.

3.7.2 Verification of HVAC Controls:
The TAB agency shall be assisted by the building control systems Contractor in verifying the operation and calibration of all HVAC and temperature control systems. The following tests shall be conducted:

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water resets, fire and freeze stats, and other safety devices.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.

3.7.3 Temperature Testing:
To verify system control and operation, a series of three temperature tests shall be taken at approximately two hour intervals in each separately controlled zone. The resulting temperatures shall not vary more than two degrees Fahrenheit from the thermostat or control set point during the tests. Outside temperature and humidity shall also be recorded during the testing periods.

3.7.4 Tab Report Verification:
At the time of final inspection, the TAB agency may be required to recheck, in the presence of the owner's representative, specific and random selections of data, air quantities, and air motion recorded in the certified report. Points and areas for recheck shall be selected by the owner's representative. Measurements and test procedures shall be the same as approved for the initial work for the certified report. Selections for recheck, specific plus random, will not exceed 10% of the total number tabulated in the report.

3.7.6 Building/Zone Pressurization:
The TAB agency shall test and adjust building/zone pressurization by setting the design flow to meet the required flow direction and pressure differential. For positive pressure areas, it shall set the supply air to design flow, and gradually reduce the exhaust air rate to obtain the required flow or pressure difference. For negative pressure areas, it shall set the supply air to design flow, and gradually increase the exhaust air rate to obtain the required flow or pressure difference.

3.7.7 Fire and Smoke Testing:
The Contractor shall test fire/smoke dampers in the presence of the TAB agency to assure proper operation. They shall verify that an access door has been installed for each fire and smoke damper. For each fire damper, the Contractor shall open the access door, disconnect the fusible link, and allow the damper to close. Operation should be smooth and the damper must close completely. The Contractor shall then reset the damper. For each smoke damper, the Contractor shall open the access door, activate the damper, and observe operation. The damper must close quickly and completely. The Contractor shall then reset the damper and observe its complete opening.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 GENERAL:

Refer to Section 23 05 00 for Common Work Results for HVAC.

1.2 SCOPE:

The Contractor shall cover all piping and apparatuses, as specified below, with insulation as manufactured by Manville, Owens-Corning or equal. All insulation, jacket, facing and adhesive shall have composite ratings not exceeding flame spread of 25 and smoke development of 50.

PART 2 - PRODUCTS

2.1 DUCTWORK:

All supply, return and outside air ductwork except internally lined return and outside air ductwork shall be insulated with 2" thick, three quarter pound per cubic foot minimum density glassfiber blanket insulation and have type FRK foil reinforced kraft vapor barrier jacket. Internally lined supply air ductwork shall be wrapped in addition to lined. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". Adhere insulation to metal with 4" strips of insulation bonding adhesive at 8" on centers. On longitudinal joints, the overlap shall be secured using 9/16" flared door staples applied 6" on centers and taped with minimum 3" wide foil reinforced kraft tape. All pin penetrations or punctures in facing shall be taped. Tape all circumferential joints with 4" wide foil reinforced kraft tape. Refer to Section 15890 for ductwork with internal lining.

2.2 AIR DISTRIBUTION DEVICES:

Each air distribution device shall be provided with a 2" thick, 3/4 lb density insulation blanket for condensation control. Insulation blanket shall be taped securely and sealed around perimeter of air device neck and backpan.

2.3 CONDENSATE DRAIN PIPING:

2.3.1 Condensate drain piping from air conditioning units located within the building that runs outside of fan housing shall be insulated with 1/2" thick molded fiberglass with a "Universal" white vapor barrier jacket with flap. Furnish manufactured rigid fitting covers.

2.3.2 All piping above slab from floor drains, deep-seal p-traps, hub drains or other devices used for condensate drain termination shall be insulated with 1/2" thick molded fiberglass with a "Universal" white vapor barrier jacket with flap and manufactured rigid fitting covers.

2.4 CHILLED AND HEATING WATER PIPING (Including Valves, Flanges and Fittings):

Chilled and heating water piping shall be insulated with 2" thickness dual-temp with finished jacket.

2.5 ALUMINUM METAL JACKET:

All insulation outside, exposed to weather shall be covered with 0.024" aluminum metal jacket.

PART 3 - EXECUTION

3.1 PROCEDURES:

3.1.1 All insulation shall be the product of reputable manufacturers and shall be applied by mechanics skilled in the use of various materials and in the employ of a concern regularly engaged in the insulating business. The materials shall all be applied in accordance with the published standards of the manufacturer of the materials, using any special materials as required by these specifications and by those published standards. Unsightly work shall be just cause for rejection.

3.1.2 All sectional covering shall finish round and smooth, without lumps or depressions and all end and joints shall butt evenly and tightly together and to the covered surface. No broken or damaged section shall be used. When covering is formed from blocks, they shall be carefully and evenly applied, securely wired in place and joints shall be closed with cement insulation.

3.1.3 In instances where insulated lines pass into other areas, wherein the line will not be insulated as described herein, the insulation shall not terminate at the wall, but shall extend full size a minimum of 1" beyond the wall.

3.1.4 Engage the services of a qualified insulation applicator to furnish and install all the insulation required for the mechanical equipment, piping, etc., specified herein.

3.1.5 All surfaces to be insulated shall be clean and dry before applying insulation. All sections of molded pipe covering shall be firmly butted together. No insulation shall be applied until the pipe, duct, etc., have been pressure tested and found tight. Piping flexible connections, flanges and unions shall not be covered unless specifically noted. Flexible connections on ducts shall not be covered.

3.1.6 Prior to the installation of any insulating material to ferrous piping systems, the piping surfaces shall be thoroughly cleaned of all mill scale, grease and dirt and shall be given a coat of rust inhibiting primer.

3.1.7 Refer to Section 23 05 00, for flame spread properties of insulating materials.

3.1.8 At all valves, unions, flanges, etc. insulation shall be beveled or tapered to the surface being insulated. Insulation ends shall then be sealed vapor-tight with mastic.

3.1.9 Where vapor barriers are required, the vapor barrier shall be on the outside. Extreme care shall be taken that the vapor barrier is unbroken. Joints, etc., shall all be sealed. Where insulation with a vapor barrier terminates, it shall be sealed off with the vapor barrier being tapered continuous to the surface being insulated. Ends shall not be left raw.

3.1.10 Metal jackets shall have side and end lap at least 2-inches wide with the cut edge of the side tap turned inside one inch to provide a smooth edge. Overlap the jacket not less than 2 inches at longitudinal and circumferential joints and secure with metal bands at not more than 9-inch centers or with screws at not more than 5-inch centers. Overlap longitudinal joints down to shed water. Seal circumferential joints with a coating recommended by the insulation manufacturer for weatherproofing.

3.1.11 All stems of temperature and pressure test plugs, thermometers, pressure gauges, air vents, etc. shall be wrapped with neoprene foam insulating tape prior to application of pipe or equipment insulation.

END OF SECTION

SECTION 23 09 00: TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 GENERAL:

1.1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections apply to work of this section.

1.1.2 Division-23 Basic Materials and Methods sections apply to work of this section.

1.1.3 The BMCS system shall connect to and be integrated into the present Intelliweb temperature controls system serving the campus contact Control Systems & Services (318) 307-6160. The integrated systems means that the building information shall appear on the existing workstation in the central plant and shall be in form, appearance and functions, the same as if it were generated by the installed equipment. The Building Management Control System (BMCS) shall be comprised of a network area controller(s) or a central PC based software package within the building for connection as an extension of the existing hardware, software, DDC controllers, or an integrated system, or as a BacNet Certified Web Based Accessed Facility. Connection to the BMCS shall be through the internet via web based protocol. The system in the building shall be complete for full control, programming, schedules and dynamic color-graphical representation of all equipment and system being monitored and controlled. This may require a Network Controller and PC between the building system and the LAN or internet web based system. Each manufacturer shall submit the methods used to fully comply with these specifications at the shop drawing stage. Setpoint adjust, parameter adjust, upload and download from existing workstation shall be provided.

1.1.4 Where required, existing systems' temperature controls shall be upgraded as required and tied into new systems to provide a complete system of temperature controls. It shall be the responsibility of the temperature controls contractor to make all interlocks, extend tubing, extend wiring and conduit (below 120 VAC), provide relays and all other controls necessary to interface the existing system with the new system. It shall be the electrical contractor's responsibility to extend any wiring and conduit (120 VAC and above) required.

1.2 SCOPE OF WORK :

1.2.1 Provide a fully integrated Control System incorporating Direct Digital Control (DDC), energy management, equipment monitoring and control consisting of the following elements as necessary to satisfy the specified sequences of operation:

A. Provide microcomputer based Distributed Control Processors (DCP's) interfacing directly with sensors, actuators and environmental delivery systems (i.e., HVAC units, boilers, chillers, systems, etc.).

B. Provide a two wire peer communication network to allow data exchange from DCP to DCP and DCP's to the existing facility and central Building Management computer.

C. Provide electric and electronic controls for all items indicated on drawings, defined in the points list at the end of this section and described hereinafter including dampers, valves and panels.

1.2.2 Provide submittals, start up, test and validation of the controls, instruction of owner's representative on maintenance and operation of the controls, and as built composite electric diagrams showing interlocks between equipment furnished under this and other sections and controls furnished herein. Provide report of check out and successful commissioning of the controls with the existing BMCS.

1.2.3 The BMCS contractor shall furnish and install a complete Building Management and Control System for all mechanical systems and other facility systems as included in the project documents. The BMCS contractor shall provide a complete and operational system to perform all sequences of operation as stated or shown on the plans and specifications.

A. The work shall include all materials and labor to perform the sequences whether specifically indicated or not.
B. The drawings and specifications are complementary to one another. What is required by one is to be considered required by all. Where conflicts exist between the plans and specifications, the more stringent requirement shall apply.

1.2.4 All temperature control wiring exterior to the building and/or exposed shall be installed in rigid metal conduit. All temperature control wiring in mechanical rooms and in areas above inaccessible ceilings shall be installed in EMT. All other temperature control wiring shall be plenum rated. All wiring and conduit (120 VAC and above) in connection with the automatic temperature control system shall be provided by the Electrical Subcontractor under another section of this specification. All wiring and conduit (below 120 VAC) shall be provided by the temperature controls contractor.

1.3 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1.	BMCS	Building Management and Control System
2.	TCS	Temperature Control System
3.	NAC	Network Area Controller
4.	IDC	Interoperable Digital Controller
5.	IBC	Interoperable BACnet Controller
6.	GUI	Graphical User Interface
7.	WBI	Web Browser Interface
8.	POT	Portable Operator's Terminal
9.	PMI	Power Measurement Interface
10.	DDC	Direct Digital Controls
11.	LAN	Local Area Network
12.	WAN	Wide Area Network
13.	OOT	Object Oriented Technology
14.	PICS	Product Interoperability Compliance Statement

1.4 DIVISION OF WORK

A. Contractor shall be responsible for all controllers (IDC and IBC), control devices, control panels, controller programming, controller programming software, controller input/output and power wiring and controller network wiring.

B. Contractor shall be responsible for the Network Area Controller(s) (NAC), software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, Web Browser pages, setup of schedules, logs and alarms, and network management and connection of the NAC to the local or wide area network.

1.5 WORK BY OTHERS:

1.5.1 Division 23: Setting in place of valves, flow meters, water pressure and differential taps, flow switches, thermal wells, dampers, and air flow stations shall be by the mechanical contractor.

1.5.2 Division 26: Power wiring to line voltage, line voltage interlocks, power for temperature control panels (DCPs), wiring to smoke and fire/smoke damper E/P switches, and setting in place of current transformers shall be by the electrical contractor in accordance with Division 26 requirements. All other low voltage control wiring shall be provided by this Section. The BMCS contractor shall coordinate his requirements with the Division 16 contractor prior to bid.

1.5.3 Division 23: The Air Terminal Manufacturer under Section 23 36 00 shall factory mount an electronic damper actuator. Coordinate damper actuator spring range and other requirements with this Section. A DDC controller shall be provided by this section for each Air terminal unit. All wiring to air terminal units shall be provided by this section.

1.5.5 Division 26: The Variable Frequency Drive Manufacturer under Sections 23 34 00 shall furnish all peripherals and interface equipment to accept speed commands (2-10vdc) as noted in the system points list for the equipment controlled in this Section. Coordinate all requirements with this Section prior to bid.

1.6 QUALITY ASSURANCE:

1.6.1 Acceptable Suppliers:

1. Intelliweb (Controls Systems & Services).

1.6.2 Installer: The system shall be installed by Division 23 and 26 as noted above and supervised by the Temperature Controls Contractor with full responsibility for proper operation of the controls including debugging and proper calibration of each component in the entire system. All low voltage electrical installation and labor shall be by the Temperature Controls Contractor in accordance with Division 26. The Temperature Controls Contractor shall have a service office with factory certified and trained technicians with a maximum response time (arrived on campus) within two hours from a call from the University.

1.6.3 Electrical Standards: All electronic equipment shall conform to the requirements of F.C.C. governing radio frequency electromagnetic interference and be so labeled and comply with NEMA standards. All system components are to be designed and built to be fault tolerant:

A. Satisfactory operation without damage at 110% above and 85% below rated voltage and at + 3 hertz variation in line frequency.

B. Provide static, transient, and short circuit protection on all inputs and outputs.

C. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be ac. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

D. All real time clocks and data file RAM to be battery backed for a minimum of 72 hours.

E. It must be possible to printout English language alarms at the existing central location even when the existing host computer is non-operational or taken out of service for periodic maintenance.

1.7 SUBMITTALS:

1.7.1 Failure to submit complete submittal data in accordance with the requirements of this specification shall be grounds for rejection of the submittal. Refer to Section 23 05 00 for additional requirements.

1.7.2 All submittal data including drawings shall be bound in a 3-ring, loose-leaf binder. Drawings shall be printed on sheets no larger than 11" x 17".

1.7.3 Product Data: Submit manufacturer's specifications for each control device furnished with all pertinent requirements of this specification clearly identified. Properly label and number each device cut sheet and include a table of contents with sheet numbers.

1.7.4 Shop Drawings: Submit sequence of operations and layout drawings of installed electric-electronic (DDC) temperature control system including wiring, thermostats, controllers, switches, panels and sensors, showing their relation to associated equipment and connections for signal and electrical power feeders.

1.7.5 Wiring Diagrams: Submit for approval complete wiring diagram for all temperature control systems indicating all control and interlock wiring and conductor and terminal identification.

1.7.6 Maintenance Data: Submit maintenance data and spare parts lists for each type of control device and include this data in the operator's & maintenance manual.

1.8 DELIVERY, STORAGE AND HANDLING:

Provide factory shipping cartons for each piece of equipment, where practical. Maintain cartons through shipping, storage and handling as required to prevent equipment damage and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Building Management Control System (BMCS) shall be comprised of a network area controller(s) or a central PC based software package within the building for connection as either an extension of the existing system, an integrated system, or as a Web Based Accessed Facility. The NAC shall connect to a local area network (LAN). Access to the system either locally in the building or remotely from a central site or sites, shall be accomplished through an extension of the existing proprietary system, or an integrated system, or standard web browsers via the internet. Provide all interface devices, software and connections as required.

B. The use of custom built integrators or software tables unique to this project are acceptable; however, if objects or points are added to this system after project completion, the owner shall not be dependent upon the manufacturer to make custom changes to the integrator or software tables to accomplish the addition of the objects or points.

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

2.2 ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system communicating on an open protocol communication network within the facility and communicating as either an extension of the existing system, or as an integrated system to the existing, or Web base via the internet to a host workstation in a remote location. The BMCS shall include all software and hardware. The new AHU and reheat controllers/modules shall be open Echelon (Lon Mark) interoperable.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system

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

D. The supplied system must incorporate the ability to access all data through the proprietary operator interface and configuration programs, or a new web based system.

E. The installed system shall provide secure password access to all features, functions and data contained in the overall BMCS. Secure Socket Layer (SSL) encryption shall be an available option for remote access.

F. The installed system must be totally scalable to allow for future expansion with the addition of controllers and/or input/output devices. It shall not be necessary to remove equipment supplied under this contract to expand the system.

G. The failure of any single component or network shall not interrupt the control functions of non-affected devices. A single network failure shall only affect shared communications or shared data; individual application controllers and network controllers shall continue normal operation minus only the data from a remote device from the affected network. Automatic default values for all network transported data shall be provided to allow continued operation until the network is restored.

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

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

2.3 NETWORKS

A. The Local Area Network (LAN) for the temperature control system shall be provided by the controls contractor and shall be a 10 Megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), and user workstation.

2.4 NETWORK ACCESS

A. Remote Access: Provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP).

2.5 DDC CONTROLLERS

A. HVAC control shall be accomplished using DDC based controllers. All programming, documentation and programming tools necessary to set up and configure the supplied controllers per the specified sequences of operation shall be provided.

B. All control sequences within or programmed into each controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

C. Each controller shall communicate with the NAC at a baud rate of not less than 19K baud. Each controller shall provide LED indication of communication and controller performance to the technician, without cover removal.

1. Each DDC controller shall be operational as standalone devices configured to perform the sequences specified, and with I/O selected for the application. Controllers shall be tested and listed under UL916 for Energy Management computing devices. Each controller shall be provided with a face mounted LED type annunciation to continually display its operational mode: power, normal, or in an alarm state. The controller shall have spare Inputs/Outputs for future expansion.

D. Each DDC controller shall be configured for DIN rail mounting using industry standard clip on adapters or direct panel mounted. Each controller shall be designed with on-board jacks for quick commissioning and troubleshooting with a portable programming tool. This connection shall be extended to a space temperature port where indicated and shown on plans.

E. DDC Controllers shall be standalone EEPROM based configured to perform the sequences specified, and with I/O selected for the application. Enclosures for controller shall be flame retardant compact plastic conforming to UL94-V5 for plenum mounting or plated steel.

2.6 NETWORK AREA CONTROLLER (NAC)

A. Contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided. It is the responsibility of this Contractor to coordinate with the Division 23 and 26 contractors to determine the quantity and type of devices.

B. The Network Area Controller (NAC) shall provide the interface between the LAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

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

C. The Network Area Controller must provide the following hardware features as a minimum:

1. One Ethernet Port - 10 Mbps

2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A
4. Battery Backup
5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
6. The NAC must be capable of operation over a temperature range of 0 to 55□C
7. The NAC must be capable of withstanding storage temperatures of between 0 and 70□C
8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

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

E. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 16 simultaneous users.

F. Event Alarm Notification and actions

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

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

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

1. Screen message text
2. Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on:
    a. Day of week
    b. Time of day
    c. Recipient
3. Pagers via paging services that initiate a page on receipt of email message
4. Graphic with flashing alarm object(s)
5. Printed message, routed directly to a dedicated alarm printer

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

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

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

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

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

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

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

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

P. Data Collection and Storage

1. The NAC shall have the ability to collect data for any property of any object and store this data for future use.
2. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
    a. Designating the log as interval or deviation.
    b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

3. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web Browser.
4. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
5. All log data shall be available to the user in the following data formats:
   a. HTML
   b. XML
   c. Plain Text
   d. Comma or tab separated values
6. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
   a. Archive on time of day
   b. Archive on user-defined number of data stores in the log (buffer size)
   c. Archive when log has reached it's user-defined capacity of data stores
   d. Provide ability to clear logs once archived

Q. AUDIT LOG

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

   a. Time and date
   b. User ID
   c. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

R. DATABASE BACKUP AND STORAGE

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

2. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
3. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.7 GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System
1. The GUI shall utilize the latest version of software available and shall run on Microsoft Windows NT Workstation 4.0, Service Pack 4 or later.
2. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Microsoft Edge) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimum knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.
3. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
    a. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of a graphic background, the GUI shall support the use of scanned pictures.
    b. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL's, and links to other graphic screens.
    c. Graphics shall support layering and each graphic object shall be configurable for assignment to one a layer. A minimum of six layers shall be supported.
    d. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.
        (1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        (2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    e. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.

f. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No entry of text shall be required.

4. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
   a. Create, delete or modify control strategies.
   b. Add/delete objects to the system.
   c. Tune control loops through the adjustment of control loop parameters.
   d. Enable or disable control strategies.
   e. Generate hard copy records or control strategies on a printer.
   f. Select points to be alarmable and define the alarm state.
   g. Select points to be trended over a period of time and initiate the recording of values automatically.
5. On-Line Help. Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.
6. Security. Each operator shall be required to log on to that system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off of the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.
7. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.
8. Alarm Console:
   a. The system will be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console can be enabled or disabled by the system administrator.
   b. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms.

2.8 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Microsoft Edge™ or Google Chrome™.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface.

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

1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
2. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
5. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
        (1) Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
        (2) Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    b. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No entry of text shall be required.
    c. View logs and charts
    d. View and acknowledge alarms
    e. Setup and execute SQL queries on log and archive information
6. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just their defined home page. From the home page, links

to other views, or pages in the system shall be possible, if allowed by the system administrator.

7. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.9 SYSTEM PROGRAMMING

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

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display.

C. Programming Methods

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
    a. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons.
    b. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
    c. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.10 OBJECT LIBRARIES

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

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

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

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

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.

E. Calendar Object. The calendar must conform to the calendar object as defined in the specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.

1. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
2. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
3. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.

4. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of shedable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each shedable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions.

1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum.
5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.

6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.

2.11 DDE DEVICE INTEGRATION

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

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

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

2.12 OTHER CONTROL SYSTEM HARDWARE

2.12.1 VALVES, DAMPERS AND ACTUATORS

A. Valves:

1. Water valves shall be sized by the control manufacturer to produce the required capacity at a pressure loss of 10 psi. Nominal body rating shall be not less than ANSI Class 125. However, the valve body and packing selected shall be designed to withstand the system static head plus the maximum pump head and the maximum temperature of control medium and hot water. Single-seated valves shall have close-off ratings equal to 125% of the system pressure encountered that is the maximum upstream pressure. The valve body and packing selected shall be designed to withstand the system static head plus the maximum pump head and the maximum temperature of control medium without leakage for hot water.

2. Two-Way and Three-Way Valves:
   a. Valves used for control of hot and chilled water shall be of the modulating globe type.

b. Valve sizes two inch and smaller shall be screwed and supplied with union fittings. The valves shall be constructed of bronze with stainless steel trim with equal percentage flow characteristics and have a rangeability of 50:1 or greater.

c. Valve sizes 2.5 inch and larger shall be flanged. The valves shall be constructed of cast iron ASTM A126 Class B. The trim shall be stainless steel with equal percentage flow characteristics. The valve rangeability shall be 100:1 or greater.

d. Valves shall be of the straight-through type as required by the sequence or indicated on the drawings.

3. Butterfly Valves: Where butterfly valves are indicated to be used as automatic control valves, they shall be line size and designed for motorized control operation with upper disc steam keyed or machined square for mating with the control operator's linkage. All butterfly control valves over 8 inches shall be equipped with a manual, mechanical control actuator override, gear box operator for emergency manual control of the valve position. Provide required accessories to mechanically disengage automatic control actuator linkage and engage manual gear operator without dismantling the valve stem and stem extensions during changeover. Valves 4-20" and larger shall be tapped, full lug, cast iron body butterfly valves with aluminum bronze discs, stainless steel stem and EPDM seat. Design must incorporate top and bottom bushings between shafts and body of material suitable to provide a bearing surface to eliminate seizing or galling. Valves 4-20" must provide bubble-tight seal at 150 PSIG. Liners are to be resilient material suitable for 250 °F temperatures.

4. Valve Constant (Cv) Charts: Control drawings shall indicate the valve constant (Cv rating) of all valves used so that the valve pressure drop may be used for balancing and performance tests. Submittal data shall also state calculated shut-off pressure for each valve size.

B. Dampers:

1. The Temperature Control Manufacturer shall provide control dampers of the types and sizes indicated on the drawings, including but not limited to outside air, return, relief air dampers, isolation and exhaust system bypass dampers.
2. Damper frames shall be 5" X 1" 6063T5 extruded aluminum hat channel with .125" minimum wall thickness with mounting holes for flange and enclosed duct mounting.
3. Dampers shall be available in two-inch size increments from 8" horizontal and vertical to 48". Requirements over 48" shall be standard modules with interconnecting hardware (jack shafting).
4. All damper blades shall be 6" 6063T5 heavy gage extruded aluminum airfoil for high velocity performance. Blades on all dampers must be not over 6" wide. Blade bearing shall be molded synthetic with 1/2" hex plated steel shafts. All blade linkage hardware shall be of corrosion-resistant finish and

readily accessible for maintenance after installation.

5. Extruded vinyl edging seals for outdoor dampers and flexible metal compressible type side seals for all dampers shall be provided.
6. Dampers and seals shall be suitable for temperature ranges of -50 Degrees F. to +250 Degrees F. at specified leakage ratings.
7. Dampers used for proportional control shall have opposed blades.
8. Leakage rates shall not exceed 6.25 CFM/Sq. Ft. at 4" wg. differential rated in accordance with AMCA 500.
9. Acceptable manufacturers are Ruskin, Arrow United Industries, American Warming and Ventilating, Inc. or approved equal.

C. Damper and Valve Actuators

1. Electronic actuators shall be of 0-10 VDC type. The minimum actuator impedance shall be 800 ohms even when more than one actuator is connected in parallel. Spring return shall be required for two-position (NO/NC) control sequence or for steam valve control. Non-spring return actuators shall be used for all modulating sequence of control. They shall conform to all requirements of sequence descriptions specified or scheduled. Main mechanical equipment actuators shall have a manual position dial to allow manual positioning of valve in absence of control power.
2. Valve actuators shall be of sufficient size to close valves at system pressure drop across the valve plus 50%.
3. Actuators for Terminal Equipment Controllers shall be 24V floating point, 0-10Vdc or pneumatic depending on Sequence of Operation and required speed of response. Regardless of actuator type, they shall be modulating and their position shall be readable in percentage open at the Workstation.

2.12.2 FLOW STATIONS

A. Flow Stations

1. Provide where indicated on the plans airflow traverse probes mounted in the ductwork capable of continuously measuring the air volume of the respective ductwork.
2. The ductwork airflow traverse probes shall contain multiple total and static pressure sensors places at concentric area centers along the exterior surface of the cylindrical probe and internally connected to their respective averaging manifolds. Sensors shall not be adversely affected by particle contamination normally present in building system airflows.
3. The duct work airflow traverse probes (two per duct) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell and symmetrical averaging signal takeoffs and fittings, and shall be of aluminum construction with hard anodized finish.
4. The airflow traverse probes shall not induce a measurable pressure drop, nor shall the sound level within the system be amplified by its presence in the ductwork. The probes shall be capable of producing steady, non-pulsating signals of standard total and static pressure, without need for flow

corrections or factors, with an accuracy of 2% of actual flow. Traverse probes shall be Tek-Air Model T-FP5000, Brandt, Air Monitor or equal.

2.12.3 FIELD SENSORS

A. Temperature Sensors:

1. Provide one of the following temperature sensor types:
   a. 1000 ohm (±0.2%) platinum resistance temperature detectors having a coefficient of resistivity of 0.00385 ohms/ohm/°C (for animal room locations).
   b. 100 ohm (±0.12%) platinum resistance temperature detectors having a coefficient of resistivity of 0.00385 ohms/ohm/°C. Provide RTD temperature transducers with of 4-20 ma output signal variations of less than 0.2% of full scale output for supply voltage variations +/-10% and integral and accessible zero and span adjustment.
   c. 10,000 ohm thermistor having an accuracy of .5°F at calibration point of 77°F may be used for room temperature only.
   d. Immersion temperature sensors shall have 316 Stainless Steel wells and duct mounted sensors shall use averaging bulbs of not less than 24" and when mounted in the pre-heat or mixed air position the averaging bulb shall be twice the diagonal length of the coil or duct.

B. Humidity Sensors:

1. Provide space and duct mounted relative humidity sensors and transducers having an operating range of 0 to 100% of R.H. with a combined accuracy of sensor and transducer ± 2.0%. The output from the transducer shall be 4-20 ma or 0-10Vdc into a maximum of 500 ohms load.

C. Carbon Dioxide Sensor

1. Provide a duct mounted microprocessor- based photo-acoustic CO2 sensor to read CO2 levels in the return air. The sensor shall have a range of 0-2000 ppm with an accuracy of ± 100 ppm. CO2 sensor shall be Siemens QPA63 Series or equal.

D. Pressure Sensors:

1. Provide air differential pressure transducers with output of 4-20 ma proportional to pressure. The airflow transmitter will have an accuracy of at least ±1.0% F.S. for static pressure

   applications and ±0.5% FS for velocity pressure applications. The transmitter shall be either Dresser Industries - Ashcroft Model XLDp or Setra Model C264.
2. Provide water and steam differential pressure transducers with output of 4-20

ma proportional to pressure. The transmitter will have an accuracy of at least ±0.2% of the transmitter range. The transmitter shall be Rosemount Series 1151 or equal.

E. Smoke Detectors:

1. Smoke sensors are provided and installed under Division 16 to conform to local codes.

F. Low Limit Temperature Switch

1. Low Limit Temperature Switch with minimum 20 ft. element for freeze protection as specified hereinafter. Element shall be serpentine across the face of the coil and shall be of sufficient length or number for three passes across the width of the coil it is protecting. Connect Low Limit Temperature Switch in series with other safety devices to de-energize fans serviced when a drop in temperature below setpoint is detected.

G. Electronic-to-Pneumatic Transducers

1. E/P Transducers shall convert 0-10 Vdc or tri-state control to a 0-20 psig pneumatic output. The device shall have an output accuracy of ± 0.5psi at 77 °F and a repeatability of ± 0.05psig. Bleed rate shall not exceed 80 SCIM. The E/P shall utilize a "pump/dump" technology. The E/P Transducer shall have the ability to build or release a volume of no less than 500 SCIM.

H. Differential Pressure Switches:

1. Provide pressure switches to monitor the differential pressure status across each piece of equipment as specified hereinafter.
2. Design and sensitivity shall match application, with SPDT contacts to make/break from a field adjustable differential pressure setting for alarm reporting to the EMS.
3. Switches shall be utilized for status, proof of flow or to indicate condition of filter banks, clean or dirty, where specified. Switches utilized for filter banks shall be Dwyer Photohelic Series 3000 or equal.

I. Current Status Switch (CSS)

1. Provide a high performance miniature split-core current status switch with adjustable set point. The current status switch shall have an operating range of between 1.25 – 50 amps and be able to detect belt loss and mechanical failure. CSS shall be Veris Hawkeye H908 or equal.

J. Pressure Electric Switch (PE)

2. Provide a pressure operated snap switch that can actuate electrical circuits. The contact ratings shall be 8 amps at 240V inductive.

K. Directional Airflow Indicator

1. Provide a room airflow direction indicator, which utilizes the Ball-In-Tube technology. The indicator shall incorporate an integral Form C contact (NO and NC) for remote alarming or DDC interface. The indicator shall be uni-directional and shall indicate either negative or positive conditions not both.

2.12.4 LOCAL CONTROL PANELS

A. Provide control panels with suitable brackets for wall mounting, for each miscellaneous control system. Locate panel adjacent to systems served.

B. Fabricate panels of 14-gauge furniture-grade steel, or 6063-T5 extruded aluminum alloy, totally enclosed, with hinged doors and keyed lock, with manufacturer's standard shop-painted finish and color. Provide UL listed cabinets for use with line voltage devices.

C. Panel Mounted Equipment: Include temperature controllers, relays, and other devices excluded in the sequence of operation. Mount devices with adjustments accessible through the fronts of panels.

D. Safety low limit shall be manual reset twenty foot limited fill type responsive to the coolest section of its length.

E. Duct smoke detectors shall be furnished and connected to the building fire alarm under Division 26.

2.13 EXISTING OPERATOR WORKSTATION

2.13.1 The controls furnished under this project shall be capable of full integration with the existing campus control systems and operator workstations utilizing existing temperature controls.

PART 3 - EXECUTION

3.1 REQUIREMENTS FOR WORKMANSHIP AND QUALITY:

3.1.1 All wiring shall be terminated by connecting to the temperature control device or numbered terminal strip as indicated on the drawing furnished by the temperature control manufacturer. All wiring shall be color coded and shall be tagged for further identification. Splices in wiring shall be held in an absolute minimum and when necessary shall be made color to color throughout the entire control system.

3.1.1 All switches, panels, etc., furnished and/or installed by the temperature control manufacturer shall be identified by means of plates made of plastic or black anodized aluminum suitably engraved. Embossed or punched plastic tape will not be acceptable.

3.1.2 The Mechanical Contractor shall provide a complete detailed wiring diagram for the air conditioning units to the Electrical Contractor for installation.

3.1.3 Temperature controls supplier shall provide an eight (8) hour training session for the University HVAC department to be signed by the Owner, to acquaint the personnel with control operation instructions and programming training, including sequence of operations, scheduling, etc.

3.1.4 Supply and exhaust fans shall be interlocked as scheduled on plans.

3.2 SERVICE AND WARRANTY:

The control system herein specified shall be free from defects in workmanship and material under normal use and service. If within 12 months from date of acceptance by the Owners any of the equipment herein described is proved to be defective in workmanship or material, it shall be replaced or repaired free of any charge to the Owner. Upon completion of the job, the temperature controls shall be thoroughly checked, adjusted and calibrated and placed in operation all devices comprising the entire control system provided under this section of the work to the complete satisfaction of the Engineer and/or owner. The Subcontractor shall provide the Owner with complete instruction manuals covering the function and operation of all control components on the project. A component technician shall be available for instruction purposes to the Owner.

PART 4 - SEQUENCE OF OPERATION FOR THE ENERGY MANAGEMENT SYSTEMS (EMS)

4.1 GENERAL

A. HVAC systems shall be controlled with Direct Digital Control (DDC) according to the point list contained in this section of the Specifications and shall be stand-alone. Additional points or software programming not listed in the point list but which are required to meet the following sequence of operation shall be provided.

4.2 VARIABLE AIR VOLUME (VAV) BOXES WITH HOT WATER COIL

A. The VAV boxes shall be controlled by a factory mounted Terminal Equipment Controller (TEC).

B. The TEC shall monitor the space temperature and modulate the VAV damper and heating coil valve to maintain space temperature setpoint (adjustable).

C. With the VAV box at minimum flow and the heating coil valve open, an increase in space temperature shall cause the TEC to modulate closed the heating coil valve. On a further increase in space temperature, the TEC shall modulate the VAV damper from minimum flow to maximum flow to maintain space temperature setpoint (adjustable). On a decrease in space temperature, the reverse shall occur.

D. The TEC shall monitor the inlet air flow and modulate the damper to maintain pressure independent control between the minimum and maximum design air flow limits (adjustable).

E. The constant volume TECs shall be equipped with an auto-zero module to automatically recalibrate the flow sensor every twenty-four (24) hours without reducing flow through the box. Auto-recalibration shall occur at 2 a.m.

4.3 AIR HANDLING UNITS: (AHU-1 thru AHU-5)

A. This is a draw through, variable volume unit. This unit consists of a supply fan, motorized outside air damper, motorized return air damper, filter section (65%), heating water preheat coil, chilled water coil, and a variable frequency drive (VFD) on the supply fan. Provide with manufacturer's discharge plenum on end of unit.

B. AHU-1and 4 shall operate as single zone VAV, while AHU-2, 3 and 5 shall operate as multiple zone VAV with air terminal boxes.

C. On a start command, the DDC Controller shall start and stop the supply air fan by opening the outside air damper. An end switch on the outside air damper shall start the supply fan.

D. The DDC Controller shall monitor the VFD status through the FLN protocol board. On supply fan failure with the exhaust system operational, the O.A. damper shall remain open and the temperature controls shall continue to operate. The supply boxes associated with the supply fan shall open to full flow and an alarm shall be sent to the EMS operator. For air handling units serving laboratories/vivarium, on exhaust system failure, the O.A. damper shall close de-energizing the supply fan and the supply boxes, associated with the supply fan, shall close to airflow and an alarm shall be sent to the EMS operator.

E. The DDC Controller shall monitor the cold deck temperature and modulate the chilled water valve to maintain a cold deck temperature setpoint (adjustable)

F. The DDC Controller shall monitor the preheat temperature and modulate the preheat control valve to prevent the preheat temperature from falling below setpoint (adjustable) whether the supply fan is operational or not.

G. The DDC Controller shall monitor the space relative humidity and modulate the humidifier steam valve to maintain space setpoint of no less than 30% RH as reset by the space sensor. The humidifier shall not operate while the cooling coil is maintaining supply air temperature.

H. The DDC Controller shall monitor the fan discharge and end of duct static pressure and modulate the supply fan variable frequency drive VFD to maintain the fan discharge static pressure setpoint (adjustable) as reset by the end of duct static pressure sensor.

I. The DDC Controller shall monitor the outside air flow through a duct mounted flow station and modulate the O.A. and return air dampers to maintain O/A minimum CFM setpoint (adjustable).

J. The DDC Controller shall monitor the mixed air plenum static pressure and override the return air damper control to prevent the mixed air plenum static pressure from exceeding -0.25" wg.

K. The DDC Controller shall monitor an automatic low limit temperature controller mounted on the downstream side of the preheat coil. Should the low limit temperature controller trip, an alarm shall be sent to the EMS operator, all water flow valves shall open and the supply fan shall stop.

L. Smoke detectors furnished and installed by Division 16 in the discharge air of the unit shall, upon detection of smoke, close the outside air damper, close the two duct mounted supply and return smoke dampers, and de-energize the supply fan.

M. The DDC Controller shall monitor static pressure switch located on the discharge side of the supply fan to prevent the VFD from exceeding static setpoint limit (field adjustable). Should the limit be exceeded, the supply fan shall be shutdown, the O.A. damper shall remain open and an alarm shall be sent to the EMS operator.

N. The DDC controller shall monitor the static pressure across the prefilters and across the final filters and shall signal a dirty filter alarm at the EMS workstation if the preset limits are exceeded.

4.4 CHILLED WATER SYSTEM

A. Chilled Water Control. The chiller shall be provided with operating, safety and monitoring controls by the chiller manufacturer as described in the chiller specification. The chiller manufacturer shall provide all interface equipment to receive analog reset (0-10 or 2-10 VDC) and digital enable commands and transmit digital status and alarm information to the DCP as identified in the points list. In no case shall the BAS defeat the operating safeties provided by the chiller manufacturer. The BAS shall monitor each chiller for status and common alarm. The chiller shall be enabled and disabled by the DCP based on an owner defined time schedule or by the night setback temperature sensors. The chiller shall modulate capacity based on system load calculated by differential temperature and flow. The chiller chilled water discharge temperature shall be capable of reset based on outside air dry-bulb temperature or by system operators. Interlock each chiller with its corresponding chilled water pump and system flow switches to preclude enabling a chiller without positive flow through the applicable chiller. The speed of the chilled water pumps shall be varied by a VFD controller to provide constant chilled water supply pressure as measured by a differential pressure sensor across the chilled water supply and return lines. Provide an insertion, dual-turbine flow meter in the chilled water line located in the greatest straight length of pipe to monitor chilled water flow for load calculation. The chilled water pumps shall alternate operation at system start-up or at designated times to balance run time on each pump. The bypass valve located in the central plant shall modulate in order to maintain the minimum required flow rate through the chiller.

4.6 HEATING WATER SYSTEM

A. Provide a DDC temperature control system for the heating water supply system. The boiler shall be provided with operating, safety and monitoring controls by the boiler manufacturer as

described in the boiler specification. In no case shall the BAS defeat the operating safeties provided by the boiler manufacturer. The BAS shall monitor boiler for status and common alarm. The heating water plant shall be enabled and disabled by the BAS based on outside air temperature or by system operators. The boiler shall be MODULATE CAPACITY based on system load calculated by differential temperature and flow. The boiler operating controls shall control boiler firing, staging, etc. to control heating water supply temperature and be reset based on outside air temperature or by system operators. Interlock boiler with its associated heating water pump and system flow switches to preclude enabling a boiler without positive flow through the boiler. The speed of the heating water pumps shall be varied by a VFD controller to provide constant heating water supply pressure as measured by a differential pressure sensor across the heating water supply and return lines. Provide an insertion, dual-turbine flow meter in the heating water secondary line located in the greatest straight length of pipe to monitor heating water flow for load calculation. The two pumps shall alternate operation at system start-up or at designated times to balance run time on each unit. The heating water bypass valve located in the central plant shall modulate in order to maintain the minimum flow rate through the boiler.

4.7 MISCELLANEOUS:

Provide interconnections to building fire alarm system as required.

PART 5 - POINTS LIST

5.1 CHILLED WATER PLANT:

5.1.1 Chiller
- Enable/Disable Signal
- Control Status Signal
- Common Alarm Signal
- Discharge Temperature Reset
- Chilled Water Supply Temp
- Chilled Water Return Temp

5.1.2 Chilled Water Pump (Each) (CWP-1, 2)
- Start/Stop
- Status
- Chilled Water Differential Pressure
- Speed Control Signal (VFD)

5.2 AIR HANDLING UNITS (EACH):

- Supply Fan
  - Start/Stop
  - Status
  - Speed Control Signal (VFD)
- Discharge Air Temperature
- Discharge Air Temperature Setpoint
- Return Air Temperature
- Mixed Air Temperature

Outside Air Temperature
Return Air Damper Position
Outside Air Damper Position
Outside Air CFM
Chilled Water Valve Position
Heating Water Valve Position
Duct Smoke Detector
  Supply Air Status
  Supply Air Alarm
  Return Air Status
  Return Air Alarm
Low Temp Limit Status
Low Temp Limit Alarm
Pre-Filter Status
Space Relative Humidity

5.3 AIR TERMINAL BOXES:

Damper Position Box Airflow
Space Temperature
Space Temperature Setpoint
Heating Water Valve Position

5.4 HEATING WATER SYSTEM:

5.4.1 Boiler
Enable/Disable Signal
Control Status Signal
Common Alarm Signal
Hot Water Supply Temp
Hot Water Return Temp
Discharge Temperature Reset
Primary Boiler Pump Start/Stop
Primary Boiler Status

5.4.2 Heating Water Pumps (Each)
Start/Stop
Status

5.5 EXHAUST FANS:

Fan Start/Stop
Fan Status

5.6 MISCELLANEOUS:

Fire Alarm

END OF SECTION

SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 - GENERAL

1.1 GENERAL:

1.1.1 Where any reference to "sheet metal" or "ductwork" appears in this section of these specifications or on the drawings, it shall be construed to include exhaust ducts, relief ducts, plenums, casings for air handling units, duct taps, grille taps and diffuser connections and all other related pieces and parts of the air conveying systems.

1.1.2 Before starting shop drawings or fabrication of any ductwork, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, tile patterns, etc.

1.2 SCOPE:

Furnish and install all labor, materials, equipment, tools and services and perform all operations required in connection with or properly incidental to the construction of complete Ductwork and Accessories System as indicated on the drawings, reasonably implied therefrom or as specified herein unless specifically excluded.

1.3 SHOP DRAWINGS:

1.3.1 Shop drawings shall be submitted on all items of sheet metal work.

1.3.2 Complete shop drawings shall be submitted for all ductwork on the project.

1.3.3 Detailed shop drawings in CAD shall be provided for all new supply and return sheet metal work, and a typical shop drawing shall be provided for the proposed installation of the new RTUs with adapter curb on the existing roof curbs. Drawings shall be provided at 1/4" scale or in the same scale as the Contract Documents, whichever is greater. As a minimum, the drawings shall include:

A. Fabrication, assembly and installation, including plans, duct sizes and bottom and/or top elevation of each duct, sections, etc.
B. Proposed duct installation in congested spaces, indicating proposed changes to duct layout and indicating coordination with building components, including ceilings.
C. Penetrations through fire and smoke rated penetrations.
D. Fittings (prefabricated and shop fabricated).
E. Seam and joint construction, duct reinforcement and spacing.
F. Locations of duct accessories (dampers, access doors, turning vanes, etc.).

G. Hangers and supports, including methods for duct/building attachment and vibration isolation.

1.4 REFERENCED STANDARDS:

ASHRAE - Guide and Data Books.
SMACNA - HVAC Duct System Design, Latest Edition.
NFPA - 90A, 90B, 91, 96, 204
SMACNA - HVAC Duct Construction Standards, Fourth Edition, 2020

1.5 QUALITY ASSURANCE:

The contractor shall comply with this specification in its entirety. If on inspections, the specifier finds that changes have been made without written prior approval, the contractor shall make the applicable changes to comply with this specification, at the contractor's expense.

PART 2 - PRODUCTS

2.1 MATERIAL:

All sheet metal duct, plenum and casing construction, unless otherwise specified herein, shall be constructed of new, prime grade, continuous hot dip mill galvanized, lock forming quality steel sheets, per ASTM A653/A653M and A924/A924M, and shall have a galvanized coating of 1-1/4 ounces total for both sides of 1 sq. ft. of a sheet, in accordance W/G90 per ASTM A653/A653M and ASTM A924/A924M. Construction shall be in strict accordance with the construction details on plan and installation details in the referenced SMACNA and NFPA standards as specified. Referenced standards shall be used to define minimum construction requirements where more stringent standards are not detailed on plans or specified herein.

2.2 LABELING AND GAUGE:

Each sheet shall be stenciled with manufacturer's name and gauge. If coil steel is used, coils shall be stenciled throughout on ten foot (10') centers with manufacturer's name and gauge. Sheet metal must conform to the tolerances listed in SMACNA HVAC Duct Construction Standards, Fourth Edition. All duct systems penetrating 1 hour fire walls shall be of minimum 24 ga. construction.

2.3 LOW PRESSURE DUCTWORK CONSTRUCTION:

2.3.1 Construct low pressure ductwork to meet all functional criteria defined in NFPA 90A, NFPA 90B, and Section VII of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" Fourth Edition. (This shall be subsequently referred to as the SMACNA manual.) All ductwork must comply with all local, state and federal code requirements.

2.3.2 Rectangular low pressure ducts shall be constructed and reinforced for 2"W.G. Longitudinal seams shall be Pittsburg lock, sealed with mastic sealant. (Snaplock is not acceptable.)

Elbows shall be mitered with double thickness turning vanes or smooth radius long sweep elbows. Combination elbows (outside smooth radius with inside miter) are not acceptable.

2.3.3 Round low pressure ducts shall be constructed in accordance with Table 3-2 and 3-3 2" W.G. "Round Duct Gauge Selection" and Figure 3-2 "Transverse Joints-Round Duct" of SMACNA HVAC Duct Construction Standards, Fourth Edition, 2020, and NFPA 90A and 90B.

Elbows shall be smooth elbows; 5 piece 90 degree elbows or 3 piece 45 degree elbows all with centerline radius 1-1/2 times the duct diameter.

2.3.4 <S> Low pressure flexible ducts shall be in accordance with SMACNA HVAC Duct Construction Standards, Fourth Edition, NFPA 90A and 90B. Flexible duct shall be equal to Genflex Type IL-1, with couplings and end connections as required for proper installation and compatibility with ductwork system in which they are installed.

A. All flexible ducts shall have positive interior air seal permanently bounded to a zinc coated high carbon spring steel helix all sheathed in a Class 1 vapor barrier factory sealed at both ends. The composite assembly including vapor barrier shall meet the Class 1 requirements of NFPA for use in a return air plenum, and be labeled by Underwriters Laboratories, Inc. 181 with a flame spread rating of 25 or less and a smoke developed rating of 50 or under.

B. Low pressure flexible duct shall be rated to 1 1/2" w.g. working pressure.

C. Flexible duct taps into low pressure plenums or main ducts shall be made with 45 degree side take-offs and rigid round duct with damper on a 3/8" square rod, nylon end bearings, graduated operators with stand-off brackets, and raised bead for tight, positive flex duct connection. Use insulation guard for internally lined ductwork. Duct connections and dampers shall be constructed of galvanized sheet metal, 24 gauge minimum for 12" diameter and smaller, 22 gauge minimum for 14" diameter, and 20 gauge minimum for 15" diameter. Damper assemblies shall be as manufactured by Greenheck or Ruskin.

D. Flexible Duct Clamps: 100 percent nylon strap, 175 pounds minimum loop tensile strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening devise. Apply clamps with sealant and as approved for UL 181, Class I installation.

2.3.5 <S> All exposed low pressure ductwork shall be factory lined, double wall spiral flat oval or spiral round as indicated on plans. Outer duct wall shall be paint-grip galvanized steel suitable for field painting unless noted otherwise.

2.4 LOW PRESSURE DUCTWORK CONSTRUCTION:

2.4.1 Construct low pressure ductwork to meet all functional criteria defined in NFPA 90A, NFPA 90B, and Section VII of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 1985 Edition. (This shall be subsequently referred to as the SMACNA manual.) All ductwork must comply with all local, state and federal code requirements.

2.4.2 Rectangular low pressure ducts shall be constructed and reinforced for 2"W.G. Longitudinal seams shall be Pittsburg lock, sealed with mastic sealant. (Snaplock is not acceptable.)

Elbows shall be mitered with double thickness turning vanes or smooth radius long sweep elbows. Combination elbows (outside smooth radius with inside miter) are not acceptable.

2.4.3 Round low pressure ducts shall be constructed in accordance with Table 3-2 and 3-3 2" W.G. "Round Duct Gauge Selection" and Figure 3-2 "Transverse Joints-Round Duct" of SMACNA HVAC Duct Construction Standards, First Edition, 1985 and NFPA 90A and 90B.

Elbows shall be smooth elbows; 5 piece 90 degree elbows or 3 piece 45 degree elbows all with centerline radius 1-1/2 times the duct diameter.

2.4.4 <S> Low pressure flexible ducts shall be in accordance with SMACNA HVAC Duct Construction Standards, First Edition, 1985, NFPA 90A and 90B. Flexible duct shall be equal to Genflex Type IL-1, with couplings and end connections as required for proper installation and compatibility with ductwork system in which they are installed.

A. All flexible ducts shall have positive interior air seal permanently bounded to a zinc coated high carbon spring steel helix all sheathed in a Class 1 vapor barrier factory sealed at both ends. The composite assembly including vapor barrier shall meet the Class 1 requirements of NFPA for use in a return air plenum, and be labeled by Underwriters Laboratories, Inc. 181 with a flame spread rating of 25 or less and a smoke developed rating of 50 or under.

B. Low pressure flexible duct shall be rated to 1 1/2" w.g. working pressure.

C. Flexible duct taps into low pressure plenums or main ducts shall be made with 45 degree side take-offs and rigid round duct with damper on a 3/8" square rod, nylon end bearings, graduated operators with stand-off brackets, and raised bead for tight, positive flex duct connection. Use insulation guard for internally lined ductwork. Duct connections and dampers shall be constructed of galvanized sheet metal, 24 gauge minimum for 12" diameter and smaller, 22 gauge minimum for 14" diameter, and 20 gauge minimum for 15" diameter. Damper assemblies shall be as manufactured by Greenheck or Ruskin.

D. Flexible Duct Clamps: 100 percent nylon strap, 175 pounds minimum loop tensile

strength manufactured for this purpose or stainless steel strap with cadmium plated worm gear tightening devise. Apply clamps with sealant and as approved for UL 181, Class I installation.

2.4.5 <S> All exposed low pressure ductwork shall be factory lined, double wall spiral flat oval or spiral round as indicated on plans. Outer duct wall shall be paint-grip galvanized steel suitable for field painting unless noted otherwise.

2.5 JOINTS:

2.5.1 All joints shall be sealed airtight with water-based duct sealer equal to United duct sealer in a manner compatible with type joint being sealed. Sealer shall be installed per the instructions set forth in the SMACNA HVAC Duct Construction Standards, Fourth Edition, 2020.

2.5.2 All sealed ducts shall be pressure tested at a developed and maintained system pressure. Leaks that whistle or are excessive shall be repaired and the test repeated. See Part 3 Execution.

2.5.3 As a Contractor option, transverse duct joints may be made with Ductmate System or approved equal with the following stipulation: "Ductmate or equal system may be employed only after Contractor personnel have been properly instructed by a manufacturer's representative in the application and installation of said system." Duct gauges shall be in strict accordance with Ductmate instructions.

2.5.4 Round Duct Joints: Round ductwork shall be spiral seam construction only. Gauges shall be in accordance with SMACNA Duct Construction Standard and fittings in accordance with SMACNA Duct Construction Standard, except as noted. Joints 0"-20" diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint diameter. Joints 21" diameter and up, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.

2.6 DUCT SUPPORTS:

2.6.1 All horizontal and vertical ducts shall be supported in accordance with SMACNA HVAC Duct Construction Standards, Fourth Edition, 2020.

2.6.2 Flexible ducts shall be free of sags and kinks and supported on minimum of 36" centers with 3/4" wide flat banding material. Perforated strap will not be acceptable.

2.7 DUCT LINER:

2.7.1 All supply, return, and outside air ductwork as noted on the plans with dashed lines drawn inside the duct, and all ductwork exposed in mechanical rooms shall have integral lining in accordance with SMACNA HVAC Duct Construction Standards, Fourth Edition, 2020, and NFPA 90A and 90B. Liner shall be 1-1/2 pound per cubic foot, 1" thick.

2.7.2 The ductwork serving the variable volume boxes and/or power terminal boxes shall be internally lined for distance of 10 lineal feet downstream of the box.

2.7.3 Where ducts are lined, exterior insulation will not be needed except as otherwise specified. Dimensions given on the drawings are inside the insulation, sheet metal sizes shall be increased to allow for the thickness of liner called for. Refer to Section 230500 for Flame Spread Properties.

2.7.4 Duct liner shall be equal to Manville "Linacoustic Permacote" meeting ASTM C1071; flexible blanket properly sealed at all joints and bare ends. Adhesive shall be UL listed water proof type. Fasteners shall be galvanized steel pins, welded or mechanically fastened.

2.7.5 Round duct liner shall be equal to Manville "Spiracoustic" meeting ASTM C427; Rigid.

2.8 DUCT ACCESS DOORS:

Duct access doors shall be hinged or Ductmate Sandwich Type Access Doors. (1" thick insulation bonded to interior face), 8" x 8" minimum size (duct opening) on ductwork up to 14" and 12" x 12" minimum size on larger ductwork. Doors shall be of adequate size to allow easy access to hardware/equipment that needs to be maintained.

2.9 AIR DISTRIBUTION DEVICES: <S>

2.9.1 Grilles, registers and ceiling outlets shall be as scheduled in the plans and shall be provided with sponge rubber or soft felt gaskets. If a manufacturer other than the one scheduled is used, the sizes shown on the drawings shall be checked for performance, noise level, face velocity, throw, pressure drop etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five foot occupancy zone will not be more than 50 FPM or less than 25 FPM. Should grilles other than those scheduled by name be furnished, manufacturer shall be prepared to demonstrate compliance with noise criteria on request to Engineer's satisfaction. All devices shall be tested per Air Diffuser Council and labeled as such.

2.9.2 Locations of outlets on drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be governed by the established pattern of the lighting fixtures or Architectural reflected ceiling plan. Where called for on the schedules, the grilles, registers and ceiling outlets shall be provided with deflecting devices and manual dampers. These shall be the standard product of the manufacturer, subject to review by the Engineer and equal to brand scheduled. All ceiling devices shall be furnished to be compatible with the type ceiling in which they are installed.

2.9.3 Air distribution devices shall be as manufactured by Titus, Metalaire, Kruege, Price or Tuttle & Bailey only and shall be as scheduled on the drawings.

2.10 INSTRUMENT PORTS:

2.10.1 Instrument ports shall be a 2-5/8" diameter base, neoprene gasket 2" deep neck, screwed cover operated with No. 024 spanner wrench, mounting screws, equal to Young 1101.

2.11 FIRE DAMPERS: <S>

2.11.1 Furnish and install UL labeled fire dampers with fusible links where indicated and/or required by local codes in accordance with NFPA 90A and 90B.

2.11.2 Fire dampers shall be 95% minimum free area Ruskin series IBD Classified UL-555.

2.11.3 Where dampers are installed in a horizontal position, provide stainless steel closure springs and cam type blade locks to insure complete damper shut-off.

2.11.4 Fire dampers shall be equipped with suitable frame style for round, oval or rectangular ducts.

2.11.5 Fire dampers shall only be installed in steel grilles, registers and diffusers. Aluminum air distribution devices may not be used in conjunction with fire dampers. It shall be the contractor's responsibility to verify that only steel devices are used with fire dampers.

2.11.6 Acceptable manufacturers: Advanced Air, Ruskin, Air Balance, Greenheck, Nailor, Pottorff.

2.12 WALL LOUVERS: <S>

2.12.1 Provide 6" thick stationary extruded aluminum louvers with drainable blades. Units shall exactly fit opening and be flashed completely weathertight.

2.12.2 Unless noted otherwise on plan, louvers shall be pre-finished in a color selected by the architect. Coordinate as required.

2.12.3 Maximum free area velocity for intake louvers shall not exceed 900 ft. per minute with a maximum pressure drop of 0.15 inches wg.

2.12.4 Louver blades shall be a minimum .125 inch thick and rigidly bracketed for 20 pounds per square foot wind loading.

2.12.5 Provide accessories as follows:

Aluminum birdscreen in removable frames, extended sill, clip angles and installation hardware.

2.12.6 Acceptable Manufacturers: Ruskin, Greenheck, Empco

PART 3 - EXECUTION

3.1 WORKMANSHIP, QUALITY AND REQUIREMENTS:

3.1.1 Ductwork shown on the drawings, specified or required for the heating, ventilating and air conditioning systems shall be constructed and erected in a first class workmanlike manner in accordance with SMACNA recommendations for low pressure and medium pressure duct construction unless more stringent requirements are specified herein. This work shall be warranted for a period of one year from the date of acceptance of the job against noise, chatter, whistling or vibrations and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Engineer.

3.1.2 Ductwork shall be erected in the general locations shown on the drawings, but must conform to all structural and finish conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site and shall make all necessary changes in cross sections, offsets, etc., whether they are specifically indicated or not.

3.1.3 Ductwork stored on site or already erected shall be clean when installed and kept clean during the work. All installed ductwork shall be in a clean, new, first class condition. The contractor shall keep ductwork clean during construction as required using such methods as sealing all openings except when attaching additional sections. Exposed ductwork shall have ends covered with plastic at all times to ensure the duct stays clean and free from contaminants. All supply ducts should be considered "intermediate level" in accordance with the latest edition of SMACMA's "Duct Cleanliness for New Construction Guidelines". Air handling units, ductwork and all associated items shall be cleaned or replaced at no cost to the Owner if allowed to get dirty. All air systems shall have appropriate filters in place during construction and replaced with permanent filters upon completion of project

3.1.4 Provide manually operated volume control dampers in all branches, splits and taps for proper balancing of air distribution whether indicated on the drawings or not. Dampers to be either single blade or multi-blade as shown in the SMACNA manual as required and as detailed on plans. They shall have an indicating device with lock to hold damper in position for proper setting.

3.1.5 Damper operators above inaccessible ceilings shall be furnished with extension rods operable through diffuser and grille faces or from remote locations.

3.1.6 All square elbows shall have double thickness turning vanes per the SMACNA manual requirements except for any return air jumper ducts noted on drawings.

3.1.7 Furnish and install in the ductwork, hinged or Ductmate Sandwich type access doors to provide access to all dampers, automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. Factory fabricated doors as manufactured by Ductmate, Milcor or equal meeting these specifications will be acceptable.

3.1.8 Where ducts connect to mechanical equipment with fans, including roof exhausters, flexible connections shall be made using "Ventglas" fabric that is fire-resistant, waterproof, mildew-resistant and practically air tight and shall weigh approximately thirty ounces (30 oz.) per square yard. There shall be a minimum of one-half inch (1/2") slack in the connections and a minimum of two and one half inches (2-1/2") distance between the edges of the duct except that there shall also be a minimum of one inch (1") of slack for each inch of static pressure on the fan system.

3.1.9 Furnish and install screens on all ducts, fans, etc., and openings furnished by this Contractor which lead to, or are, outdoors. Screens shall be 16 gauge, one half inch (1/2") mesh in removable galvanized steel frames.

3.1.10 Furnish test openings with covers in each zone duct for taking readings of air velocities or pressures in ducts. See the SMACNA manual for cover construction.

3.1.11 All holes in ducts for damper rods and other necessary devices, shall be either drilled or machine punched, (not pin punched), and shall not be any larger than necessary. All duct openings shall be provided with sheet metal caps if the openings are to be left unconnected for any length of time. In general, sheet metal screws shall not be used in duct construction unless the head (not the point) of the screw is in the airstream. Transformations shall have a ratio of not more than one inch (1") in transformation to every two inches (2") of length unless specifically shown otherwise on the drawings.

3.1.12 All duct drops to return and exhaust grilles shall be full size of the grille, and internally lined with 1" thick duct liner (except in healthcare facilities). The inside of all grilles, branch ductwork and duct drops shall be "blacked-out" with a minimum of two (2) coats flat black paint.

3.2 DUCT LINER:

A. Adhere insulation to sheet metal with full coverage of a UL listed adhesive.

B. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.

C. All exposed edges of the liner must be factory or field coated with mastic. For systems operating at 4000 fpm or higher a metal nosing must be installed over all liner leading edges in addition to the mastic coating.

D. Repair liner surface penetrations with UL listed adhesive.

E. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 FLASHING:

3.3.1 Where ducts pass through roofs or exterior walls, suitable flashing shall be provided to prevent rain or air current from entering the building. The flashing shall be not less than No. 24 gauge galvanized steel.

3.3.2 Where ducts exposed to view pass through walls, floors or ceilings, furnish and install sheet metal collars to cover the voids around the duct.

3.4 FIRE DAMPERS:

3.4.1 Fire dampers shall be installed in accordance with the SMACNA recommendations and as detailed on the drawings.

3.4.2 Provide a duct access panel for each fire damper.

3.4.3 Seal wall and floor penetrations with approved firestopping material. Firestop shall be equal to BIO Fireshield, Inc., BIO K-2.

END OF SECTION

SECTION 23 35 00

AIR CONDITIONING EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL:

Refer to Section 23 05 00 for Common Work Results for HVAC..

1.2 SCOPE:

Furnish and install all labor, materials, equipment, tools and services and perform all operations required in connection with, or properly incidental to, the construction of complete air conditioning equipment systems as indicated on the drawings, reasonably implied therefrom or as specified herein unless specifically excluded.

1.3 SCHEDULES ON DRAWINGS:

In general, all capacities of equipment and motor and starter characteristics are shown on schedules on the drawings. Reference shall be made to the schedules for such information. The capacities shown are minimum capacities. Variations in the characteristics will be permitted only on written approval of the Engineer. Insofar as is possible, all items of the same type (i.e. air handling units, rooftop units, fans, etc.) shall be by the same manufacturer. Where instructions on installation are not included on these specifications or on the plans, the manufacturer's instructions shall be followed. Equipment shall be labeled and provided with installation and operating instructions in accordance with the International Mechanical Code.

1.4 EQUIPMENT INSTALLATION AND WARRANTY SCHEDULE:

1.4.1 This Subcontractor shall refer to the architectural specifications for the required time schedule for the installation of equipment furnished as a part of this contract. The required time schedule will necessitate the setting-in-place of some items before the normal period of occupancy of the space and before the acceptance of substantial completion and subsequent approval by the Owner and Engineer. The Subcontractor is advised that the warranty for each item of equipment will not begin until the documented time of beneficial use as defined in the architectural specifications, and the Subcontractor will, therefore, make the necessary arrangements with the equipment manufacturers for extended warranties as may be required.

1.4.2 All exterior equipment shall be provided with factory finished and fabricated, fully louvered coil guards completely enclosing coils preventing damage from outside sources. Wire screens or mesh are not acceptable. Where factory fabricated guards are not available, provide 300 series stainless steel, shop fabricated guards shall be provided.

1.5 EFFICIENCY:

Unless a higher efficiency is schedule on the plans, all equipment shall comply with the efficiency requirements of ASHRAE Standard 90.1 (latest edition) as a minimum. Efficiency requirements shall satisfy both the heating and cooling requirements where applicable.

1.6 REFERENCE STANDARDS:

ASHRAE Handbook - HVAC Applications (latest edition)
ASHRAE Handbook - HVAC Systems & Equipment (latest edition)
ASHRAE Handbook - Fundamentals (latest edition)
Standard for Mechanical Refrigeration Systems - ANSI B9.1
Standard for Installation of Residence Type Warm Air Heating & Air Conditioning Systems - NFPA 90B
Standard for Installation of Air-Conditioning & Ventilating Systems - NFPA 90A
International Mechanical Code – IMC - 2021
Reference SECTION 23 05 00 for additional information
International Energy Conservation Code - IECC - 2021
Energy Standard for Buildings Except Low-Rise Residential Buildings – ASHRAE Standard 90.1

PART 2 - PRODUCTS

2.1 FILTERS: <S> <OM>

2.1.1 To protect the air-moving equipment during construction and for the purpose of testing and balancing, this Contractor shall furnish and install a complete set of temporary filters. These temporary filters shall be of glass fiber in heavy cardboard frame with suitable retainers to hold the media in place. Provide two (2) complete sets of each type of filter for each piece of air moving equipment, in addition to "start-up" filters. Provide Engineer documentation, signed by the Owner that these additional filters have been turned over to the Owner.

2.1.2 For all air moving equipment permanent filter type shall be equal to 2" thick MERV 11 efficiency pleated throw-away filters.

2.1.3 Acceptable Manufacturers: Farr, Air Guard, AFF.

2.2 EXHAUST FANS: <S> <OM>

2.2.1 Roof exhausters shall be of the direct-driven centrifugal type as manufactured by Greenheck or equal and have capacity as scheduled on the drawings. The fan shall be complete with a weather-proof protection for fans and motors, centrifugal type wheels, automatic shutter, non-fused disconnect switches, birdscreens and suitable motor and belt guards. The fans shall be supplied with the factory fabricated roof curb for sloped roof except where noted on the drawings. All fans shall bear the AMCA seal for air and sound performance, and shall be U.L. 702 listed and labeled.

2.2.2 Ceiling and inline exhaust fans shall be equal to Greenheck Model CSP/SP and as scheduled on the drawings. The fan housing shall be constructed of heavy gauge galvanized

steel, acoustically lined with 1/2 inch thick insulation. The motor shall be mounted on resilient elastic grommets. The fan shall have a forward curved centrifugal wheel. All fans shall bear the AMCA seal for air and sound performance, and shall be U.L. 702 listed and labeled. Provide high strength molded polystyrene integral grille and wall/roof cap with birdscreen.

Fans shall be fabricated with factory fabricated roof curb. All fans shall bear the AMCA seal for air and sound performance.

2.2.3 Acceptable Manufacturers: Greenheck, Loren Cook, Twin City Fan, PennBarry.

2.3 AIR PURIFICATION SYSTEMS: <S> <OM>

2.3.1 GENERAL DESCRIPTION

A. Codes and Standards. The following codes and standards are referenced throughout. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 86-2007 including ozone chamber test required as of December 21, 2007
4. The cold plasma equipment and power supply shall be UL and CE listed.
5. The technology shall have been tested to DO-160 by an independent lab and successfully passed all requirements for shock, vibration, EMF and line noise. Manufacturers not tested to DO-160 shall not be acceptable.

B. Quality and IP Assurance

1. Basis of design is Global Plasma Solutions. O2 Prime, Airgenics, Bioxin and American Ion shall be considered equal subject to meeting all specifications herein. All other manufacturers requesting prior approval must submit product drawings, specifications and test results specified in section 2.2 at least four weeks prior to bid date.
2. The Air Purification System shall be a product of an established manufacturer within the USA. Direct Current (DC) Ion modules manufactured outside the USA and assembled in the USA on mounting plates shall not be acceptable.
3. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.
4. 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. Any system containing titanium dioxide (Ti02), which has been listed by the CDC as a known carcinogen, shall not be acceptable.
5. The Air Purification Technology shall have been tested by UL or Intertek/ETL 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 requesting prior approval shall submit their independent UL 867 test data with ozone results to the engineer for preliminary review and 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.

6. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.007 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 0.0042 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

C. Submittals

1. Product Data: Submit manufacturer's technical product data for ion generators including:
   a. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
   b. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
   c. Performance data for each type of plasma device furnished.
   d. Product drawings detailing all physical, electrical and control requirements.
   e. Copy of UL 867 independent ozone test.
   f. Statement on the manufacturer's letterhead stating that the technology contains no titanium dioxide (Ti02).

2. Operating & Maintenance Data: Submit O&M data and recommended spare parts lists.

A. PRODUCT DELIVERY, STORAGE AND HANDLING

Deliver in factory fabricated shipping containers. Identify on outside of container type of product and location to be installed. Avoid crushing or bending. Store in original cartons and protect from weather and construction work traffic. Store indoors and in accordance with the manufacturers' recommendation for storage.

E. WARRANTY

Equipment shall be warranted by the manufacturer against defects in material and workmanship for a period of eighteen months after shipment or twelve months from owner acceptance, whichever occurs first. Labor to replace equipment under warranty shall be provided by the owner or installing contractor.

2.3.2 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. Basis of Design: Global Plasma Solutions

C. All other Suppliers of comparable products requesting prior approval shall:
   1. Submit for prior approval in accordance with the requirements of Section 15010.
   2. In addition, manufacturers submitting for prior approval for Bi-Polar Ionization must as part of the prior approval request provide their ASHRAE 62.1-2007 calculations that prove conformance to the ASHRAE Standard with the reduction of outside air to the scheduled values. A letter on the manufacturer's letterhead requesting prior approval must accompany the request for prior approval stating their calculations are ASHRAE compliant. A third party validation study performed on a previous installation of the same application using the same make and model equipment shall also be included.
   3. Submit independent test data from ETL or UL showing ozone levels produced during the UL 867 ozone chamber test. Manufacturers without this test data shall not be acceptable.
   4. Submit pathogen testing per section 2.2.
   5. Submit at least two other end user references in the same application with contact phone number, email, equipment used and application for the equipment at that facility. Manufacturers not having the above references in similar applications using the same equipment models as proposed on the current project shall not be acceptable.
   6. Ionization bars manufactured using DC output ionization modules shall not be permitted due to corrosion, ion short-circuiting, intermittent coil coverage and shock hazard.
   7. Ionization bars manufactured using ion modules not having epoxy coating all circuit boards and internal components shall not be acceptable.
   8. Manufacturers submitting as an alternate shall include their DO-160 test results.
   9. It is the responsibility of any alternate manufacturer and mechanical contractor proposing an alternate to the basis of design to confirm any proposed substituted product does not infringe on the patented intellectual property of the basis of design. The engineer and owner recognize the basis of design holds multiple patents and multiple patents are pending.

2.3.3 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

   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 NELAC 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.
7. Capable of modular field assembly in six inch (150mm) sections.

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. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.
   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. Electrode Specifications (Bi-polar Ionization):
      a. Each flexible ionization bar with Bi-polar Ionization output shall include a minimum of six carbon fiber cluster ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 2.0" apart shall not be acceptable. All hardware required for mounting shall be provided by the air purification manufacturer. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion.
      b. Electrodes shall be provided in 36.0" sections with high temperature double sided tape, and the power head shall be epoxy filled
      c. Electrodes shall be energized when the main unit disconnect is turned on.

d. The ionization output shall be a minimum of 240 million ions/cc over the entire width of the 36" ion strip as measured 1 inch from the cold plasma needles.

F. Air Handler Mounted Units:

1. Where so indicated on the plans and/or schedules Plasma Generator(s) shall be supplied and installed. The mechanical contractor shall mount the Plasma Generator and wire it according to the manufacturers IOM. A 115VAC or 208-240VAC circuit shall be provided to the plasma generator power supply. No more than 5 watts shall be required per power supply

G. Plasma Requirements:

1. Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided for all equipment listed above.
   a. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 115VAC or 208-240VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.
   b. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced.
   c. Ionization output from each flexible electrode shall be a minimum of 240 million ions/cc when tested at 1".
   d. Each plasma electrode shall be made from Kapton tape.

H. Electrical Requirements:

2. 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 115 VAC or 208-240VAC, 1 phase, 50/60 Hz. The contractor shall coordinate electrical requirements with air purification manufacturer during submittals.

I. Control Requirements:

3. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset.
4. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS when specified on the schedule.
5. The installing contractor shall mount and wire the Plasma device within the air handling unit specified or as shown or the plans. The contractor shall follow all manufacturer IOM instructions during installation.

2.4 VARIABLE FREQUENCY DRIVE (VFD): <S> <OM>

2.4.1 Description: Provide as described herein VFD which convert fixed frequency utility power into adjustable frequency power necessary to operate three phase AC motors at variable speed. This shall allow proportional variation in volume in volume flow of the air handling units that are

variable volume or constant pressure systems. VFD shall incorporate microprocessor logic to ease user set up for application functions.

2.4.2 Service conditions: The VFD shall operate satisfactorily in the following conditions:

1. Operating ambient temperature - 10° to 40° C
2. Storage temperature - 20° - 60° C
3. Relative humidity to 90% noncondensing
4. Vibration 1 G max under 20 Hz; 0.2 G at 20 to 60 Hz

2.4.3 Enclosure:

Standard: The VFD and the BYPASS PANEL and all peripheral equipment required for proper operation of the VFD's shall be provided in NEMA 1 wall mount enclosures, one per VFD.

Weatherproof: For VFD's mounted on exterior equipment (exhaust fans, etc.), the VFD and the BYPASS PANEL and all peripheral equipment required for proper operation of the VFD's shall be provided in NEMA 3R wall mounted enclosures, one per VFD.

2.4.4 Electro-mechanical construction shall be as described below:

1. Input voltage: As scheduled on the ELECTRICAL drawings.
2. Output current overload rating of 125% of motor FLA for 1 minute.
3. Voltage source design using PWM inverter technology.
4. Microprocessor based control circuit generating sine coded PWM output current waveform.
5. Non-volatile memory (NV RAM); all programming is maintained when disconnected from power.
6. Corrects displacement power factor to 98% throughout the motor speed range and eliminates power line notching, through the use of diode bridge input section or power factor correction capacitors and isolation transformer.
7. Input phase insensitive, sequencing of the 3 phase input lines is not required.
8. Capable of single phase input operation - required 50% drive derating and three phase motor on the output.
9. Fused DC bus with capacitive filtering.
10. Insulated Gate Bipolar Transistors (IGBT) output, allowing motor noise, at 60 Hz, less than 2 dB (@ 1 meter) above that resulting from across the line operation. In the event that the VFD manufacturer does not utilize IGBT technology they shall provide output reactors in each VFD to reduce noise.
11. Three current transformers detect the output current to provide: Electronic thermal overload protection, Three phase current limit, Ground fault protection, Short circuit protection and Speed search capability.
    As an alternate the VFD manufacturer must provide isolation transformer, external motor overload and external logic to accomplish speed search must be provided.
12. Digital operator keypad and display provides local control and readout functions -or- provide individual meters for readout and PLC for terminal status indication:
    a. Run/Stop/Jog commands.
    b. Speed command.
    c. Reset command.

d. Output frequency meter and speed command meter, which can be programmed for other speed related indications including, RPM, CFM, FPM and % max. RPM.
e. Volt meter, Amp meter, Kilowatt meter functions.
f. Input and output terminal status indication.
g. Diagnostic indication.

2.4.5 Performance features - All VFD's furnished shall meet the performance standards described herein:

1. The VFD shall provide output frequency and voltage modulation with selectable volts/hertz ratio for optimum variable torque output.
    a. Output frequency from 0 to 400 Hz.
    b. Output voltage from 0 to motor rated voltage.
2. Fixed carrier frequency programmable up to 15 KHz, allowing motor noise, at 60 Hz, less than 2 dB (@ 1 meter) above that resulting from across the line operation -or- output reactor must be provided to reduce noise.
3. Compatible with standard NEMA B motors.
4. UL listed and CSA approved.
5. Lock out reverse operation.
6. Drive defaults to 80% of last speed through internallogic -or- provide a PLC to accomplish this function.
7. Soft start, linear or S-curve function.
8. Ramp to stop or coast to stop selection.
9. Provide braking through DC injection with voltage level, current limit and duration adjustable, and selectable for either stop (deceleration braking) or braking before start (anti-windmill braking) -or- provide a mechanical brake and time delay relay to accomplish.
10. Critical frequency rejection capability in 3 ranges with adjustable span o f0 to 10 Hz to avoid possible vibration problems at driven equipment resonant frequencies -or- provide a PLC to accomplish this function.
11. Two (2) second momentary power loss ride thru (drive logic is maintained) -or- provide external capacitors or battery backup to accomplish this function.
12. Auto restart (up to 10 attempts) -or- provide a PLC to monitor fault condition and accomplish restart. The auto restart for the equipment on this project shall be set at the time of start-up to five (5) attempts at starting prior to a lockout situation occurring.
    a. The VFD shall have the ability to start into free running (coasting) motor via speed search feature.
13. High starting torque capability for high inertia loads.
14. Full range auto torque boost for high inertia loads.
15. Stall prevention.
16. Standard frequency reference (speed) input signals; 0-10 Vdc, 4-20 mA.
17. Accepts reverse or direct acting frequency reference input signal.
18. Programmable bias and gain for frequency reference input signal.
19. External fault input (i.e. firestat or freezestat) programmable to command ramp to stop, coast to stop, emergency stop or continue operation -or- provide external relays to accomplish this function.
20. Speed search to start a rotating motor and load -or- provide external logic to accomplish safe restart.

21. Terminals and programming for remote run/stop and speed reference.
22. Remote operation run/stop, 2 wire or 3 wire control.
23. Local/remote operation input via contact closure.
24. Analog output (0 to10 Vdc) proportional to frequency or current.
25. RUN/FAULT OUTPUT CONTACTS (1 amp resistive) selectively activated at initial fault occurrence or after final auto restart attempt.
26. Stall prevention by reducing output voltage and frequency during momentary overload. Automatically resume normal operation when overload occurs.
27. Digital diagnostic indication and protection for:
    a. DC bus undervoltage and overvoltage.
    b. Load over torque.
    c. Fuse blown.
    d. Motor overload.
    e. Heatsink over temperature.
    f. Instantaneous over current.
    g. Operator error.
    h. Central processor fault.
    i. External fault.
    j. Dynamic braking fault.

2.4.6 Adjustments and programmability:

1. Incremental/Floating Point Control
    a. One contact closure input causes acceleration for duration of the closure, another causes deceleration. When both switches are open the last speed command is held.
2. Factory default settings formost common HVAC applications. These settings can be easily re-established through a reset code.
3. Program security code.
4. Thirty (30) operational changes possible in control and display functions without stopping the drive including:
    a. Acceleration and deceleration time.
    b. Frequency command.
    c. Frequency command bias and gain.
    d. Multi-step speed references.
    e. Jog reference.
    f. Monitor display.
5. Two independent, selectable acceleration/deceleration ramp times.
6. Acceleration time from 0.1 to 6000 seconds.
7. Deceleration time from 0.1 to 6000 seconds.
8. Maximum and minimum output frequency form 0 to 400 Hz.
9. Programmable upper and lower frequency limits.
10. Pre-set selectable Volts/Hertz (V/Hz) patterns plus 1 custom pattern.
11. Auto speed reference (instrument follower) input signal adjustable for bias and gain.
12. Programmable start and stop ramp time.
13. Four programmable multi-function input terminals.
14. Multi-function output contacts programmable for:

Run mode	Zero speed detect
Overtorque detect	Coast to stop detect

Run reference mode	Speed reference mode
Output frequency detect	Speed synchronization
Low voltage detect	Operation ready
Speed reference missing	Braking resistor fault
Drive fault	Firestat/freezestat

15. Adjustable torque and current limit from 0 to 170%.
16. Ramp to stop or coast to stop selection.
17. Adjustable upper and lower frequency limits independent of pre-set V/Hz pattern.
18. Programmable lock out code, to prevent operator access to parameter settings.
19. Nine (9) selectable pre-set speed programming capability.
20. Programmable jog speed.

2.4.7 Components - Furnished with all VFD's

A. Input section - VFD power input stage converts three phase AC line power into a fixed DC voltage via a solid state full wave diode rectifier with metal oxide varistor (MOV) protection.

B. Intermediate section - DC bus maintains a fixed DC voltage with filtering and short circuit protection as a DC supply to the VFD output section. It is interfaced with the VFD diagnostic logic circuit to continuously monitor and protect power components.

C. Output section - Insulated gate bipolar transistors (IGBT) convert DC bus voltage to variable frequency and voltage PWM sine coded output to the motor.

2.4.8 Accessories

A. Bypass control allows operation of the motor across the line should the VFD require service:

1. Bypass and drive are factory assembled and electrically interlocked.
2. VFD can be removed with bypass control left in place.
3. NEMA 1 enclosure.
4. DOOR INTERLOCKED DISCONNECT.
5. VFD input contactor.
6. BFD output contactor.
7. Bypass contactor.
8. Overload relay.
9. 115 VAC control transformer.
10. Safety circuit terminal strip.
11. Drive-Off-Line selector.
12. Power on light.
13. VFD select light.
14. Line select light.
15. Normal-Test selector.
16. Hand-Off-Automatic switch.

B. A Factory certified VFD technician shall provide START-UP SUPERVISION AND PROGRAMMING of the VFD's for proper operation. This work shall not be performed by the installing contractor. The factory certified VFD technician shall provide operator training to the building's operations personnel.

C. The UNIT MANUFACTURER shall provide one (1) year parts and LABOR warranty. This warranty shall not be provided by the installing contractor. The labor warranty shall include mileage and subsistence to the from the jobsite. No additional costs shall be incurred by the owner during the period of the warranty.

2.4.9 Source quality control

A. Mean time between failure (MTBF) 100,000 hours minimum.

B. In-circuit testing of all printed circuit boards.

C. Printed circuit boards burned in for 96 hours at 85 C.

D. Functional testing of printed circuit boards after burn in.

E. Fully assembled VFD tested with induction motors.

F. All integrated circuits tested to .5% AQL acceptance criteria.

2.4.10 Drives schedule

A. Rated input voltage as scheduled on the ELECTRICAL prints.

B. Variable torque horsepower - as scheduled for the air handling units.

C. Maximum continuous output current shall be the FLA of the motors.

2.4.11 Approved Manufacturers: MagneTek, Cutler Hammer, Allen Bradley, Danfoss.

2.5 SEMI-INSTANTANEOUS PACKAGED GAS FIRED BOILER: <S> <OM>

2.5.1 Furnish and install a boiler plant as specified and as scheduled on the plans. The boiler plant shall consist of hydronic boiler module(s). Each Boiler shall be UL Listed, CSD-1 approved, ASME coded and stamped, and incorporate a gas train designed in accordance with FM. Each Boiler shall have capacities as shown on the plans, when fired with natural gas. The Boiler manufacturer must publish known part load value efficiencies; the thermal efficiency must increase as the firing rate decreases. The boiler control panel shall incorporate the functions of temperature control, combustion safeguard control, message annunciation, and fault diagnostic display, on individual field replaceable circuit boards mounted within a single housing. Each boiler shall have a footprint of no more than 28" W, 55 1/2" L, 79" H with a UL Listing for zero side wall clearance. Each boiler shall have ASME approved relief valve.

2.5.2 Boiler modules shall be natural gas fired, condensing design with a modulating forced draft power burner and positive pressure vent discharge.

2.5.3 Modulating Air/Fuel Valve and Burner

The Boiler burner shall be capable of a 20 to 1 turndown ratio of the firing rate without loss of combustion efficiency or staging of gas valves. The burner shall be nozzle mix design, with spark ignition and flame rectification. The burner head shall be cast stainless steel. All burner material exposed to the combustion zone shall be of stainless steel construction. There shall be no moving parts within the burner itself. The modulating air/fuel valve shall meter the air and natural gas input. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment and shall be located within the boiler cabinet.

2.5.4 Pressure Vessel/Heat Exchanger

A. The boiler shall be capable of handling return water temperatures down to 40□F without any failure due to thermal shock or fireside condensation. The heat exchanger shall be ASME stamped for a working pressure not less than 150 psig. The pressure vessel for 2000 MBH input boilers shall have a maximum water volume of 30 gallons. The boiler water pressure drop shall not exceed 2 psig at 180 gpm. The boiler water connections shall be 4" flanged 150 lb. ANSI rated. The pressure vessel shall be constructed of SA53 carbon steel, with a 0.25-inch thick wall and 0.50-inch thick upper head. Inspection openings in the pressure vessel shall be in accordance with ASME Section IV pressure vessel code. For other boiler sizes see the plan schedule.

B. The boiler shall be designed such that the thermal efficiency increases as the boiler firing rate decreases. The heat exchanger shall be constructed of a minimum 316L stainless steel tubes and tube sheets with a one-pass combustion gas flow design. The tubes shall be no less than 0.065-inch wall thickness. The upper and lower stainless steel tube sheet shall be no less than 0.313 inch thick. The pressure vessel/heat exchanger shall be welded construction. The heat exchanger shall be ASME stamped for a working pressure not less than 150 psig. Access to the tube sheets and heat exchanger shall be available by burner and exhaust manifold removal. Minimum access opening shall be no less than 13.5-inch diameter.

2.5.5 The exhaust manifold shall be of corrosion resistant porcelainized cast iron with flue connection. The exhaust manifold shall have a gravity drain for the elimination of the condensation with collecting reservoir.

2.5.6 Boiler Controls:

A. The boiler control system shall be segregated into three components: Control Panel, Power Box, and Input/Output Connection Box. The entire system shall be Underwriters Laboratories Recognized.

B. The control panel shall incorporate three self-governing features designed to enhance operation in modes where it receives an external control signal by eliminating nuisance faults due to over-temperature, improper external signal or loss of external signal. These features are: Setpoint High Limit, Setpoint Low Limit, and Failsafe Mode. Setpoint High Limit allows for a selectable maximum boiler outlet temperature and acts as temperature limiting governor. It is a PID function that automatically limits firing rate to maintain outlet temperature within a 0 to 10 degree selectable band from the desired maximum boiler outlet temperature. Setpoint Low Limit allows for a selectable minimum operating temperature.

C. Failsafe Mode allows the boiler to switch its mode to operate from an internal setpoint if its external control signal is lost, rather than shut off. This is a selectable mode; hence the control can be set to shut off the unit upon loss of external signal if so desired.

D. The boiler control system shall incorporate the following additional features for enhanced external system interface: system start temperature feature; pump delay timer; auxiliary start delay timer; auxiliary temperature sensor; MA output feature which allows for simple monitoring of either temperature setpoint, outlet temperature, or fire rate; remote interlock circuit; delayed interlock circuit; and fault relay for simple remote fault alarm.

F. Each boiler shall utilize an electric single seated safety shutoff valve with proof of closure switch in its gas train and incorporate dual over-temperature protection with manual reset in accordance with ASME Section IV and CSD-1.

2.5.7 Temperature Control Mode

A. The boiler(s) shall operate in Indoor/Outdoor-Reset control mode through its control panel. The panel can be field reconfigured to offer internal setpoint, or 4 to 20 mA temperature setpoint. The following is a description of I-O-R and the BMS.

B. Indoor/Outdoor Reset:

1. Boiler shall include integral factory wired operating controls to control all operating and energy input of the boiler plant. The system shall be comprised of a microprocessor-based control utilizing pulse width modulation for bumpless transfer of header temperature. The controller shall have the ability to vary boiler input throughout its full range to maximize the condensing capability of the boiler and without header temperature swings.

2. The boiler shall operate to vary header temperature setpoint on an inverse ratio in response to outdoor temperature to control discharge temperature $\pm$2°F. Unit shall operate with an Inverse Efficiency Curve, with known Part Load Value Efficiencies. Maximum efficiency shall be achieved at minimum firing input. Reset ratio shall be fully field adjustable from 0.3 to 3.0 in operation. The boiler shall have LCD display for monitoring of all sensors and interlocks. Outdoor

controller conduit and wiring furnished by Boiler Supplier.

C. Boiler Management System (BMS):

1. The boiler Manufacturer shall supply as part of the boiler package a completely integrated Boiler Controller to control all operation and energy input of the multiple boiler heating plant. The Boiler Management System shall be comprised of a microprocessor based control utilizing a pulse width modulated (PWM) signal to communicate with the Boiler. The controller shall have the ability to operate up to 8 boilers.

2. The controller shall have the ability to vary the firing rate and energy input of each individual boiler throughout its full modulating range to maximize the condensing capability and thermal efficiency output of the entire heating plant. The controller shall control the boiler outlet header temperature within $\pm$2°F. The controller shall be a PID type controller for accurate temperature control with excellent variable load response. The controller shall provide contact closure for auxiliary equipment such as system pumps and combustion air inlet dampers based upon outdoor air temperature.

3. When set on Internal Setpoint Mode, temperature control setpoint shall be fully field adjustable for 50°F to 200°F in operation. When set on Indoor/Outdoor Reset mode, the controller will operate on an adjustable inverse ratio in response to outdoor temperature to control the main header temperature. Reset ratio shall be fully field adjustable from 0.3 to 3.0 in operation. When set on 4ma to 20ma Temperature Control Mode, the controller will operate the plant to vary header temperature setpoint linearly as an externally applied 4-20 ma signal is supplied. The controller shall have a LCD display for monitoring of all sensors and interlocks. Nonvolatile
memory backup of all control parameters shall be internally provided as standard. The controller will automatically balance the sequence of operating time to each module by a first-on first-off mode and provide for setback and remote alarm contacts. Connection between central BMS system and individual modules shall be twisted pair low voltage wiring, with the boilers 'daisy-chained' for ease of installation. This conduit and wiring will be provided by the Boiler Supplier.

2.5.8 Accessories and Installation:

A. All aspects of installation of Boiler Plant shall be in strict accordance with manufacturer's instructions.

B. The vent system must conform to all manufacturers' recommendations and shall utilize UL listed stainless steel AL-29-4C Positive Pressure materials in a double wall configuration. This stack shall be supplied by the Boiler Supplier.

C. Boiler plant piping shall be field constructed of materials as specified. Each boiler shall have individually isolating shutoff valves for service and maintenance. Each boiler shall require a minimum gas pressure of 7" W.C. at input scfh. Each boiler shall be provided with an individual supply gas regulator for proper gas regulation with a 2" NPT connection. Each boiler shall be supplied with an (field installed in discharge piping) automatic, pressure compensating, flow control valve of 4" size with maximum flow as scheduled on plans. Flow cartridges shall be field changeable for future GPM modifications and shall be constructed of stainless steel. The system Header temperature Sensor complete with sensor well shall be furnished with the boiler(s) and field installed in the discharge header at the location directed by the manufacturer. Wiring and conduit shall be supplied by the boiler supplier.

2.5.9 Warranty

The pressure vessel/heat exchanger of the boiler shall carry a 7 year prorated, limited warranty against failure due to condensate corrosion, thermal stress, mechanical defects or workmanship. The six individual circuit boards of the control panel assembly shall carry a 2-year warranty against failure due to defective materials of workmanship. All other parts shall carry a 1-year parts warranty. In addition, a 1-year labor warranty including trouble-shooting shall be provided by the authorized factory service company. This service company shall have a service office located within 150 miles of the project site. A Warranty Certificate must be issued to the owner from the manufacturer and a copy of warranty must be submitted for engineer's approval.

2.5.10 Field Service

Contractor shall provide the services of a local factory authorized representative to supervise all phases of equipment startup. All control wiring between Boilers, Header Temperature Sensor and the controller shall be the responsibility of the temperature controls contractor. It shall comply with the Electrical and control wiring specifications. A copy of the startup papers with factory operation, installation and maintenance instructions shall be submitted at the completion of startup.

2.5.11 Acceptable Manufacturers: AERCO International, RBI.

2.6 HEAT TAPE: <S> <OM>

2.6.1 Furnish and install a complete UL listed system of heaters, components, controls to prevent above grade chilled water piping to the air-cooled chillers from freezing.

2.6.2 The self-regulating heater shall consist of two (2) 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be cut to length in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket. To provide a ground path and to enhance the heater's ruggedness, the heater shall have a braid of tinned-

copper and an outer jacket fluoropolymer as required per section 427-23 of the NEC-1996. For installation on plastic piping, the heater shall be applied using aluminum tape (AT 180).

2.6.3 The heater shall have a self-regulating factor of at least 90 percent. The self-regulation factor shall be defined as the percentage reduction, without thermostatic control, of the heater output going from 40°F pipe temperature operation to 150°F pipe temperature operation.

2.6.4 The heater shall operate on line voltages of 277 volts without the use of transformers.

2.6.5 The heater shall be sized according to this table. The required heater output rating is in watts per foot at 50°F.

	Minimum Ambient	Temperatures
Pipe Size	-10°F	-20°F
3 inch or less	5 watt	5 watt
4 inch	5 watt	5 watt
6 inch	8 watt	8 watt
8 inch	10 watt	10 watt

2.6.6 Acceptable manufacturers: Raychem Corporation, Deltatherm or prior approved equal.

2.6.7 All heating cable components shall be UL-listed for use as part of the system to provide pipe freeze protection. Components enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall require only standard hand tools and shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems requiring the installing contractor strip the bus wires, or which used crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be reenterable for servicing.

2.6.8 Heating cable circuit shall be protected by a ground fault device for equipment protection in accordance with section 427-22 of the NEC-1996.

2.6.9 Provide the following master control:

a. Thermostatic Control-Ambient Sensing: The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.

2.7 FAN COIL UNITS: <S> <OM>

2.7.1 Provide horizontal concealed fan coil units of the style and capacities indicated on the plans and in the equipment schedules.

2.7.2 Base units shall be complete with water coil, centrifugal fan with PSC motors, 3-speed switch, condensate drain pan, and 18-gauge galvanized steel casing.

2.7.3 Coil shall have 1/2" O.D. copper tubes with aluminum fins mechanically bonded with 5/8" O.D. male sweat fittings.

2.7.4 Coils shall be leak tested at 350 psig minimum air pressure and shall be suitable for working pressures up to 250 psig. Coils shall have a manual air vent (automatic if specified).

2.7.5 Drain pan shall be 18 gauge galvanized steel, completely coated with fire retardant closed cell foam insulation. Drain connection shall be 7/8" O.D. male sweat fitting.

2.7.6 Motors shall be 3-speed permanent split capacitor type with built-in thermal overload.

2.7.7 Fans shall be centrifugal forward curved type statically and dynamically balanced. Fan wheels and housings shall be galvanized steel.

2.7.8 One inch throwaway filters shall be provided.

2.7.9 Accessory items: Room thermostat, fan speed control, auxiliary electric heat when scheduled.

2.7.10 Acceptable manufacturers: Carrier, Trane, Williams or Daikin.

2.8 CHEMICAL TREATMENT: <S> <OM>

2.8.1 Provide complete water treatment systems for each of the following:

a. Chilled Water Piping System
b. Heating Water Piping System

2.8.2 Qualifications - The water treatment chemical and service supplier shall be a recognized specialist whose major business is in the field of water treatment. The supplier shall have been active in the field of industrial water treatment for at least ten years and shall have a fully staffed laboratory, development facility, service department, and full-time service personnel.

2.8.3 Chemicals: - Provide, at no additional cost to the owner, all chemicals required for treating and testing included water systems for one year of operation.

2.8.4 Water Analysis - The appropriate chemicals to be used will be determined by the analysis of a water sample taken from the building site by the water treatment supplier. Provide ingredients necessary to achieve the desired water conditions.

2.8.5 Instructions - Instruct owner's personnel in the use and operation of each water treatment system, including: monitoring equipment, feed equipment, preparation of chemical solutions, charging of the chemical solution reservoirs, proper handling of chemicals, and proper use of test kits, charts and logs.

2.8.6 Testing Equipment and Reagents - Furnish water test equipment and reagents in appropriate cases to verify control parameters.

2.8.8 Manufacturers - Design is based on products by Garratt - Callahan Chemical Company. Equal equipment by GESCO, Betz, or Culligan is acceptable.

2.8.9 Closed loop hydronic piping systems:

A. Provide equipment of the appropriate size, and type scheduled below, as manufactured by Garratt-Callahan Chemical Company.

B. Shot Feeders: Provide chemical feeders of the by-pass or shot type for each separate hydronic system. Feeders shall be five gallon capacity complete with bottom drain, 3/4" NPT inlet and outlet valves. Fill cap shall be 3-1/2" (minimum) located on top with non-slide, quick opening fitting of ductile iron with Buna-N O-ring. Pressure Rating: 200 psig. Maximum temperature rating: 212°F.

C. Pretreatment: All piping chemicals and related equipment shall be thoroughly flushed out with cleaning chemicals designed to remove deposits from construction, such as: pipe dope, oils and loose mill scale. Reference Section 15055.

D. Chemicals: Provide chemicals and dye indicator for the control of scale formation, corrosion, and algae based on water analysis of the system make up water. The chemical shall be provided in sufficient quantities for one year of corrosion inhibitor.

2.9 SPLIT-COUPLED VERITCAL IN-LINE PUMPS: <S> <OM>

2.9.1 Furnish and install pumps with capacities as shown on plans. Pump must be capable of being serviced without disturbing piping connections.

2.9.2 Pump body shall be of Class 30 cast iron, rated 175 psi maximum pressure, with gauge ports at nozzles, and with vent and drain ports.

2.9.3 Impeller shall be bronze, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.

2.9.4 The liquid cavity shall be sealed off at the motor shaft by an internally-flushed mechanical seal with ceramic seal seat, and carbon seal ring, suitable for continuous operating temperature of 225^{o} deg. F with maximum operating temperature of 250^{o} deg. F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.

2.9.5 Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.

2.9.6 Motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans.

2.9.7 Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

2.9.8 Provide each pump with manufacturer's triple-duty valve; cast iron body with brass disc, stainless steel stem and spring, EPDM seat, and BUNA N O-rings. Provide with two (2) metering ports and two (2) drain tappings. Max pressure drop shall not exceed 3 PSI at design flowrate.

2.9.9 Provide each base mounted pump with manufacturer's suction diffuser with cast iron body, guide vanes and cover plate. Strainer shall be 0.125" perforated stainless steel. Provide with fine mesh galvanized start-up strainer for removal after 24 hours of pump operation. Max pressure drop shall not exceed 1.5 PSI at design flowrate.

2.9.10 Acceptable manufacturers: Armstrong, Bell & Gossett, Taco.

PART 3 - EXECUTION

3.1HEAT TAPE:

3.1.1 Heat Tape Installation:

A. Apply the heater linearly on the pipe after piping has been successfully pressure tested. Secure the heater to piping with cable ties or fiberglass tape.
B. Apply "electric traced" signs to the outside of the thermal insulation on 20'-0" centers.

3.1.2 Testing

After installation and before and after installing the thermal insulation, subject heater to testing using a 2500 VDC megger. Minimum insulation resistance shall be 20 megaohms regardless of length.

END OF SECTION

SECTION 23 36 00 - AIR TERMINAL UNITS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Variable volume terminal units.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. General

1. Manufacturers must participate in the ARI Certification program. Unit performance data must be Rated in Accordance with ARI Standard 880, and must display the ARI Symbol on all standard units. If a manufacturer does not participate in the ARI Certification program, specified equipment must be witnessed by an ARI certified testing laboratory to meet the criteria of the specification, including intended radiated NC, in an equipment mockup. Mockup must be similar to construction and operating conditions of this project.

2. Shutoff terminals must be UL listed as a Room Air Terminal.

B. Acceptable Manufacturers

1. TRANE
2. TITUS
3. CARRIER
4. METALAIRE

2.2 MANUFACTURED UNITS:

A. The contractor shall furnish and install ceiling mounted variable air volume terminal for connection to single medium pressure duct, central air systems, with variable volume (as scheduled and/or specified) electric actuator wired to terminal strip. The direct digital controller shall be provided and mounted by the building automation system contractor. Where hot water heating coils are shown, they shall be factory mounted on the units by the manufacturer.

B. Identify each terminal unit with clearly marked identification label and airflow indicator. Label shall include unit nominal air flow, maximum factory set air flow, minimum factory set air flow, and coil type.

2.3 FABRICATION:

A. Casings. Units shall be completely factory assembled, manufactured of corrosion protected welded or screwed steel, and fabricated with a minimum of 18-gauge metal on the high pressure (inlet) side of the VAV damper and 22-gauge metal on the low pressure (outlet) side and unit casing. Plenum air filter and sound attenuator shall be provided on all fan-powered units.

B. INSULATION - Foil Face - Interior surface of unit casing is acoustically and thermally lined with a minimum of 1/2 inch, R-Value 2.2 1.9 lb./cu. ft. foil face insulation. All exposed edges are sealed to prevent fibers in the airstream. Meets NFPA-90A, UL 181 and bacteriological standard ASTM C 665.

C. Assembly: Air volume damper, and controls in single cabinet.

2.4 VOLUME DAMPER:

A. Locate air volume damper assembly inside unit casing. Construct from extruded aluminum or a minimum of 20 gauge (0.9 mm) galvanized steel components. Key damper blades into shaft with nylon fitted pivot points. Flow sensor must be provided regardless of control chosen. Flow sensor must be a ring or cross. Single bar or single point sensing device is not acceptable.

B. Mount manually operated damper quadrant or automatic damper operator and automatic flow control assembly.

C. Air volume control damper shall be factory calibrated assembly consisting of air modulation damper and extension for connection to control actuator. All actuator linkage shall be protected by a sheet metal enclosure provided by the terminal unit manufacturer.

D. Air volume control damper shall be factory calibrated assembly consisting of air valve with integral actuator.

E. Electric actuator shall position damper. The electric actuator shall be provided by the terminal unit manufacturer.

2.5 HEATING COILS:

A. Hot Water Heating Coil: Copper tube mechanically expanded into aluminum plate fins, leak tested under water to 300 psig pressure, factory installed. Female sweat-type water connections shall be provided, with same side connections (right hand or left hand). The control valve shall be furnished by the building automation system contractor.

B. Coil Capacity: Per schedule.

2.6 WIRING:

Factory mount and wire control actuators. The Building Automation System contractor shall mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source. The Building Automation System contractor shall furnish and install a step down transformer for DDC controller, actuator and control valve.

2.7 TESTS:

A. Factory set and check all analog electronic and pneumatic controllers to within 5% of scheduled maximum and minimum settings. Base performance on tests conducted in accordance with ARI 880.

B. Maximum Casing Leakage: 1 percent of nominal air flow at 0.5 in w.g. inlet static pressure.

C. Maximum Damper Leakage: 1 percent of design air flow at 4 in w.g. inlet static pressure.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install in accordance with manufacturer's instructions.

B. The sheet metal contractor shall install a minimum of two (2) feet of straight hard duct on the high pressure inlet connection to the terminal unit. Attached to the straight duct the sheet metal contractor can use a maximum of three (3) feet of high pressure flex duct for connection to the main supply duct. All joints shall be seal per these contract documents.

3.2 ADJUSTING:

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design air flow to 25 percent nominal air flow. Set units with heating coils for minimum flow as scheduled.

END OF SECTION

SECTION 23 65 00- AIR-COOLED WATER CHILLERS

PART 1 - GENERAL

1.1 SECTION INCLUDES:

A. Chiller package.
B. Charge of refrigerant and oil.
C. Controls and control connections.
D. Chilled water connections.
E. Starters.
F. Electrical power connections.

1.2 RELATED SECTIONS:

A. Section 23 05 03 - Piping Systems.
B. Section 23 09 00 - Temperature Controls.
C. Section 26 05 03 - Equipment Wiring Connections.

1.3 REFERENCES:

A. ANSI/ARI 590 - Positive Displacement Compressor Water - Chilling Packages.
B. ANSI/ARI 550 - Centrifugal or Rotary Water - Chilling Packages.
C. Comply with applicable Standards/Codes of ANSI/ASHRAE 15, ETL, cETL, NEC, and OSHA as adopted by the State.
D. Units shall meet the efficiency standards of the current version of ASHRAE Standard 90.1, and FEMP standard 2012.

1.4 SUBMITTALS:

A. Submit shop drawings and product data in accordance with the specifications.
B. Submittals shall include the following:
   1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections
   2. Summary of all auxiliary utility requirements such as electricity, water, etc. Summary shall indicate quality and quantity of each required utility.
   3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
   4. Schematic diagram of control system indicating points for field interface/connection.
   5. Diagram shall fully delineate field and factory wiring.
   6. Installation and operating manuals.

1.5 QUALITY ASSURANCE:

A. Qualifications: Equipment manufacturer must specialize in the manufacture of the products

specified and have five years experience with the type of equipment and refrigerant offered.

B. Regulatory Requirements: Comply with the codes and standards specified.

C. Chiller manufacturer plant must be ISO Registered.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Chiller shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.

B. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units, to be performed by the successful contractor.

D. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

E. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

1.7 WARRANTY:

A.The manufacturer shall provide start-up supervision and operator training of the air-cooled chiller. The contractor shall verify that all required electrical, controls and piping is properly connected and operational. The manufacturer shall clearly state in his bid that the start-up supervision and training will be performed by a factory trained representative, not sales personnel.
B. 1st Year Labor Warranty: Parts & Compressor
C. Extended Compressor Warranty: None.
D. Extended Unit Warranty: Entire unit, four (4) years parts and labor.
E. Refrigerant Warranty: Five (5) years R32 refrigerant.
F. Delay Warranty Start: Warranty period shall begin at the time of documented equipment start-up.

1.8 MAINTENANCE:

A. Maintenance of the chillers shall be the responsibility of the owner and performed in accordance with the manufacturer’s instructions.

1.9 OPERATION AND MAINTENANCE DATA:

A. Submit SIX (6) copies of operation and maintenance data.

B. Include start-up instructions, maintenance data, controls, and accessories.

PART 2 - PRODUCTS

2.1 SUMMARY:

A. The manufacturer shall furnish, for installation by the successful contractor an air-cooled water chiller utilizing scroll compressors, low sound fans and hydronic pump system as scheduled on the contract documents. The chiller shall be installed in accordance with this specification and perform at the specified conditions as scheduled. Each chiller shall consist of hermetic tandem scroll compressor sets, brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation. Chiller shall be functionally tested at the factory to ensure trouble free field operation

B. Approved Manufacturers: Daikin, Carrier, Trane, York.

C. Substitution: Any manufacturer desiring to furnish equipment on this project shall submit COMPLETE submittal data fourteen (14) days prior to the bid date. Catalog cut sheets and sales data are not acceptable. The unit manufacturer shall list all deviations from the specified unit. Any manufacturer allowed to bid this project will be listed herein or by addenda. Listing herein or by addenda does not relieve the contractor from providing equipment which meets both the letter and the intent of these documents. Only those manufacturers listed herein or by addenda will be considered as viable suppliers on this project.

2.2 GENERAL UNIT DESCRIPTION:

A. Provide and install as shown on the plans factory-assembled, factory-charged air-cooled scroll compressor packaged chillers in the quantity specified. Each chiller shall consist of hermetic tandem scroll compressor sets, brazed plate evaporator, air-cooled condenser section, microprocessor-based control system and all components necessary for controlled unit operation.
B. Chiller shall be functionally tested at the factory to ensure trouble free field operation

2.3 DESIGN REQUIREMENTS:

A. Flow Range: The chiller shall have the ability to support variable flow range down to 40% of nominal design (based on AHRI conditions).
B. Operating Range: The chiller shall have the ability to control leaving chilled fluid temperature from 15F to 65F.
C. General: Provide a complete scroll compressor packaged chiller as specified herein and as shown on the drawings. The unit shall be in accordance with the standards referenced in section 1.02 and any local codes in effect.
D. Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum percentage of full load (without hot gas bypass) of 25%. Performance shall be in accordance with AHRI Standard 550/590.
E. Acoustics: Sound pressure levels for the unit shall not exceed the scheduled levels. All manufacturers shall provide the necessary sound treatment (parts and labor) to meet these levels if required. Sound data shall be provided with the quotation. Test shall be in accordance with AHRI Standard 370.

2.4 CHILLER COMPONENTS:

A. Compressor
1. The compressors shall be sealed hermetic, scroll type with crankcase oil heater and

suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability.

B. Evaporator

1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates. Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor.

2. The evaporator shall be protected with an external, electric resistance heater plate. The evaporator and suction piping to the compressors shall be insulated with 3/4" (19 mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of 'Good' in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of a heater plate and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

3. The water-side maximum design pressure shall be rated at a minimum of 469 psig (3235 kPa). Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).

C. Condenser

1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.

2. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water. Coils shall withstand 1000+ hour acidified synthetic sea water fog (SWAAT) test (ASTM G85-02) at 120°F (49°C) with 0% fin loss and develop no leaks.

D. Refrigerant Circuit

1. Each of the two refrigerant circuits shall include a replaceable-core refrigerant filter-drier, sight glass with moisture indicator, liquid line solenoid valve (no exceptions), expansion valve, and insulated suction line.

E. Construction

1. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.

2. Upper section of unit shall have protective and decorative louvers covering the coils and

unit end; base section of unit shall have protective, 12 GA, PVC-coated, wire grille guards and have painted steel wraps enclosing the coil end sections and piping.

F. Control System

1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and two power blocks (one per circuit) for connection to remote, contractor supplied disconnect switches. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.

2. Shall include high short circuit current rating of 65,000 amps with single-point disconnect switch

G. Unit Controller

1. An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure.

2. The unit shall be protected in two ways: (1) by alarms that shut the unit down and require manual reset to restore unit operation and (2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shut down alarms shall activate an alarm signal.

3. Shutdown Alarms

a. No evaporator water flow (auto-restart)
b. Sensor failures
c. Low evaporator pressure
d. Evaporator freeze protection
e. High condenser pressure
f. Outside ambient temperature (auto-restart)
g. Motor protection system
h. Phase voltage protection (Optional)

4. Limit Alarms

a. Condenser pressure stage down, unloads unit at high discharge pressures.
b. Low ambient lockout, shuts off unit at low ambient temperatures.
c. Low evaporator pressure hold, holds stage #1 until pressure rises.
d. Low evaporator pressure unload, shuts off one compressor.

5. Unit Enable Section

a. Enables unit operation from either local keypad, digital input, or BAS

6. Unit Mode Selection

a. Selects standard cooling, ice, glycol, or test operation mode

7. Analog Inputs:
a. Reset of leaving water temperature, 4-20 mA\
b. Current Limit

8. Digital Inputs:
a. Unit off switch
b. Remote start/stop
c. Flow switch
d. Ice mode switch, converts operation and setpoints for ice production
e. Motor protection

9. Digital Outputs
a. Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
b. Evaporator pump; field wired, starts pump when unit is set to start

10. Condenser fan control - The unit controller shall provide control of condenser fans based on compressor discharge pressure.

11. Building Automation System (BAS) Interface

a. Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.

b. BACnet MS/TP master (Clause 9)

c. BACnet IP, (Annex J)

d. BACnet ISO 8802-3, (Ethernet)

e. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.

f. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet objects. Proprietary BACnet objects shall not be allowed. BACnet communications shall conform to the BACnet protocol (ANSI/ASHRAE135-2001). A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

2.5 OPTIONS AND ACCESSORIES:

A. The following options are to be included:

1. Rapid Restore™: The chiller shall be equipped with the capability to restart and to reach full load more quickly than standard in case of a power interruption. The chiller shall be capable of rapidly restarting after power loss duration of up to 180 seconds. The time to restart the chiller shall be a maximum of 125 seconds, and full load shall be achieved in 220 seconds from power restoration. Fast Loading Stand-By Chiller: The chiller shall be equipped with the capability to start and to reach full load more quickly than standard in the event that the primary chiller system is disabled. The chiller shall be capable of rapidly achieving full capacity. The time to full load shall be achieved in 115 seconds.

2. Low Ambient Control: Fan VFD allows unit operation from 32°F down to -4°F (-23.3 C).
3. High Ambient Control Panel for operation from 105°F up to 125°F ambient temperatures
4. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
5. BAS interface module to provide interface with a combination of BACnet IP, BACnet MSTP, and Modbus protocols.
6. The following accessories, if selected, are to be included:

a. Rubber-in-shear vibration isolators for field installation

b. Factory-mounted thermal dispersion type flow switch

c. Wye strainer, to be installed at the evaporator inlet and sized for the design flow rate , with perforation diameter of 0.063" with blowdown valve and Victaulic couplings (factory mounted)

d. 115V GFI convenience outlet

B. Optional Factory-Installed Pump Package: None

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install in accordance with manufacturer's instructions, shop drawings, and contract documents.
B. Adjust and level chiller in alignment on supports.
C. Coordinate electrical installation with electrical contractor. One (1) - 480 volt service is required for the main power and one (1) - 115 volt service for the heat tape and one (1) - 115 volt service for the control power. The contractor shall verify the scheduled electrical connection of the chiller with that shown on the electrical prints. Report any discrepancy to the engineer.
D. Coordinate controls with controls contractor.
E. Install a field-supplied or optional manufacturer-supplied strainer in the chilled water return line at the evaporator inlet that meets manufacturer perforation size specifications.
F. Connect to chilled water piping.
G. Arrange piping for easy dismantling to permit tube cleaning.

3.2 MANUFACTURER'S FIELD SERVICES:

A. Supply service of factory trained representative to provide starting and testing of machine, and provide instruction on operation and maintenance to Owner. The chiller manufacturer's start-up personnel shall coordinate with the building automation system supplier to make sure the systems chiller and control system will properly operate.

B. The chiller manufacturer and building automation system contractor shall coordinate the operation and installation of the component and software prior to the bid date. There will be no change orders for lack of proper coordination of the system between the contractors, manufacturer and building automation system supplier. If the parties mentioned above are unable or unwilling to properly install and operate the system they shall not bid the project.

END OF SECTION

SECTION 23 74 00

INDOOR CENTRAL-STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED:

Packaged Air Handling Units.

1.2 QUALITY ASSURANCE:

1.2.1 Air Handling Units: Product of manufacturer regularly engaged in production of components who issues complete catalog data on total product offering.

1.2.2 Variable Volume Air Handling Units: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. All air handling units must be certified through ARI Standard 430. Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the contractor.

1.2.3 Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410-87.

1.3 SUBMITTALS:

1.3.1 Submit as-built drawings and product data under the General Conditions of these contract documents and as specified herein. As-built drawings shall show total unit configuration in direction of airflow, unit dimensions, and field duct connection details.

1.3.2 Product data shall indicate dimensions, weights, coil performance, fan performance, motor electrical characteristics, finishes of materials, filter media, filter sizes, and filter quantities.

1.3.3 Submit manufacturer's installation instructions under the General Conditions of these contract documents and as specified herein.

1.3.4 Provide fan curves with specified operating point clearly plotted. Fan curves shall indicate air volume, static pressure, fan speed and brake horsepower.

1.3.4 Submit sound power levels by octave band for air handling units at scheduled design conditions. Provide sound power levels for "discharge" and "inlet plus cabinet" sound paths in accordance with AMCA 300 and AMCA 301. If unit sound power levels exceed values of the scheduled units on drawings, contractor shall submit detailed plan outlining steps to meet design noise levels.

1.3.5 The contractor shall provide a 1/2" scale drawing of the mechanical equipment rooms where all air handling units will be located. The drawing shall show all piping, equipment and recommended clearances for the equipment. This drawing shall be furnished prior to commencement of work.

1.4 DELIVERY, STORAGE, AND HANDLING:

1.4.1 Deliver products to site under the General Conditions of these contract documents and as specified herein. Units shall ship fully assembled up to practical shipping and rigging limitations. Units not shipped fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Each section shall have lifting lugs or shipping skid to allow for field rigging and final placement of section.

1.4.2 Deliver units to site with fan motors, sheaves, and belts completely assembled and mounted in units. Mount motors as specified herein.

1.4.3 Store and protect products under the General Conditions of these contract documents and as specified herein.

1.4.4 Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

1.5 ENVIRONMENTAL REQUIREMENTS:

Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- Daikin; Model: PreciseLine
- Trane; Model: UCCA

2.1.1 Substitutions: Any manufacturer desiring to furnish equipment for this project, who is not listed above shall provide complete submittal data as outlined above, fourteen (14) days prior to the bid date. Sales literature and general catalog data will not be acceptable. If a manufacturer is deemed acceptable to bid, the name/model number of that manufacturer will be listed by addendum. If the manufacturer is not listed herein or by addendum they will not be acceptable. Additionally, listing herein or by addendum does not alleviate the contractor from furnishing equipment which meets the letter and the intent of this specification.

2.2 GENERAL:

2.2.1 Manufacturer must clearly define any exceptions made to Plans and Specifications. Mechanical Contractor is responsible for expenses that occur due to exceptions made.

2.2.2 Fabricate draw-thru type air handling units with fan sections, coil sections, access sections, mixing boxes, filter sections as shown on the plans.

2.2.3 Factory fabricate air handling units of sizes, capacities, and configurations as scheduled on drawings.

2.2.4 Provide factory installed base rails/mounting legs to support all sections of units, if a concrete housekeeping pad is not shown. Construct base rails/mounting legs of minimum ten (10) gauge galvanized steel channels or I-beams. Base rails/mounting legs shall have enough height to ensure proper trapping of condensate of all air handling units. Contractor will be responsible for providing a housekeeping pad when base rails/mounting legs are not of sufficient height to properly trap unit. Base rail/mounting legs not constructed of galvanized steel shall be chemically cleaned, coated with rust inhibiting primer, and finished with rust inhibiting enamel.

2.2.5 The general contractor shall provide a concrete housekeeping pad for all units located on the floor. The concrete housekeeping pad shall be tall enough to provide proper trapping of the air handling unit. The concrete pad height shall have a minimum height as determined by the following formula. Total Concrete Pad Height and Trap Height = [1.5 x (Total Static Pressure (in inches) + 1) + [1.5 x Condensate Drain Diameter (in inches)] + insulation thickness.

2.3 CASING:

2.3.1 Construct casings of minimum sixteen (16) gauge galvanized steel structural frames and minimum two (2) inch thick double wall panels. Construct double wall panels of minimum eighteen (18) gauge galvanized steel exterior panels and minimum twenty (20) gauge perforated galvanized steel interior panels in the fan section and solid twenty (20) gauge galvanized steel in all other sections. In order to properly clean the interior of the air handler of microbial growth and other debris, the casings shall be constructed such that structural frames are free standing and double wall panels are non-load bearing.

2.3.2 Construct casing sections located upstream of supply fan for operation at four (4) inches water gage negative static pressure and casing sections located downstream of supply fan for operation at six (6) inches water gage positive static pressure. Seal joints between casing sections with closed-cell foam gasketing for leak seal and thermal and acoustical break. Maximum allowable leakage shall not exceed 1% at the unit design total operating pressure. Units found to exceed leakage limits or to have condensation upon operation shall be corrected by a factory certified technician at cost to the owner. Unit casing shall be able to withstand up to 8 inches water gage positive or negative pressure with at maximum deflection of 1/200.

2.3.3 Panels shall be fully removable to allow for a proper way to thoroughly clean panels of microbial growth and to access internal parts. Secure panels to structural frames with zinc chromated plated screws. Seal joints between exterior panels and structural frames with closed-cell foam gasketing for leak seal and thermal and acoustical break.

2.3.4 Casings not constructed of G90-U galvanized steel, casings with welds on exterior surfaces, or casings with welds on interior surfaces that have burned through to exterior surfaces shall be chemically cleaned, coated with rust inhibiting primer, and finished width rust inhibiting enamel in order to prevent premature corrosion and microbial growth.

2.3.5 Casing shall have removable access panels or doors as scheduled on drawings. Construct access doors of minimum eighteen (18) gauge galvanized steel exterior panels and minimum twenty-two (22) gauge galvanized steel interior panels. Provide automotive style neoprene gasketing around full perimeter of access doors to prevent air leakage. Provide "ventlock" style non-corrosive alloy latches operable from the inside or outside of unit. If access doors do not open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement. Insulate access doors with two (2) inch thick 1-1/2 pound per cubic foot density matt faced fiber glass insulation. The above mentioned type access doors shall be provided in the following sections, at a minimum: Fan section and mixing box section.

2.3.6 Insulate ALL casing sections, including filter/mixing box section with closed cell foam insulation with minimum R-value of 13. Provide double wall casing construction and encase insulation between exterior and interior casing panels such that no insulation is exposed to airstream. Foil facing on insulation is not acceptable as alternate to double wall construction. Insulate all structural channels connected to casing panels and cover openings in structural channels with galvanized steel. Insulation shall comply with NFPA 90A.

2.3.7 Provide sealed double wall drain pans constructed of minimum 18 gauge galvanized steel exterior pans and minimum 18 gauge galvanized steel interior pans. Encase manufacturer's standard insulation between exterior and interior walls. Drain pans shall be sloped in two (2) planes; cross break interior pans and pitch toward drain connections to ensure complete condensate drainage. Units with coils shall have drain pans under complete coil section and horizontal draw-thru units shall have drain pans under complete fan section, coil sections and all access sections between coils. All drain pan connections will be to the side of the unit to enable proper trapping. The contractor shall properly pipe the all drain connections per the local codes.

2.4 FANS:

2.4.1 Provide supply fan section with direct-drive plug-type plenum fan designed and suitable for class of service indicated on the unit schedule. The fan type shall be scheduled on the prints. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts

shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping.

2.4.2 Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50, 200,000 hour average life per ANSI/AFBMA 9. Extend grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to casing.

2.4.3 Mount fans on minimum 16 gauge steel isolation base. Internally mount motor on same isolation base and internally isolate fan with one (1) inch or two (2) inch housed spring isolators. Install flexible canvas ducts between fan and casings to ensure proper isolation and prevent vibration and noise from being transmitted through the unit and ductwork. Flexible canvas ducts shall comply with NFPA 90A.

2.4.4 Fan sections shall have full height, double wall, hinged, removable access doors on drive side for inspection and maintenance of internal components. Construct doors as described above.

2.4.5 Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions. Balance at design RPM's as scheduled on drawings.

2.5 MOTORS AND DRIVES:

2.5.1 Factory install all motors on slide base to permit adjustment of belt tension.

2.5.2 Fan Motors shall be heavy duty, high efficiency open drip-proof, operable at the scheduled voltage and phase. The minimum motor efficiency shall be 92%.

2.6 COILS:

2.6.1 Install coils such that headers and return bends are enclosed by unit casings. All coils shall be ARI 410 certified.

2.6.2 Construct coils of configuration plate fins and seamless tubes. Fins shall have collars drawn, belled and firmly bonded to tubes by means of mechanical expansion of tubes. Do not use soldering or tinning in bonding process.

2.6.3 Construct coil casings of minimum 16 gauge galvanized steel with formed end supports and top and bottom channels. If two or more coils are stacked in unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through airstream. Staggered or offset coils designed to fit

additional coil area in smaller casings are not acceptable. All coils shall be vertically stacked on top of one another.

2.6.4 Water Coils

A. Clearly label supply and return headers on outside of units such that direction of coil water-flow is counter to direction of unit air-flow.

B. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.

C. Construct headers of round copper pipe or cast iron.

D. Construct tubes of 1/2 inch O.D. copper and construct fins of aluminum.

2.7 FILTERS:

2.7.1 Provide factory fabricated filter section of the same construction and finish as unit casings. All filter sections shall be furnished complete with insulated double wall construction. Filter sections shall have filter guides and full height, double wall, hinged, removable access doors for filter removal. Construct doors in accordance with these contract documents. Filter sections shall flange to other unit components. Provide filter blockoffs as required to prevent air bypass around filters. The manufacturer shall provide two (2) complete sets of filters, in addition to start-up filters. The contractor shall provide additional filters required to maintain cleanliness of the equipment. The contractor shall be responsible for cleaning the units internally prior to completion of the project.

2.7.2 For the prefilter, provide two (2) inch MERV 13 filter section with maximum face velocity of 500 feet per minute with disposable pleated media filters. Filters shall be removable from one side of filter sections.

PART 3 - EXECUTION

3.1 INSTALLATION:

3.1.1 The contractor shall properly orient and position the equipment on the housekeeping pad and install per the manufacturers recommendation.

3.1.2 The equipment shall be installed per the manufacturer's recommendations and these contract documents.

3.1.3 Make connections to coils per the coil details outlined in these contract documents.

END OF SECTION

SECTION 26 00 00
ELECTRICAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A Provide all materials, equipment, labor, and transportation required to install a complete and working electrical system. It is the intent of the drawings and specifications to provide complete installations even though each and every item necessary is not specifically mentioned or shown.

B Perform all Division 26 work in strict accordance with the requirements and recommendations stated in the latest adopted version of all federal, state, and local codes, ordinances, and standards (NFPA, NEC, IECC, etc.) except when requirements are modified by the Authority Having Jurisdiction.

C Where local codes or practices exceed or conflict with the NEC, it shall be the Contractor's responsibility to perform the work in accordance with the local code prevailing and local interpretations thereof by the Authority Having Jurisdiction. This Contractor shall bear all costs for correcting any deficiencies due to non-compliance.

1.02 REFERENCES AND STANDARDS

A All adopted State and Local Building Codes and Facility Standards.

B All requirements of the local authority having jurisdiction.

1.03 DEFINITIONS

A Owner's Representative - Indicates the entity designated or hired to represent an owner on a project. This entity could be the owner themselves, an Architect or could be another third party hired to represent the owner. Verify who will be representing the owner on this project before bidding.

B EMCS - Energy Management Control System (Building Management System / BMS), used to control mechanical systems in the building via hardware and / or software.

C Or equal - Indicates that the contractor may substitute equipment by another manufacturer if the salient features of the equipment indicated by manufacturer's name and / or described are adequate in the judgment of the Owner's Representative.

D Provide - Furnish and install all material and labor required for a complete installation ready for operation as required in accordance with the intent of the Contract Documents.

E Shall - Indicates a mandatory requirement or requirements.

F Unless otherwise noted, refer to NEC 100 for additional definitions used in these specifications.

1.04 COORDINATION

A Electrical service to all portions of existing buildings at the construction site not involved with the project shall remain in operation throughout construction. Provide all required temporary electrical service in the base bid to all required areas to satisfy OSHA requirements.

B All metering and temporary electrical service charges and / or costs of utilities shall be paid by the Contractor.

C The Drawings are not to be construed as shop drawings but indicate the extent, general locations, arrangement, etc., of conduit systems and equipment. Electrical drawings are diagrammatic and shall not be scaled for exact size. If the contractor has any questions regarding the layout of a particular device or equipment item, he shall contact the Owner's Representative for clarification. This Contractor shall, in laying out their work, refer to other sections of the specifications and other drawings such as air conditioning, structural, plumbing, architectural, civil, etc., to eliminate conflicts and undue delays in the progress of the work. Where items are furnished by other trades require connections by this Contractor, they shall be held responsible for providing rough-in drawings and assistance upon request.

D Plans, specifications, and other documents have been prepared and developed with reasonable professional care and coordination. It is the intent that all documents are supportive and complimentary, one to the other; and as such what is required by one shall be considered as required and binding as if indicated by all. Work indicated shall include, regardless of whether or not specifically stated, such supportive or required items or work as consistent with what is indicated, is reasonably inferable from what is indicated, and / or is common construction procedure or knowledge with regard to what is indicated.

1.05 SUBMITTALS

A The submittals required in this Division shall conform to and be submitted in accordance with the General Conditions, Instructions to Bidders, Division 1 and requirements listed in all sections of Division 26.

B Shop drawings, manufacturer's data materials lists, etc., are required for all equipment and material where submittals are required.

C Each submittal shall contain data relevant to the particular equipment (including options). The data shall be identified by "highlighting", arrows, underlining, etc. Do not submit pages of non-relevant information. Broad general data is not acceptable. If equipment submitted is not as specified in the Contract Documents, then the submittal shall contain specific details prominently identifying any differences in form, fit or function. If the equipment submitted is not as specified, then the Contractor shall be responsible for any additional costs necessary to install and connect the equipment. This includes, but is not limited to, increased panelboard size, circuit breaker size, disconnect size or circuit size.

D Submit warranty information on all equipment specified in this division. Warranty shall start at the time of substantial completion, unless otherwise indicated in subsequent sections.

E Submit dimensional layout of all electrical equipment locations, drawn to scale, with equipment locations shown. Clearances shall be in accordance with NEC and local codes. Panelboard and switchgear submittals will be rejected without dimensioned room or equipment location layouts.

F Some products require that a color selection be coordinated with the Owner's Representative. Information regarding such products shall be submitted to the Owner's Representative for review.

G If materials or equipment are installed before being reviewed without comment by the engineer, the contractor shall be liable for the removal and replacement of such unapproved materials and equipment, at no additional expense to the owner. Additionally, if the removal and replacement of unapproved materials or equipment necessitates the removal and replacement of other related materials or equipment, then the contractor shall be liable for the removal and replacement of the related materials and equipment at no additional expense to the owner.

H Partial submittals for review will not be accepted.

1.06 CLOSEOUT SUBMITTALS

A This Contractor shall accumulate during the job's progress the below list of data and shall keep it updated during construction as a set of Record Documents:

1. Exact dimensioned locations of all new and existing switchgear, devices, luminaires, controls, all other equipment and new or existing site utilities.
2. All warranties, as described in this section and in each subsequent specification section.
3. All shop drawings, as-built drawings, submittals, operating manuals, maintenance manuals, repair parts lists, etc.
4. Factory start-up and testing documentation, commissioning documentation, etc.

B Training Documentation: Provide a letter in the closeout submittals documenting that the end user (determined by the Owner) received training as required in any section in this division. Documentation to include name of person, date, duration, and content of training.

1.07 QUALITY ASSURANCE

A This contractor shall be certified / licensed to install the provided products and equipment.

1.08 DELIVERY, STORAGE, AND HANDLING

A Contractor shall store and handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

1.09 EXISTING FIELD CONDITIONS

A All proposals shall take these existing conditions and any revisions required into consideration, and the lack of specific site information on the drawings shall not relieve the contractor of any responsibility.

1.10 WARRANTY

A This Contractor shall guaranty fully all workmanship, material, equipment, systems, etc., provided by them for a period of one (1) year after substantial completion of the project, unless otherwise modified in other specification sections. The use of building equipment for temporary service and testing does not constitute the beginning of the warranty. This guaranty means that this Contractor shall make good to the owner, at no cost, any defects that become apparent during the year following substantial

completion. This guaranty is in addition to any other guaranties or warranties and is not intended to limit such other guaranties or warranties.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Unless otherwise noted, products shall be only from manufacturers that have been in business for at least five (5) consecutive years and have been manufacturing proposed products for at least two (2) consecutive years.

2.02 SUBSTITUTION OF PRODUCTS

A All proposed substitutions are subject to PRIOR APPROVAL and must be received by the Engineer and / or Owner's Representative no less than ten business days prior to the schedule date for opening of bids.

B Items noted as "No Substitutes" or "No Alternates" shall be as specified only. No substitutions will be accepted.

2.03 PERFORMANCE REQUIREMENTS

A All materials, components, products, assemblies, equipment, etc. shall be new, free from defects, listed (by an NEC accepted listing agency), and approved / rated for the application, environment and purpose. No Exceptions.

PART 3 - EXECUTION

3.01 INSTALLATION

A All equipment shall be installed in strict compliance with manufacturer's installation instructions and properly torqued using a calibrated torque tool.

B All panels, enclosures, devices, equipment and associated conduits, whether provided by this Contractor or any other, shall be flush-mounted and cleanly recessed in all finished spaces unless otherwise noted on the Drawings.

C Unprofessional and incomplete work shall be rejected and corrected at no additional expense. The judgement of professionalism and completeness of work shall be made by the Engineer and / or Owner's Representative and shall be final.

D All electrical connections shall be made per NEC 110.14 and torqued per manufacturer's instructions.

E Where existing utilities already exist or where renovation / addition work is to be done, maintain all utility services during construction to existing structures and / or portions of a project that are to remain in place and operational.

F This Contractor shall be responsible for damage to the project caused by this Contractor's failure to recognize hazards associated with items such as lack of power, scheduling of work (tardiness), inexperienced workmen, excessive cutting, etc. This Contractor shall repair at no expense to the owner any such damage.

3.02 INTERFACE WITH OTHER WORK

A The Electrical Contractor shall coordinate installation of the electrical system and coordinate all electrical connections with the General Contractor, Mechanical, Plumbing, and Communications Contractors to coordinate proper wire and insure proper wire sizes, OCPD sizes, a complete working system for the Owner.

B Cooperation with trades of adjacent, related or affected materials or operations, and / or trades performing continuations of this work under subsequent contracts is considered a part of this work in order to affect timely and accurate placing of work and to bring together, in proper and correct sequence, the work of such trades, including under the general contractor Division 1 and Division 23.

C The Electrical plans are based on equipment schedules shown. Should any mechanical equipment or device be submitted with different electrical properties from those properties shown, all electrical and / or mechanical changes shall be made at the expense of the trade or contractor initiating the change with no expense to the Owner's Representative, Engineer, etc.

D Make permanent connection to new utilities or existing lines. Determine depth and location, and bid accordingly. Relocate and repair any existing lines cut by general construction work.

3.03 CONTRACTOR COORDINATION - ELECTRICAL / MECHANICAL (DIV 23)

A Electrical Contractor to provide the following:

1. All line voltage wiring, conduits, back boxes and hook-up to all HVAC equipment including required fused or non-fused safety switches.
2. All boxes and conduit into accessible attic space for all thermostats and sensors. Coordinate with Mechanical Drawings for exact locations and requirements.
3. All contactors and relays shown on the Electrical Drawings only.
4. All conduit and back boxes for control wiring in all mechanical spaces to protect control wiring from damage. Conduit and back boxes to be required from 6" above each piece of equipment or control to a common 12" square NEMA 1 enclosure provided by Electrical Contractor and mounted directly above the EMCS / BMS controls in that space. Coordinate all required conduit paths with mechanical contractor before bidding and again before installing. Mechanical contractor to provide Electrical Contractor with conduit paths required for controls wiring on a drawing with adequate dimensions for bidding.
5. All other equipment and materials, including but not limited to, contactors and relays for mechanical equipment, motor starters (with heaters as required) / VFDs, thermostats, controls and wiring, etc. shall be provided by mechanical contractor.

3.04 CONTRACTOR COORDINATION - ELECTRICAL / PLUMBING (DIV 22)

A Electrical Contractor to provide the following:

1. All line voltage wiring, conduits, back boxes and hook-up to all plumbing equipment including required fused or non-fused safety switches.
2. All other equipment and materials, including but not limited to, contactors, relays, and switches required to control plumbing equipment, etc. shall be provided by plumbing contractor.

3.05 CONTRACTOR COORDINATION - ELECTRICAL / CONTROLS (DIV 23, 25)

A Electrical Contractor to provide the following:

1. All junction boxes (standard one or multi-gang) required for controls contractor. Coordinate with controls contractor for exact locations.
2. Various relays, devices, wiring and other equipment for control equipment as indicated or required per details on Electrical Drawings.
3. All other equipment and materials, including but not limited to, relays, hardware, software, sensors, and control wiring, etc. shall be provided by controls contractor.

3.06 INSTALLATION - OTHER WORK

A Cutting and Patching:

1. All cutting required by the installation of sleeves, conduit, equipment, etc., shall be coordinated with the General Contractor, but performed by this Contractor. Patching shall be by General Contractor. This Contractor shall not cut any structural element or any finished work without written permission from the Owner's Representative.

B Concrete Work:

1. This Contractor shall provide all forming, reinforcing and concrete as indicated or required for equipment bases, transformer pads, etc. Work shall conform to the applicable portion of Division 03 - Concrete.

C Trenching and Backfill:

1. This Contractor shall perform all trenching, excavation, shoring, pumping and backfill required in the installation of their work. All trenches shall be maintained dry until all circuits have been satisfactorily tested and then filled in tamped 6" layers immediately after approval of tests by the Owner's Representative. All backfill shall be free of construction debris and any other foreign material which might damage any circuit runs. Stability of backfilled soil shall match adjacent undisturbed soil.

D Flashing and Waterproofing:

1. All building penetrations to the outside shall be flashed and counter-flashed as required to eliminate leaks. Provide link-seal fitting on all below grade conduit penetrations greater than 2".

3.07 SYSTEM STARTUP

A All circuit and operational tests of the electrical systems shall be made by this Contractor and repeated until equipment meets or exceeds testing requirements and all electrical systems are operating properly.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A Selective demolition of electrical and lighting systems and equipment and the off-site removal of the portions of those systems and equipment not reused, in a code-compliant and lawful manner.

PART 2 - PRODUCTS

2.01 NOT APPLICABLE.

PART 3 - EXECUTION

3.01 ELECTRICAL EXAMINATION

A Verify existing field measurements, circuiting arrangements, wiring and equipment served in areas as shown on the Drawings. Adjust all circuiting, wiring and materials to be provided as required by job conditions.

B The Contractor accepts all existing conditions when beginning demolition, whether or not those conditions are reflected in the Contract Documents.

3.02 LIGHTING EXAMINATION

A Emergency interior and exterior lighting: If the unswitched phase conductor needed for proper operation does not exist, provide a new unswitched phase conductor to each luminaire as needed for proper operation. The unswitched phase conductor must come from the same branch circuit that powers the luminaire.

3.03 PREPARATION

A Provide temporary wiring and connections to maintain required existing systems that must remain operational during construction.

3.04 DEMOLITION OF EXISTING ELECTRICAL

A Where demolition of equipment or materials is required, this Contractor shall minimize cutting and exercise all due caution to leave undamaged surfaces, material and equipment meant to remain.

B Disconnect and remove all unused or abandoned wiring, devices, conduits, panels and distribution equipment back to source, unless otherwise specified in the drawings. Mark all unused breakers and fused switches as spares and turn them off.

C Mark all unused breakers and fused switches as spares and turn them off.

D When luminaires, receptacles, switches, conduits or similar are removed and the location is not reused, patch all unused floor, wall and ceiling back boxes, penetrations or similar openings to match the existing surfaces and maintain existing fire ratings.

3.05 EXTENSION / EDITING OF EXISTING ELECTRICAL

A Where existing circuits are edited or existing equipment is partially removed, extend / repair existing circuits to ensure all devices and equipment that are not intended to be removed remain in place and are fully operational.

B Install identification on all existing unmarked equipment to remain in accordance with Section 26 05 53 - Identification for Electrical Systems. Replace all lost nameplates, labels or markers.

3.06 RE-INSTALLATION

A Install all relocated materials and equipment under the provisions of Divisions 01 and 26.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A This section includes conductors for power circuits, including terminations and connectors.

1.02 SUBMITTALS

A Submittals required in this section shall conform to and be submitted in accordance with the General Conditions, Division 01, and Division 26.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Conductors shall be manufactured in the United States. Acceptable manufacturers are:
1. Alan Wire, Cerrowire, Encore Wire, General Cable, and Southwire

2.02 MATERIALS

A All feeders to be soft-drawn annealed copper.

B All branch circuit conductors shall be soft-drawn annealed copper.

C Aluminum is permissible ONLY where specifically indicated on the Drawings. Aluminum used shall be AA-8xxx rated and compact stranding is preferred.

2.03 MANUFACTURED UNITS

A Manufactured Power Circuit Conductors:
1. Conductors for shall be rated for at least 600 volts and 90°C. No exceptions.
2. Conductor insulation shall be type THHN / THWN-2 or XHHW-2.
3. Conductors shall be #12 AWG or larger.
4. Conductors that are #8 AWG and larger shall be stranded. Conductors that are #12 AWG and #10 AWG may be stranded if crimp on fork terminals are used for device terminations. Otherwise, #12 AWG and #10 AWG shall be solid conductors. Never place bare stranded conductors directly under device screws.

B MC Cable: Unless othewise noted on the Drawings, MC cable is allowed ONLY for luminaire whips. Total length not to exceed six (6) feet. MC cable must meet all requirements listed in this section including (but not limited to) separate full-size neutrals, conductor material, isolated ground, installation per NEC, etc.
1. Conductor Insulation: The insulation over the conductors shall be type THHN 90°C dry with an extruded polypropylene protective covering.
2. Armor: A zinc coated galvanized steel armor shall be applied over the cabled wire assembly with an interlock in compliance with UL 1569 Section 13. Armor shall be colored to identify the voltage and number of conductors.
3. Fittings: Fittings shall be listed and identified as MCI-A for such use with metal clad interlocking armor ground. Connectors shall be of steel or malleable iron and shall have saddle clamp to insure a tight termination of MC or MCI-A cable to box.

C Manufactured Conductor Terminations and Connectors:
1. All accessory materials such as connectors, splice and tap fittings, and terminations shall be of a type designed or intended and suitable for the use.

They shall be compatible with the conductor material. Both compression (crimp) and mechanical (screw set) connections are acceptable. Installation, compression, and torque settings shall be per manufacturer's recommendations.

2. Only connection devices that require the complete removal of the conductor jacket or insulation and result in a connection to the complete conductor surface area are suitable for use. Insulation piercing type connectors, press in type connectors or Wago style connectors shall NOT be used.

PART 3 - EXECUTION

3.01 INSTALLATION

A More than one conductor shall not be installed in any termination unless the termination is marked as suitable for more than one conductor.

B Wire Sizing: Provide conductors sized as indicated on Drawings unless modified as described below. Where conductor sizes have been omitted from Drawings, bid shall include conductors with ampacity as least as large as the overcurrent protection device protecting the conductors, or at least as large as the amp rating of the load being served, whichever is greater. In such cases, notify the Engineer before installation for size verification.

C Voltage Drop: The intent of the drawings is to limit the voltage drop from the service entrance conductors to each branch circuit to less than 5%. The electrician is responsible to ensure proper voltage drop values are maintained as mentioned here and as required per the NEC.

D Neutral Conductors: Provide a separate neutral conductor for each feeder or branch circuit. Multiple circuits shall not share a common neutral. Neutral conductors shall be sized as large as the phase conductors. Neutral conductors shall not be of a reduced size.

E Equipment Grounding Conductors: Provide equipment grounding conductors in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

F Number of Current Carrying Conductors (CCC) per conduit:

1. #12 Wire - no more than six (6) CCCs in a single conduit.
2. #10 Wire - no more than nine (9) CCCs in a single conduit.
3. ELSE - no more than three (3) CCCs in a single conduit.
4. When more than three (3) CCCs are in a single conduit, the electrician is responsible for derating the available ampacity to current carrying conductors per NEC requirements and provide calculations to the Engineer, when requested.

G Installation in Raceways:

1. All conductors shall be installed in a raceway.

H Terminations:

1. Use compression (crimp) or mechanical (screw set) type lugs or connectors for all terminations or splices of stranded conductors. See 26 05 26 Grounding and Bonding where themal welding may be used.
2. Use ring tongue type terminators on all control wiring.

3. Conductive antioxidant shall be applied on all connections per manufacturer's instructions, regardless of conductor material.

I Splices:

1. Where splices are required, they shall be in a box or enclosure. Splices within a conduit run are not acceptable.

J Color Coding:

1. Provide factory colored insulated conductors for #6 AWG and smaller.
2. If existing wiring in renovation or addition work has a consistent color coding, then match the existing and note in record documents. Otherwise, colors shall be as follows:

Line	208/120V	240/208V 1ph	240/120V	480/277V
A	Black	Black	Black	BROWN
B	Red	n/a	Orange	ORANGE
C	Blue	Red	Blue	Yellow
Neutral	White	White	White	Gray
Ground	Green	Green	Green	Green
Isol Grnd	Green +Yellow	Green + Yellow	Green + Yellow	Green + Yellow

K Identification: All conductors in a panelboard shall be identified by means of tags or tape.

L MC Cable: Where allowed, install MC cable to meet all NEC requirements.

1. Support: All MC cable shall be supported by dedicated J-cable hangers or cable tray. Where suspended from the ceiling or roof structure, use split-ring hangers or wrought-iron hanger rods.

3.02 SITE TESTS

A Perform in accordance with manufacturer's printed testing procedures, applicable industry standards, ANSI standards, IEEE standards, and NEMA standards. Provide calibrated testing equipment in good working order and which complies with the above requirements. The below test shall be performed after the conductors have been pulled into the conduit and after terminations have been added, but before final connections are made. Document all readings and testing and make documentation available to Owner upon request.

B Feeder Insulation Test: The insulation of new service entrance conductors and each new feeder run shall be tested using a megger. Readings must indicate not less than one (1) megohm to be acceptable.

C Branch Circuit Insulation Test: The insulation of each new branch circuit shall be tested using an ohm meter. Readings must indicate not less than one (1) megohm to be acceptable.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A Grounding and bonding shall include the solid grounding of the various electrical systems and equipment and the proper bonding of all electrical system components and equipment to meet NEC 250 and all other applicable NEC sections, codes, and ordinances. These systems shall be provided for the proper protection of life, equipment, circuits, and systems.

B Permanently ground entire lighting and power systems in accordance with the latest adopted version of the NEC, including service equipment, distribution, panelboards, switch and starter enclosures, motor frames, devices, transformers, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.

C Grounding and bonding requirements specified in this section may be supplemented in other sections of these Specifications.

1.02 COORDINATION

A On all additions and new construction, complete grounding and bonding of concrete encased electrode system (building reinforcing steel /rebar) to the satisfaction of the local AHJ prior to concrete placement.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A Apache Grounding, Copperweld, Inc., ILSCO Corporation, nVENT (Cadweld, Critec, Erico), Thermoweld, and Thomas & Betts (T&B)

2.02 PERFORMANCE REQUIREMENTS

A General:

1. All grounding and bonding shall be in strict accordance with NEC 250, 517, etc.

B Conductors:

1. Grounding Conductor: Copper, insulated (green) where required or uninsulated where allowed in the Specifications or by code, sized per drawings or NEC Table 250.66.
2. Bonding Jumpers - Insulated conductor, sized to be minimum cross-sectional area greater than or equal to that of the equivalent grounding conductor as determined from NEC Table 250.102.

C Connections:

1. General: All connectors shall be listed and labeled as grounding connectors for the materials used.
2. Welded Bond - Exothermic welded connection or bond such as "Cadweld". No phosphorous or any other caustic, toxic or explosive substance may be used.
    a. Provide exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

3. Clamps - Listed bronze connectors, suitable for grounding and bonding applications, in configurations required for a particular installation.

D Buss Bars:

1. Bare annealed copper bars, 1/4" x 4" x 20" unless otherwise noted on the drawings.

PART 3 - EXECUTION

3.01 APPLICATION

A Unless otherwise indicated, the below list of connection styles shall be followed.

B Outdoor Below Grade Grounding Connections:

1. Welded bond only, no exception.

C Outdoor Above Grade Grounding Connections:

1. Clamps may be used. Use welded bond where clamping is not accessible or practical.

D Indoor Grounding and Power Connections:

1. Clamps may be used. Use low-smoke/low emission welded bond where clamping is not accessible or practical.

3.02 INSTALLATION

A General:

1. Where the Drawings or Specifications exceed NEC requirements, then follow the Drawings or Specifications.
2. Bond all ground electrodes together to form the grounding electrode system including metal underground water pipe, metal frame of the building or structure, concrete encased electrodes, ground ring, rod and pipe electrodes and plate electrodes.
3. At all electrical system components, assemblies, circuits, etc. that are over 120v to ground, provide locknuts and / or listed fittings per NEC 250.97 for bonding of metal raceways. In case of oversized, concentric or eccentric knockouts, comply with NEC 250.92(B). The use of snap-in, wedge-type, or pivot-type connectors is prohibited.
4. Refer to Drawings for additional special grounding systems or grounding requirements not mentioned here.

B Concrete Encased Electrode:

1. Fabricate with twenty (20) feet (6m) of conductor laid lengthwise in excavation for foundation or footings. Install so conductor is within two (2) inches (50mm) of the bottom of the concrete. Where base of foundation is less than twenty (20) feet (6m) in length, coil excess conductor at base of foundation. Bond conductor to reinforcing steel at four (4) locations, minimum. Extend conductor below grade and connect to building grounding electrode.

C Equipment Grounding Conductor (EGC):

1. Comply with NEC 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.

2. All power circuits shall be provided with a separate copper insulated EGC run in the raceway with the power conductors. The conduit shall not be used as the sole means of grounding. The insulation of the EGC shall be green.
3. Bonding to the EGC shall be provided at each end of metallic conduit runs and at all boxes and enclosures.
4. Connect wiring device grounding terminal to outlet box with bonding jumper and branch circuit equipment grounding conductor.

D Grounding Busses:
1. Provide a copper buss bar where indicated on Drawings or in rooms containing any of the below list. Provide a #2 AWG insulated grounding electrode conductor from the grounding electrode system to each grounding buss.
2. Provide in each IDF and MDF room.
3. Provide at each CATV / MATV head-end mounting board.
4. Provide at each building communications rack.
5. Provide at each sound reinforcement equipment rack.

E Lightning Protection System:
1. Bond grounding conductors or grounding conductor conduits to lightning protection down conductors or grounding conductors in compliance with NFPA 780.
2. Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system ground conductor and installed in conduit.

F Other Grounding Systems:
1. Other buildings served from common service:
   a. The main building service is the source for electric service.
   b. Bond grounding conductor of building main feeder to grounding electrode system.

3.03 CONNECTIONS

A General:
1. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
2. Aluminum to steel connections shall be with stainless steel separators and mechanical clamps. Aluminum to galvanized steel connections will be with tin-plated copper jumpers and mechanical clamps.
3. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.

B Exothermic Welded Connections:
1. Use for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and plate electrodes.

Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

2. Terminate insulated EGCs for feeders and branch circuits with pressure-type grounding lugs. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to the housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to the ground buss in the housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushing and bare grounding conductors.

C Compression Type Connections:

1. Use hydraulic compression tools to provide the correct circumferential pressure for compression connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.

D Moisture Protection:

1. Where insulated ground conductors are connected to ground rods or ground busses, insulate the entire area of the connection and seal against moisture penetration of the insulation and cable.

3.04 SITE TESTING

A Testing:

1. Test the electrical system after installation is complete. Inspect and test for stray currents, unintended ground shorts, and proper physical condition of grounding system. Correct any deficiencies and re-test to verify satisfactory installation.
2. Document all readings and testing and make documentation available to Owner upon request.
3. Perform ground resistance and continuity testing in accordance with IEEE 142.
4. Perform leakage current tests in accordance with NFPA 99.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A Provide all raceway and conduits, outlet boxes, pull and splice boxes, floor boxes, poke-thru boxes, wireways, gutters, and associated fittings as indicated on the Drawings and as required for feeders, branch circuits, splices, taps, equipment connections, and for compliance with regulatory requirements. All locations shown on the Drawings are approximate unless dimensioned.

B Provide complete, separate conduit systems for all electrical systems on this project to include, but not limited to service entrance, feeders, branch circuit, control wiring furnished by this contractor, emergency and standby power and lighting circuits, critical power, communication systems, and other electrical systems as required.

C Provide outlet wiring boxes of the type, shape and size, including depth of box, to suit each respective location and installation; constructed with knockouts or threaded hubs in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Provide outlets as shown, as required and per NEC.

1.02 DESIGN REQUIREMENTS

A Boxes and fittings shall be made of the same material as the conduit material they are installed with, unless modified below or otherwise noted on the Drawings.

1.03 SUBMITTALS

A Submit on all conduit, raceways, pull boxes, back boxes, hand holes, cover plates, extension rings, fittings, labeling, and supports for conduits inside and on roof.

1.04 COORDINATION

A Coordinate mounting heights, orientation and locations of back boxes for outlets mounted above counters, benches, back splashes, etc.

B Conduit systems shall not be covered or otherwise concealed until review has been made and approvals obtained from the AHJ.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A Raceways, Wireways, Gutters and Conduits: Aflex, Atkore (AFC, Allied, FRE, Power Strut, TJ Cope), American Conduit, Calbond, Cantex, Carlon, Champion, Hoffman, Hubbell, KorKap, Nepco, Nucor, Omega, Plasti-Bond, Perma-Cote, Pittsburgh, Sedco, Spang, Square-D, Thomas & Betts, Western Tube and Wheatland, Walker and Wiremold.

B Surface-mount Raceways: Hubbell, Mono-Systems, Panduit, Tehalit and Wiremold.

C Boxes and Fittings: Appleton, Atkore (AFC, Allied, Power Strut, TJ Cope), Cantex, Eaton, ECN Korns, Hoffman, Hubbell, Keystone, Lew, Madison, nVent Caddy, Orbit Industries, Quazite, Raco, Regal, Stahlin, Steel City, Thomas & Betts and Walker.

D Others: Where specifically listed on Drawings.

2.02 GENERAL PERFORMANCE REQUIREMENTS

A Minimum conduit / raceway size shall be 1/2" for all circuits. and 3/4" except for in walls for receptacles and switch leg circuits, which may be 1/2".
B Fittings shall be threaded or compression type. Set screw or bolt-on fittings are NOT acceptable.
C All fittings shall have an insulated throat bushing, no exceptions.
D See Section 26 05 19 - Low Voltage Conductors for information on where MC cable is allowed.
E Aluminum conduit shall not be installed in direct contact with concrete or masonry construction.

2.03 RIGID METAL CONDUIT - STEEL (RMC)(IMC) - PER ANSI C80

A Steel: Hot-dipped galvanized rigid steel (GRC) and galvanized intermediate metallic conduit (IMC) with zinc-coated threads and an outer coating of zinc chromate.
B Fittings: Per NEMA FB 1.
1. Malleable iron, either cadmium plated or hot-dipped galvanized. Die cast zinc.
2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required.

2.04 RIGID METAL CONDUIT - ALUMINUM (RAC) - PER ANSI C80

A Aluminum: Rigid aluminum conduit shall be threaded only.
B Fittings: Per NEMA FB 1
1. Aluminum fittings required.
2. Use deflection and expansion couplings with bonding jumpers at all expansion joints where required.

2.05 PVC COATED RIGID METAL CONDUIT - NEMA RN 1

A Steel: Galvanized rigid steel conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6 and ETL PVC-001.
B Fittings: Per NEMA FB 1.
1. Malleable iron or steel, PVC coated (40 mils) exterior, urethane coated (2 mils) interior.
2. Use fittings listed and labeled as complying with UL 514B.
C Conditions: The installer shall be certified by a manufacturer to install coated conduit.

2.06 ELECTRICAL METALLIC TUBING (EMT) - ANSI C80.3

A Galvanized thin wall steel or aluminum tubing.
B Fittings: Per NEMA FB 1.
1. Die cast zinc, pressure cast, malleable iron or steel. Clamps shall be steel. Where aluminum tubing is allowed, aluminum fittings are required unless otherwise noted.

2.07 RIGID NONMETALLIC CONDUIT (RNC)

A PVC: Schedule 40 PVC, NEMA TC 2, high impact resistant.
B RTRC: Fiberglass, NEMA TC 14, standard wall.
C Fittings: Per NEMA TC 3 & 14, solvent weld socket type.
D Conditions: Do NOT use PVC for elbows in sizes 1-1/2" and larger.

2.08 FLEXIBLE METAL CONDUIT (FMC)

A Steel: Spiral-wound, square interlocked, hot-dipped galvanized steel.

B Aluminum: Spiral-wound, square interlocked aluminum.

C Fittings: Per NEMA FB 1.

1. Cadmium plated two-screw, double-clamp malleable iron. Hot-dipped galvanized two-screw, double-clamp malleable iron. Pressure cast. Steel cast. Zinc coated, aluminum.

2.09 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFC)

A Steel: Spiral-wound, square interlocked, hot-dipped galvanized steel strip with a bonded outer jacket of PVC.

B Fittings: Per NEMA FB 1.

1. Cadmium plated, compression type, malleable iron. Hot-dipped galvanized, compression type, malleable iron. Terminations shall be insulated throat type.
2. Aluminum: Copper free (1% or less).

2.10 WIREWAYS / GUTTERS

A Steel: Not less than 16-gauge sheet steel. Size and length shall be as indicated on drawings. Otherwise, provide dimensions per NEC 366 and NEC 376, but never smaller than four (4) inches by four (4) inches. Construction shall be oil-tight, dust-tight and rain-tight with hinged fully gasketed cover. Finish shall be ANSI gray epoxy paint over rust-inhibiting prime coat.

2.11 GENERAL OUTLET / BACK BOX / JUNCTION BOX

A All boxes shall meet NEMA OS 1 (metallic) and NEMA OS 2 (nonmetallic).

B Cast Boxes: NEMA FB 1, Type FS or FD malleable iron or aluminum. Furnish gasketed cover by box manufacturer and provide threaded hubs.

C Floor-mounted Back Boxes: Shall be adjustable and gasketed.

D Outlet and Pull Boxes: Single or ganged back boxes.

1. Interior: Standard box shall be 2-1/8" deep or better. Use 3-1/2" deep boxes as needed and 1-1/2" shallow boxes as required for wall depth.
2. Exterior: Standard box shall be 3-1/2" deep NEMA 3R or better.
3. In Ground or Concrete: NEMA 4 cast iron box with external recessed flanged cover. Depth as required.

E Box Ganging: Gang type boxes shall be used where multiple devices are located adjacent to one another, including ceiling, wall and cast in floor boxes.

F Box Barriers: In boxes with multiple switches, where the voltage between adjacent switches exceeds 150 volts to ground, provide an enclosure equipped with identified, securely installed barriers between adjacent devices.

2.12 PULL / SPLICE BOXES AND HAND HOLES

A Surface Mounted Cast Metal Box: NEMA 250, Cast aluminum with ground flange, neoprene gasket and stainless steel cover screws.

B In-Ground Cast Box: NEMA 250, Type 6, cast aluminum, concrete or fiberglass with flanged (smooth/nonskid) cover, recessed cover box for flush mounting.

C Handholes: Fiberglass with weatherproof nonskid cover with pre-cut 6 inch x 6 inch (150 mm x 150 mm) cable entrance at center bottom of each side.

2.13 ROOFTOP CONDUIT SUPPORTS

A Supports shall be adjustable height. Metal parts to be stainless steel or galvanized steel.

B Approved Products:

1. Miro Industries model #24-R-AH, 48-R-AH, 24AH and 48AH.
2. PHP Systems model #PP10.

PART 3 - EXECUTION

3.01 PREPARATION

A Place conduit sleeves in the cavities of walls and floor slabs for the free passage of conduits.

B Apply caulking for all conduit sleeves through floors and through exterior walls.

3.02 GENERAL INSTALLATION

A The Drawings indicate an approximate location of boxes for switches, lighting outlets, power outlets, raceways, etc. The Drawings may not give complete and accurate information in regard to locations of such items. The exact locations shall be determined by reference to the Drawings and by actual measurements during construction of the building, subject to approval by the Owner's Representative.

B The Owner's Representative reserves the right to adjust locations of raceway and boxes up to six (6) feet in any direction prior to rough-in to accommodate intended purpose at no additional cost.

C All installations shall meet NEC requirements for acceptable fill ratings and conductor derating. NO exceptions. Listed partitions are acceptible in gutters or similar for proper partitioning.

3.03 CONDUIT, RACEWAY, FITTING AND BOX APPLICATION

A General Application:

1. Conduit Sleeves: Provide RMC sleeves at all locations where conduits pass through beams, outside walls, fire rated walls, or structural members. The size of these sleeves shall be such as to permit readily the subsequent insertion of conduit of the proper size with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, the inside diameter of each pipe sleeve shall be at least 1/2" greater than the outside diameter of the service pipe. After the conduits are installed, fill the annular space between the conduit and its sleeve with a mastic or caulk. Use packing as required to accomplish this. At fire rated wall penetrations, use fire barrier.
2. Surface-mount Raceway: Not permitted except as noted on the Drawings or in locations where concealing conduit is not possible.
3. Branch Circuits: Shall not be installed in or under the ground floor slab unless specifically required on the Drawings or pre-approved by the EOR. No exceptions.

B Underground / In-ground:

1. Acceptable Conduit: RMC, PVC, and Fiberglass.

2. Fittings: All elbows shall be long sweep galvanized steel or fiberglass, no PVC. Other fittings shall match the conduit material.
3. Boxes: Shall be cast metal, concrete or fiberglass. Shall be ANSI 77 traffic rated for the location.
    a. Street / Drive: Vehicle Tier 22 rated.
    b. Sidewalk: Personnel or vehicle Tier 8 rated.
    c. Grass: Personnel Light Duty rated.
4. Conditions: Conduit risers from elbow to above grade shall be RMC.

C Imbedded in / Passing through concrete:
1. Acceptable Conduit: RMC, PVC, and Fiberglass.
2. Fittings: All elbows shall be long sweep galvanized steel or fiberglass, no PVC. Other fittings shall match the conduit material.
3. Masonry Boxes: Galvanized steel masonry rated box.
4. Conditions:
    a. PVC allowed in concrete filled storm shelter walls or where required by utility provider.
    b. Where allowed, conduit imbedded in concrete shall not be larger than 3/4". Verify with project Structural Engineer prior to placing.

D Crawlspace:
1. Acceptable Conduit: PVC.
2. Fittings: Shall match the conduit material.
3. Boxes: Shall match the conduit material.

E Wet and Damp Locations:
1. Acceptable Conduit: RMC.
2. Fittings: Shall be rated for the space and shall match the material of the conduit they are installed with.
3. Boxes: Recessed shall match conduit material. Surface-mount shall be stainless steel.

F Concealed / Exposed Dry Locations:
1. Acceptable Conduit - EMT.
2. Fittings: Shall match the conduit material.
3. Boxes: Malleable iron or cast aluminum (type FS / FD), with threaded hubs and gasketed covers.
4. Conditions: Do not use aluminum in cinder-fill walls.

G Existing Walls:
1. Acceptable Conduit:
    a. Concealed: FMC and EMT.
    b. Surface-Mount: Surface-Mount Raceway and EMT.
2. Fittings: Shall match the conduit material.
3. Conditions: Surface-mount raceway shall be used in finished spaces. EMT may be used only in unfinished spaces, unless otherwise directed on the Drawings.

H Indoor Equipment Connections:

1. Acceptable Conduit: FMC and LFC (Liquid-Tight FMC).
2. Fittings: Shall match the conduit material.
3. Boxes: Shall match the conduit material.
4. Conditions:
    a. Where FMC or FNC are used, total length not to exceed 72" above ceiling, 48" exposed below ceiling.
    b. In kitchen or similar spaces, use LFC unless otherwise directed on the Drawings.
    c. Install flexible conduit to all recessed luminaires in accessible ceilings. Do not use more than four (4) flexible metal conduits per junction box to supply luminaires in a location. Do not supply a luminaire from another with any raceway or FMC. Suspend junction boxes and conduits from high roofs with hangers and trapeze.

I Outdoor Above Grade:
1. Acceptable Conduit: RMC.
2. Fittings: Shall match the conduit material.
3. Boxes: Weatherproof cast steel or cast aluminum.
4. Conditions: Conduits may be used on a roof ONLY where indicated on the Drawings and shall be supported per the Specifications.

J Outdoor Equipment Connections:
1. Acceptable Conduit: LFC (Liquid-Tight FMC).
2. Fittings: Shall be rated for the space or environment.
3. Boxes: Shall be rated for the space or environment.
4. Conditions: Flexible conduit types shall not exceed 72" in length.

K Corrosive Environments:
1. Acceptable Conduit: PVC and LFNC.
2. Fittings & Boxes: Shall be rated for the space or environment.
3. Conditions: Flexible conduit for equipment connections only unless otherwise noted on the Drawings.

L Hazardous Locations:
1. Acceptable Conduit: RMC.
2. Conditions: All conduit, boxes, fittings, hardware, etc. shall be rated for hazardous location.

M Passing Through a Firewall:
1. Acceptable Conduit: EMT and RMC.
2. Conditions: Provide fire caulking at all penetrations.

3.04 CONDUIT, RACEWAY, FITTING AND BOX APPLICATION

A General:
1. Unless otherwise indicated on the Drawings, conduits shall be concealed in walls, partitions and above the ceiling. In rooms where ceilings are not present or scheduled, orient conduit parallel or perpendicular to structure.

2. Conduits shall be continuous between enclosures such as outlet, junction and pull boxes, panels, cabinets, motor control centers, etc. The conduit must enter and be secured to enclosures so that each system is electrically continuous throughout. Where knockouts are used, provide double locknuts, one on each side. At conduit terminations, provide insulated throat fittings. Where conduits terminate in equipment having a ground buss, such as in switchgear, and panelboards, provide conduit with an insulated grounding bushing.
3. Capping
    a. Cap open ends of raceways until conductors are installed to prevent ingress of dirt and moisture.
    b. Cap or close ends and unused openings in wireways and gutters.
4. Sealing
    a. Seal both ends of all conduits that serve as a passageway for control wiring, data, etc. through a rated wall to prevent air / gasses / contaminates from moving from one space to another.
    b. Seal both ends of underground conduits as required to prevent ingress of water and other contaminates from outside.
    c. All Sealant shall be fire caulk, putty packs, etc. to maintain the rating of the wall.
5. Provide insulated ground wire in all PVC conduit and extend to ground buss.
6. Moisture traps: Provide junction box with drain fitting at low points in conduit system to avoid moisture traps.
7. Use expansion-deflection fittings on conduits two (2) inches and larger crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems. Provide fittings to accommodate expansion and deflection where raceway crosses seismic, control and expansion joints.

B Support:

1. Install conduits parallel and supported on unistrut or equal trapezes and anchored with split ring hangers, conduit straps or other devices specifically designed for the purpose. Wire ties are not permitted. Do not attach raceway to ceiling support wires or other piping systems.
2. Securely fasten and support all conduit runs. Provide required clamps, straps, clips, hangers and brackets. Raceways installed in joists shall be secured to joists with clamps at 20'-0" maximum spacing. Raceways installed parallel to joists shall be supported by caddy clips (1 inch or smaller) or in unistrut / threaded rods / beam clamps trapeze at 15'-0" centers. Raceways installed perpendicular to bottom of joists shall be secured with individual conduit hangers at 10'-0" maximum spacing or unistrut / threaded rods / beam clamps at 15'-0" maximum centers. Raceways supported by straps at walls shall be supported per NEC. Support all raceways within one (1) foot of each box, cabinet, disconnect, bend or other raceway termination.

3. Raceways shall be supported with 2-hole straps. Single hole straps are not acceptable.
4. Support raceway using coated steel or malleable iron straps, clevis hangers, and split hangers.
5. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports.

C Raceway Spacing:
1. Maintain twelve (12) inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104°F (40°C). (Excluding roof mounted conduits.)

D Raceway Bends:
1. Make bends with standard ells or conduit bent in accordance with the NEC.

E Concealed Locations:
1. Install concealed conduit as directly and with the largest radius bends as possible. Conceal conduit in finished areas.

F Pull String:
1. Provide a Greenlee #431 or equal (240 lbs.) nylon pulling line in all conduits that are to be used as spares and all conduits used by other divisions, such as controls, communications, and similar systems. Identify both ends of the line by means of labels or tags reading "Pulling Line".

G Fire Rated Walls:
1. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to comply with the latest applicable edition of the UL Fire Resistance Directory, Volumes I and II.

H Rooftop Installation:
1. RMC installed on the roof shall be securely fastened in place and supported on approved supports at least every ten (10) feet. Additionally, conduit shall be securely fastened and supported within three (3) feet of each outlet box, junction box, device box, cabinet, conduit body, or other conduit termination.
2. LFC on the roof shall be securely fastened in place by an approved means within twelve (12) inches of each box, cabinet, conduit body, or other conduit termination, and shall be supported and secured at intervals not to exceed 4.5 feet. Flexible conduit shall not lay on roof.

I Raceway Assemblies:
1. Bring conduit to shoulder of fittings; fasten securely.
2. Provide conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

J Surface Raceway:
1. Provide flat-head screws, clips, and straps to fasten raceway channel to surfaces. Mount plumb and level.
2. Provide insulating bushings and inserts at connections to outlets and corner fittings.

3. Serve surface-mount raceways from flush outlet boxes mounted behind raceway where possible and as directed.

3.05 WIREWAY AND GUTTER INSTALLATION

A Install wireways and surface raceways where noted or as required. Field apply a 90% grey zinc paint coating over cuts or scratches before any other finish is applied.

3.06 BACK BOXES, OUTLETS AND FITTINGS APPLICATION

A Back Boxes: Sizes and configuration shall be as required for the intended service and shall conform to and be applied in accordance with NEC Table 314.16(A). Provide extension rings, expandable bars sets, supports, gaskets for weatherproof type etc., where required.

B Ceiling-mounted Boxes: Provide supports and attachments to properly support ceiling and bracket-type devices or luminaires. Where the box shall support the device, the box shall be rated for the weight of the device / luminaire supported.

C Voice & Data Outlet: Provide back boxes at each voice and data outlet. Communications wiring, device and plate to be provided by communications Contractor. See Divisions 27 and 28 for additional requirements.

3.07 BACK BOXES, OUTLETS AND FITTINGS INSTALLATION

A Do not connect or install outlet boxes back-to-back.

B Unless otherwise shown or specified, install boxes for switches at 44" and receptacles at 18" AFF. Verify door swings with Drawings and schedules and locate switches and pull stations on the strike side of the door unless otherwise noted.

C Where back boxes are required for switches, receptacles, data jacks, thermostats, CO_2 sensors, etc. and are shown next to each other, all devices shall be installed at the same height and, where possible, provide a gang back box and cover them with a multi-gang cover plate.

D Protect boxes in such a manner as to prevent foreign material, such as plaster, from entering boxes. Boxes shall be thoroughly cleaned of foreign materials before pulling conductors.

E Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

F Accessible Ceilings: Install outlet and junction boxes no more than six (6) inches (150 mm) from ceiling access panel or from removable recessed luminaire. Provide suitable access doors for all boxes mounted above gypsum / hard or otherwise inaccessible ceilings.

G Do not fasten boxes to ceiling support wires or other piping systems.

H Support boxes independently of conduit.

I Install gang box where more than one device is mounted together. Do not use sectional box.

J Provide plaster rings for all boxes in plastered walls and ceilings.

K At all ceiling-mounted receptacle and luminaire locations (exit light, pendants, linear direct / indirect, etc.), provide a heavy-duty dual bar hanger with ceiling ties to

support the back box. Provide Cooper Industries BA50F or approved equal with appropriate back box for the application.

L Outlet Boxes adjacent to studs may be supported to stud using a CV style mounting bracket as long as they are mechanically fastened to joist or stud using at least two mechanical fasteners and each shall have metal far-side box supports (Morris 18350, Orbit ABS-6, Caddy 766A or approved equal). Any outlet box not mounted adjacent to a joist / stud shall be supported by both adjacent joists / studs using a mounting bracket that stretches the entire length between the joists /studs and is mechanically fastened to joists / studs at both ends.

M Plates shall cover any cracks between box and tile. Use oversize plates where necessary.

3.08 FLUSH BOXES

A Mount all outlet boxes such that finished installation with mud ring is within 1/4 inch of the finished wall or ceiling line unless otherwise indicated. Provide knockout closures to cap unused knock out holes where knock out holes have been removed. Install outlets flush with finish walls or ceiling surfaces for concealed wiring.

B Provide galvanized steel extension rings where required to extend the box forward in conformance to NEC requirements. Attach ring with at least two machine screws. Install electrical boxes and fittings in compliance with NEC requirements and in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that the boxes and fittings serve the intended purposes. Under no circumstances shall a conduit enter/exit an extension ring. Conduits shall enter / exit the electrical box only.

C Locate boxes and conduit bodies to ensure accessibility of electrical wiring. Install blank cover plates, painted to match surrounding, at pull boxes, junction boxes and all others to which no luminaire or device is to be attached.

3.09 INTERFACE WITH OTHER PRODUCTS

A Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00 - Firestopping.

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

3.10 ADJUSTING

A Adjust flush-mounting outlets to make front flush with finished wall material.

B Install knockout closures in unused openings in boxes.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A All identification for electrical equipment and systems that is required by code or ordinance shall be provided, whether or not shown on Drawings or specified herein.

1.02 SUBMITTALS

A Submit Electrical Identification schedule including list of wording, symbols, letter size, color coding, tag number, location, and function.

PART 2 - PRODUCTS

2.01 MATERIALS

A General Requirements:
1. All means of identification referenced in this section shall be of sufficient durability to withstand the environment per NEC 110.21. Where plastic is used outdoors, it shall be UV rated or treated.
2. Lettering shall be Arial font and colors shall conform to FS L-P-387.
3. Thickness for signs and engraved labels shall be 1/16" thick minimum.

B Signs: For identifying multiple electrical services.
1. Provide Aluminum OUTDOORS and provide Plastic INDOORS.
2. Appearance: White with black lettering, lettering to be 1/4" tall minimum.

C Equipment Labels: For panelboards, switchboards, switchgear, disconnects, equipment, etc.
1. Provide UV rated engravable plastic (L-P-387) OUTDOORS and Engravable plastic (L-P-387) INDOORS.
2. Appearance: Lettering shall be 1/4" tall minimum that is White with black lettering for Non-Emerency and Red with Black lettering for Emergency

D Electrical Safety Labels: For fault current and arc flash labelling.
1. Inside building or enclosure to be self-adhesive vinyl.
2. Appearance: Color, layout and dimensions per city requirement. In the absence of any city requirement, use industry standard colors and layout.

E Marker Labels / Sleeves: For circuit identification and other labelling.
1. Marker Label - 2" or wider write-on marker label with white writing portion and clear laminating portion for protection.
2. Marker Sleeves - 2" or wider sleeve colored to identify electrical systems per requirements in Part 3.

F Wire Markers: For circuit or voltage identification.
1. Conductor Marking: Electrical tape.
2. Circuit Marking: Tubing type, cloth tape, split sleeve.
3. Appearance: Colors to match requirements in Part 3.

G Underground Warning Tape:
1. Four (4) inch wide plastic tape.

2. Appearance: Colored red and yellow with suitable warning legend describing buried electrical lines.

H Mechanical Fasteners: Stainless steel screws, non-corroding pop rivets.

PART 3 - EXECUTION

3.01 PREPARATION

A Coordinate with the Owner's Representative to obtain a list of the finalized owner's room number list before ordering identification tags.

B Degrease and clean surfaces to receive adhesive for identification materials.

3.02 APPLICATION OF EQUIPMENT LABELLING

A Main Service Disconnecting Means:

1. Mark the label on the main service disconnecting means with the calculated fault current listed on the panel schedule along with the issue date of the Drawings per NEC 110.24(A). The calculated fault current shall be labelled "Maximum Fault Current" and the date shall be labelled "Date Calculations Performed". Use the seal date on the drawings for the date field.
2. Provide a sign at each service at each structure per NEC 230.2(E).

B Panelboards, Switchboards, Switchgear:

1. Circuit directory shall be frame mounted inside the door with heat-resistant transparent face and a directory card that is type written and completely filled out.
2. Circuit directory shall coordinate each breaker with the proper load served. Each circuit shall be uniquely identifiable per NEC 408.4(A) including room numbers. Room numbers shall be as directed by Owner.
3. Circuit directory shall indicate all spares and spaces in erasable pencil.
4. Equipment Label shall indicate the high leg per NEC 408.3.

C Instantaneous Fault Current (AIC): Electrician to field-mark the equipment labels with the calculated instantaneous fault current (as shown on panel boards) per NEC 110.24(A) and use the issue date of the drawings as the calculation date.

D When series rated panels are specifically allowed, provide a label affixed by the manufacturer indicating the tested and approved series rating combinations per NEC 240.86. Provide an additional label affixed behind the panel door to be field marked in accordance with NEC 110.22(C).

3.03 INSTALLATION OF EQUIPMENT IDENTIFICATION

A General:

1. Install all labels in an easily visible location and parallel to equipment lines.
2. Provide signs and tags for equipment requiring identification as shown on Drawings and for equipment as required by the NEC.
3. All signs and tags to be mechanically fastened. Double-sided tape or other fastening methods are not acceptable.
4. Provide for each main disconnect not grouped together.
5. Install signs on outside of cover for safety switches and time clocks.

6. Install signs on outside top, not on door, and at each circuit for panelboards, switchboards and motor control centers.
7. All labeling identification shall contain both the owner's and architect's room names and numbers. Coordinate with General Contractor to secure construction room numbers.
8. Provide all additional signage required by the AHJ at no cost to the Owner.

B Conduit Identification:

1. Underground Conduits
   a. All primary and secondary service conduits and all other underground conduits (2" and larger) shall be identified using Underground Warning Tape located no more than 12" below finished grade and run the entire length of all underground conduits.
2. When any of the below systems are required to be run in conduits (per Drawings, Div. 27, Div. 28, AHJ or Owner Requirements), conduits shall be colored with painted band, marker labels or marker sleeves every ten feet (10') maximum and at back box locations using paint or marker labels. All colors shall be by system per the below list:
   a. Fire Alarm System: Red
   b. Voice / Data cabling: Blue
   c. Security System: Green
   d. Intercom, A/V, etc. (Media Mgmt.): Yellow
   e. CATV / MATV: Black
   f. Lighting Controls: Orange

C Back Box Cover Identification:

1. When any of the below systems are required to be run in conduits (per Drawings, Div. 27, Div. 28, AHJ or Owner Requirements), identify the back box covers per system. by painting the entire cover or by using marker labels. Marker labels not acceptable for back box covers for Fire Alarm. See below for colors.
2. Cover Identification: Paint the entire cover or use marker labels. Marker labels not acceptable for back box covers for Fire Alarm. See below for colors.
3. Back Box Cover Information: Label the back box with the source panel and circuiting using Marker Labels or Sharpie. Label as "Future Use" if there are no conductors pulled.
4. Back Box Cover Color:
   a. Fire Alarm System: Red
   b. Voice / Data cabling: Blue
   c. Security System: Green
   d. Intercom, A/V, etc. (Media Mgmt.): Yellow
   e. CATV / MATV: Black
   f. Lighting Controls: Orange
   g. Other (unless otherwise specified herein): White

D Electrical Distribution Nameplates:

1. Application: Panelboards, Switchboards, Switchgear, Transformers, MCCs, etc.
2. Identification: Sign or Equipment Label with mechanical fasteners, per NEC 408.4(B).
3. Information shall include (Example in parenthesis):
    a. Panel designation (CHAC).
    b. Voltage, phase and wires (277/480v 3ph 4w).
    c. Source of service (Fed from MSB).

E Electrical Equipment Nameplates:

1. Application: Safety switches, disconnects for HVAC, motors, time clocks, water heaters, etc. and enclosure for controls, relays, contactors, solenoids, other electrical assemblies.
2. Identification: Sign or Equipment Label with mechanical fasteners.
3. Information shall include (Example in parenthesis):
    a. Load served (A/H #C206) or (Parking Lot Lighting).
    b. Voltage and phase (480v 3ph).
    c. Circuits used (CHAC-15,17,19).

END OF SECTION

SECTION 26 20 00
LOW VOLTAGE ELECTRICAL DISTRIBUTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A Electrical service including underground primary requirements, transformer and secondary enclosure requirements, overhead and underground service entrance requirements, metering, and final connections.

B Provide and install all components of the low voltage distribution system(s) including all switchboards, panelboards, transformers, fuses, circuit breakers, disconnects, MCCs, etc. as shown on the Drawings and as required for a complete and working system. All equipment shall be sized to meet the latest adopted version of NEC 220 requirements as a minimum.

1.02 COORDINATION

A Prior to ordering disconnects and fuses or fuse holders, coordinate fuse ratings with the Mechanical Contractor to verify that fuses for all mechanical equipment matches the Maximum Over-Current Protection (MOCP) values of the mechanical equipment being provided. This Contractor to adjust upstream breaker sizes, branch circuit conductor sizes, whip sizes and disconnect sizes to accommodate the fuse (Over-Current Protection Device, OCPD) requirements for the supplied equipment.

1.03 SUBMITTALS

A Provide scaled shop drawings for each electrical equipment room showing the placement of all panelboards, transformers, and other equipment such as mechanical equipment, drawn to scale and dimensioned. Such shop drawings will be reviewed for compliance with the intent of the Drawings and the spaces available for all electrical equipment.

B Clearly indicate on the submittals whether equipment is fully-rated or series-rated and arrange the submittals in order the panelboards appear on the Drawings.

C Include the following parameters as applicable in the submittal: equipment name, description, voltage, phase, ampacity, kVA rating, K-rating, control voltage, impedance, etc.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A All panelboards, switchboards, disconnects, OCPDs, etc. shall be from the same manufacturer to ensure proper breaker coordination.

B All equipment on this project shall be new. Refurbished or used equipment will not be acceptable.

C Approved Manufacturers: ABB (formerly GE), ACT Communications, Asco, Bussman, Eaton (Cutler Hammer), Hammond Power Solutions, Industrial Electric Manufacturing (IEM), Jefferson, Littlefuse, Mersen (Ferraz Shawmut), MGM Transformer, Mirus International, Powersmith, Siemens, Square-D, and States Manufacturing.

D All other manufacturers shall require pre-approval in accordance with Section 26 00 00 - Electrical.

2.02 GENERAL REQUIREMENTS

A Unless specifically noted otherwise on the Drawings, all equipment in these Specifications shall meet the the requirements outlined below.

B Conductor material for switchboards, panelboards, disconnects, etc. shall be copper.

C Unless otherwise indicated on the Drawings, provide the following enclosures for all panelboards, switchboards, switchgear, disconnects, transformers, etc.:

1. NEMA 1 - All equipment located in interior dry locations.
2. NEMA 3R - All equipment located in damp, wet or exterior locations.
3. NEMA 4X - All equipment located in corrosive environments.

D All panelboards, switchboards, disconnects, etc. shall have weatherproof threaded hubs for top / bottom / side conduit entries.

E All equipment shall have a factory applied gray finish applied over a rust inhibiting treatment. Any items which have the finish marred shall be touched up or refinished to like new condition before final acceptance. This shall include, but shall not be limited to, sanding and properly removing rust or other contaminants and completely repainting equipment if damage is extensive. Overall acceptance is subject to approval of the Owner's Representative.

F Provide all labeling / identification per Section 26 05 53 - Identification of Electrical Systems.

G Provide, at each main switchboard and all downstream distribution, a complete (time-current) coordination study and an arc flash study with all required labels. Contractor may use the equipment manufacturer to provide both the required studies and the required labels. Contractor to adjust all settings for electronic-trip circuit breakers. See Section 26 05 73 - Power System Studies for more details.

2.03 PANELBOARD / SWITCHBOARD COMMON REQUIREMENTS

A Construction: NEMA PB 1, UL 67, interiors shall be completely factory assembled. See General Requirements above for NEMA enclosure rating requirements.

B Enclosure Properties: Door in door construction, standard conduit knockouts in ends and sides of cabinet. Provide flush type combination catch and key door locks on all panelboards and load centers. Key all locks alike, provide two keys with each panelboard.

C Bus Information:

1. Ground Bus: Full length, 25% phase rated, bonded to each bus, additional isolated bus in computer and communication panels.
2. Neutral Bus: Full length
   a. 200% of phase rated for all non-linear, computer or isolated ground (IG) panels.
   b. 100% of phase rated for all lighting and power panels.

D OCPDs: Provide bolt-on circuit breakers unless otherwise indicated on the Drawings.

E Fault Withstandability: Suitable for operation and able to withstand the symmetrical short circuit current as indicated on the Drawings or available at the location, whichever is larger.

F Spaces: Install all allotted or indicated spaces so that future OCPDs can be added without additional machining, drilling, tapping or bus extensions.

G Circuit Identification:

1. Frame-mounted directory with a heat-resistant transparent face for identifying circuits. Mount inside the panelboard door. Use equipment names as reflected by panelboard schedules on the Drawings. Use room names and numbers selected by the Owner's Representative, which may differ from those shown on Drawings.
2. Provide on all new and revised existing panelboards per Division 26 with new information. See Section 26 05 53 - Identification for Electrical Systems for more information.

H Features and Accessories:

1. Provide metering and instrumentation per Section 26 09 13 - Electrical Power Monitoring and per Division 23 Energy Management Control System requirements.
2. Provide GFCI and GFPE protection as indicated here, as shown on the Drawings and where required per NEC.
3. Provide SPDs at each main switchgear per Section 26 43 00 - Surge Protective Devices.

2.04 PANELBOARDS

A Construction:

1. Flush-mounted panelboards: Trims shall fasten to permit both horizontal and vertical adjustment. Provide barriers per NEC 215.15.
2. Surface-mounted panelboards: Trims shall fasten to insure no overhang.

2.05 SAFETY SWITCHES AND ENCLOSED CIRCUIT BREAKERS

A Product Description:

1. Provide single-throw, horsepower rated, 100% load break and make rated, designed for locking in "ON" or "OFF" position, steel cabinets, as required by the application and required per the NEC.
2. Provide equipment rated for the required voltage and with the number of poles required, dependent on the equipment requirements.
3. Provide SPDs at equipment in accordance with Section 26 43 00 - Surge Protection Devices.

B Construction:

1. All safety switches and enclosed circuit breakers shall be Heavy Duty (HD) type and built per NEMA KS 1 and UL 98.

C Disconnect / Safety Switches:

1. Safety switches shall be fused, unless indicated as non-fused on the Drawings.
2. All disconnects / safety switches shall be lockable in the OFF position.
3. Use fuse clips which are rejecting type to accept Class RK or L fuses only.
4. Size fused safety switches and upstream conductors serving motor loads at 125% to 175% of motor nameplate or per NEC values, whichever is larger, and round to the next standard size.

D Enclosed Circuit Breakers: Provide where indicated on Drawings, otherwise provide a disconnect / safety switch.

2.06 CIRCUIT BREAKERS

A Product Description: Bolt-on, quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the Drawings.

B Interrupting Ratings: Provide size (ampacity) and withstand (AIC) rating as indicated on the Drawings. Series rated panels are NOT allowed. All panels shall be FULLY RATED.

C Thermal Magnetic Circuit Breaker: Bi-metallic overload elements, magnetic trip, common trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable.

D Electronic-Trip Circuit Breaker: Solid-state, microprocessor-based, true RMS sensing trip units with the following field-adjustable trip response settings:

1. Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
2. Long time delay.
3. Short time pickup and delay.
4. Instantaneous pickup.

E Features and Accessories: Provide as required by NEC, as indicated in the Specifications and as shown on the Drawings.

1. AFCI: Arc fault sensing where arc fault protection is indicated or required.
2. GFCI / GFPE: Ground fault pickup and delay where ground fault protection is indicated or required by NEC.
3. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
4. Lock-Out Provision: For locking the circuit breaker in the off position.

F Provide number of poles indicated for the specified equipment or service, with common trip handle for all poles.

G Independently mount so that a single unit can be removed from the front of the panelboard without disturbing or removing main bus, other units or other branch circuit connections.

H All circuit breakers that have an overcurrent trip setting fixed or adjustable at 1200a or higher shall have an Energy-Reducing Maintenance Switch or similar approved method for arc energy reduction and shall meet all requirements of NEC 240.67 and NEC 240.87. No exceptions.

2.07 FUSES

A Performance Requirements:

1. All fuses shall be from the same manufacturer.
2. Provide ampacity rating as indicated on the Drawings or required by NEC.
3. Unless otherwise indicated on the Drawings, size fuses serving all motor loads at 175% of motor nameplate FLA or NEC motor table ampacity, whichever is larger.

B 600-amp and less: UL Class RK-1 dual element, time delay.

C 601-amp and larger: UL Class L time delay.

2.08 FRACTIONAL HORSEPOWER MOTOR-RATED SWITCH

A Product Description: NEMA WD-1 & WD-6, motor-rated toggle switch. For use when switch-mounted thermal overload relays are not required.

B See Specifications section 26 27 26 - Wiring Devices for additional requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify mounting supports are properly sized and located including concealed bracing in walls.

3.02 PREPARATION

A Coordinate with the power utility company to obtain information regarding the available short circuit current at the service point. Provide this information to the electrical gear manufacturer for use in the overcurrent protective device coordination study required by Section 26 05 73 - Power System Studies.

B Coordinate all requirements with the power utility company and include in the base bid, including but not limited to the following:

1. Whether the service will be overhead or underground.
2. The extent of any underground primary.
3. The need for a secondary enclosure. Provide in bid if required.
4. Any charges from the power utility company for providing service.
5. The need for a transocket for utility metering.

3.03 APPLICATION

A Panelboards and Switchboards: Provide a complete isolated ground system including isolated ground panelboard with 200% neutral, SPD and separate isolated ground bus where indicated on the Drawings.

B Transformers:

1. Provide K-1 transformers when serving panelboards, unless altered by below items.
2. Provide K-13 transformers when serving isolated ground panelboards.
3. Provide K-20 transformers when serving panelboards in network operations centers (NOC).

C Circuit Breakers:

1. Provide ground fault circuit breakers (GFCI) where indicated on the Drawings, panelboard schedules and / or as required by NEC 210.8(B), 422.5, etc. For example, provide protection at all EWCs, hand dryers, kitchen equipment, concessions equipment, etc. Pull separate neutrals with each circuit to ensure correct GFCI operation.
2. Provide combination AFCI / GFCI circuit breakers where AFCI protection is required per NEC and as indicated on the Drawings.

D Motor Disconnecting Means:

1. Provide a motor-rated switch as a disconnecting means at all motors powered by 120v, 277v and 208v 1ph 20a circuits, unless otherwise indicated on the drawings.
2. Provide a fused disconnect at all motors not listed above, unless otherwise indicated on the drawings.

3.04 INSTALLATION

A General:
1. Set all equipment plumb, straight and level.
2. Provide and install all equipment, including electrical connections, in accordance with the manufacturer's written instructions, the applicable requirements of NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.

B Panelboards and Switchboards:
1. Install in the locations as shown and as recommended in NEMA PB1.1. Mount the panelboards such that the top of the switch or circuit breaker in the highest position will not be more than 6-1/2 feet above the floor or working platform. Space all panelboards and switchboards to meet the requirements of NEC 110 and 408. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured.
2. Provide required SPD breaker for each panelboard/ switchboard as indicated on the Drawings.
3. Coordinate installation of panelboards and enclosures with other trades, including Mechanical and Plumbing to avoid clearance issues with dedicated equipment space and working clearances.
4. Place all free standing or floor mounted equipment on four (4) inch housekeeping pads.
5. Where series-rated panelboards are allowed, field mark the factory furnished label in accordance with NEC 110.22(C).

C Fuses:
1. Check fasteners on fuse clips for tightness when installing fuses.
2. Install fuses so label is in an upright, readable position. Fuses without labels are not acceptable.
3. Do not install fuses until equipment is ready to be energized.

D Safety Switches and Enclosed Circuit Breakers:
1. Mount switches no more than six (6) inches above and within six (6) feet of the equipment served, so that operating handle is easily accessible. Align tops of switches when grouped together.
2. Provide a four (4) inch housekeeping pad for all free standing / floor mounted safety switches whether they are mounted inside or outside.
3. Mount vertically on required separate support system hardware with switch easily accessible (door to open 90 degrees minimum).

4. Permanently mount safety switches from inside with plated or stainless bolts, toggle bolts or anchors. Exposed mounting bolts, screws, etc. are not acceptable.
5. Permanently install fusible switches with Class R fuse kits so that fuses are readable when looking at open switch.
6. Do not mount switches / disconnects to access panels or on nameplate data on equipment per NEC.
7. Installation of conductors: Switches shall not be used as "junction boxes" between HVAC units (splicing or "pig tailing" is not permitted). The maximum number of conductors allowed per termination is determined by the manufacturer's approved rating for each terminal or lug.

E Contactors and Relays:

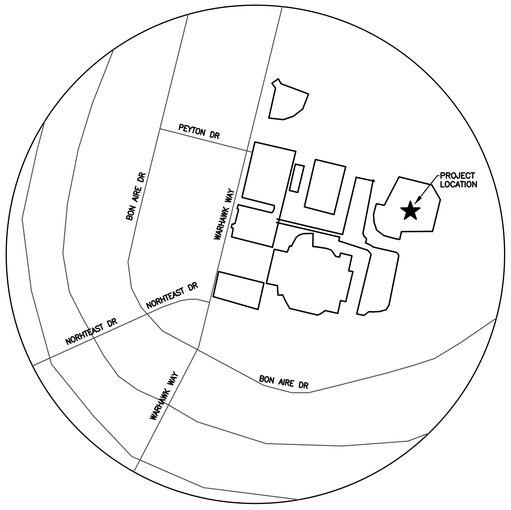
1. Unless otherwise indicated on the Drawings, mount contactors in electrical enclosures in electrical room, mechanical room or designated area on Drawings in accordance with manufacturer's instructions and recommendations.
2. Provide an override toggle switch, for maintenance and testing, located beside each contactor used for lighting.
    a. Provide relay with integral override switch per Exterior Lighting Controls details on the Drawings.

END OF SECTION

HVAC RENOVATIONS AT WARHAWK FIELD UNIVERSITY OF LOUISIANA MONROE

322 WARHAWK WAY, MONROE, LOUISIANA

MAY 02, 2025



VICINITY MAP
UNIVERSITY OF LOUISIANA MONROE
MONROE, LOUISIANA

INDEX TO DRAWINGS

SHEET	DESCRIPTION
T1	TITLE SHEET
ED1.1	ELECTRICAL DEMOLITION–FIRST FLOOR PLAN
ED1.2	ELECTRICAL DEMOLITION–SECOND FLOOR PLAN
EP1.1	ELECTRICAL–FIRST FLOOR PLAN
EP1.2	ELECTRICAL–SECOND FLOOR PLAN
MD1.1	MECHANICAL DEMOLITION–FIRST FLOOR PLAN
MD1.2	MECHANICAL DEMOLITION–SECOND FLOOR PLAN
MH1.1	MECHANICAL–FIRST FLOOR PLAN
MH1.2	MECHANICAL–SECOND FLOOR PLAN
MH7.1	MECHANICAL–DETAILS
MH7.2	MECHANICAL–DETAILS
MH8.1	MECHANICAL–SCHEDULES
MH9.1	MECHANICAL–PIPING DIAGRAMS

EMA
DESIGN SOLVE ENHANCE

9441 STEVENS ROAD - SUITE 200
SHREVEPORT, LOUISIANA 71106
318-425-4500

LOUISIANA REGISTERED ENGINEERING FIRM #F-5818
TEXAS REGISTERED ENGINEERING FIRM #F-893
P+A NO. 5-001-2338-002

HVAC RENOVATIONS AT
WARHAWK FIELD
UNIVERSITY OF LOUISIANA MONROE

GENERAL DEMOLITION NOTES:

(GD1) CONTRACTOR SHALL PROTECT ALL AREAS NOT SCHEDULED FOR WORK (I.E. FINISHED SPACES, ROOF, ETC.)

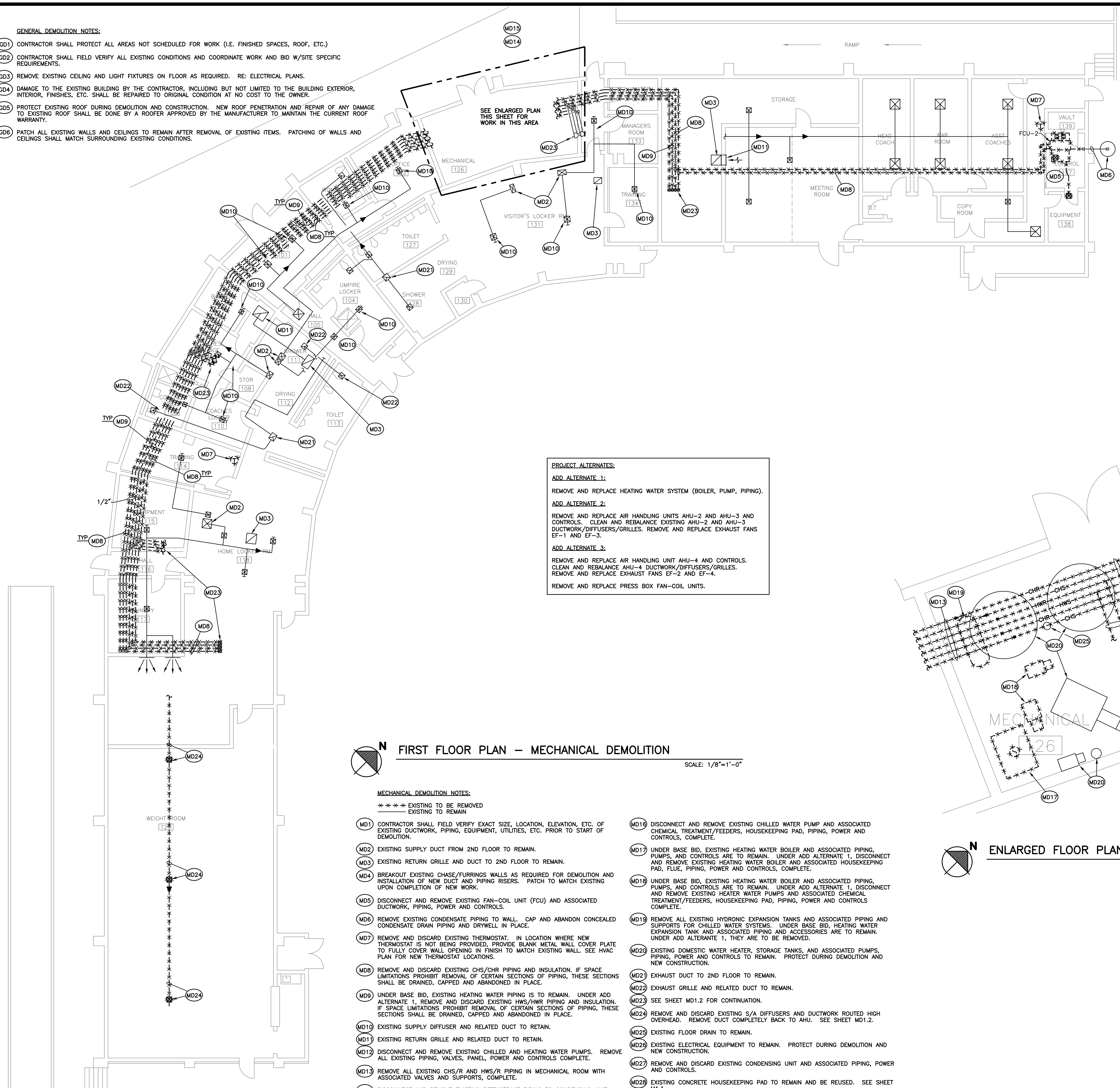
(GD2) CONTRACTOR SHALL FIELD VERIFY ALL EXISTING CONDITIONS AND COORDINATE WORK AND BID W/SITE SPECIFIC REQUIREMENTS.

(GD3) REMOVE EXISTING CEILING AND LIGHT FIXTURES ON FLOOR AS REQUIRED. RE: ELECTRICAL PLANS.

(GD4) DAMAGE TO THE EXISTING BUILDING BY THE CONTRACTOR, INCLUDING BUT NOT LIMITED TO THE BUILDING EXTERIOR, INTERIOR, FINISHES, ETC. SHALL BE REPAIRED TO ORIGINAL CONDITION AT NO COST TO THE OWNER.

(GD5) PROTECT EXISTING ROOF DURING DEMOLITION AND CONSTRUCTION. NEW ROOF PENETRATION AND REPAIR OF ANY DAMAGE TO EXISTING ROOF SHALL BE DONE BY A ROOFER APPROVED BY THE MANUFACTURER TO MAINTAIN THE CURRENT ROOF WARRANTY.

(GD6) PATCH ALL EXISTING WALLS AND CEILINGS TO REMAIN AFTER REMOVAL OF EXISTING ITEMS. PATCHING OF WALLS AND CEILINGS SHALL MATCH SURROUNDING EXISTING CONDITIONS.



PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

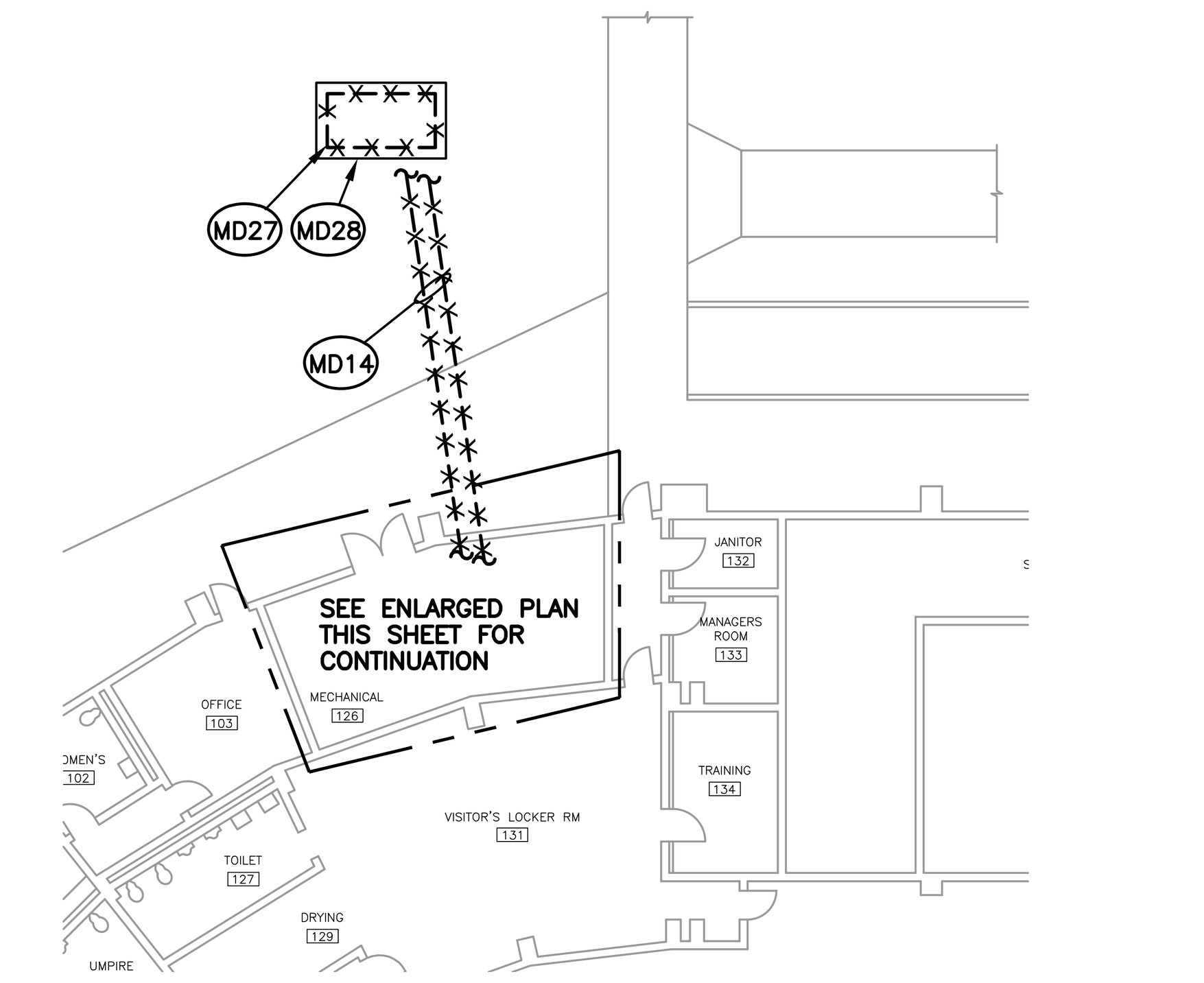
ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

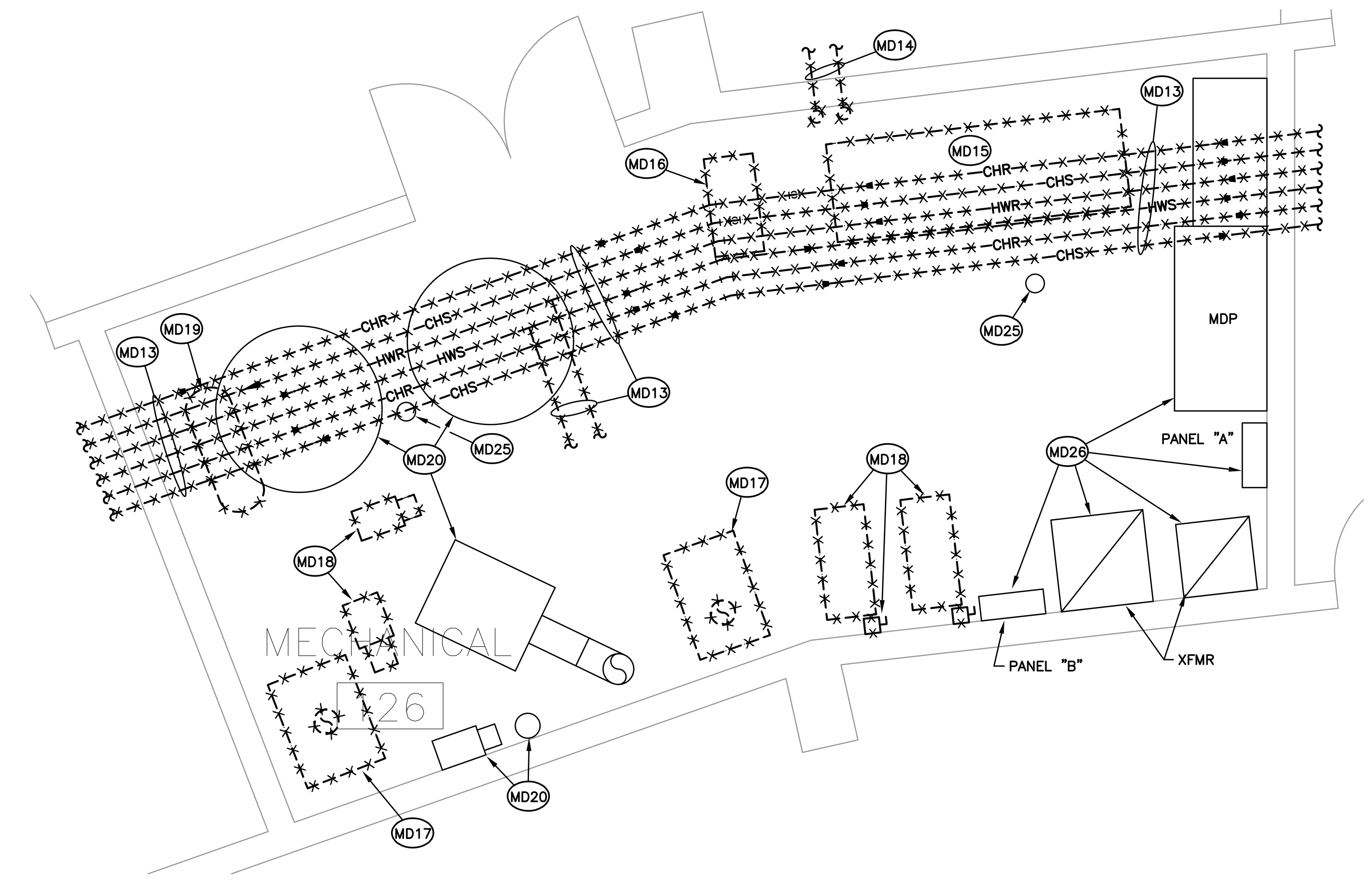
FIRST FLOOR PLAN – MECHANICAL DEMOLITION

SCALE: 1/8"=1'-0"



PARTIAL SITE PLAN – MECHANICAL DEMOLITION

SCALE: 1/16"=1'-0"



ENLARGED FLOOR PLAN – MECHANICAL DEMOLITION

SCALE: 3/8"=1'-0"

MECHANICAL DEMOLITION NOTES:

✳✳✳✳ EXISTING TO BE REMOVED
——— EXISTING TO REMAIN

(MD1) CONTRACTOR SHALL FIELD VERIFY EXACT SIZE, LOCATION, ELEVATION, ETC. OF EXISTING DUCTWORK, PIPING, EQUIPMENT, UTILITIES, ETC. PRIOR TO START OF DEMOLITION.

(MD2) EXISTING SUPPLY DUCT FROM 2ND FLOOR TO REMAIN.

(MD3) EXISTING RETURN GRILLE AND DUCT TO 2ND FLOOR TO REMAIN.

(MD4) BREAKOUT EXISTING CHASE/FURRINGS WALLS AS REQUIRED FOR DEMOLITION AND INSTALLATION OF NEW DUCT AND PIPING RISERS. PATCH TO MATCH EXISTING UPON COMPLETION OF NEW WORK.

(MD5) DISCONNECT AND REMOVE EXISTING FAN-COIL UNIT (FCU) AND ASSOCIATED DUCTWORK, PIPING, POWER AND CONTROLS.

(MD6) REMOVE EXISTING CONDENSATE PIPING TO WALL. CAP AND ABANDON CONCEALED CONDENSATE DRAIN PIPING AND DRYWELL IN PLACE.

(MD7) REMOVE AND DISCARD EXISTING THERMOSTAT. IN LOCATION WHERE NEW THERMOSTAT IS NOT BEING PROVIDED, PROVIDE BLANK METAL WALL COVER PLATE TO FULLY COVER WALL OPENING IN FINISH TO MATCH EXISTING WALL. SEE HVAC PLAN FOR NEW THERMOSTAT LOCATIONS.

(MD8) REMOVE AND DISCARD EXISTING CHS/CHR PIPING AND INSULATION. IF SPACE LIMITATIONS PROHIBIT REMOVAL OF CERTAIN SECTIONS OF PIPING, THESE SECTIONS SHALL BE DRAINED, CAPPED AND ABANDONED IN PLACE.

(MD9) UNDER BASE BID, EXISTING HEATING WATER PIPING IS TO REMAIN. UNDER ADD ALTERNATE 1, REMOVE AND DISCARD EXISTING HWS/HWR PIPING AND INSULATION. IF SPACE LIMITATIONS PROHIBIT REMOVAL OF CERTAIN SECTIONS OF PIPING, THESE SECTIONS SHALL BE DRAINED, CAPPED AND ABANDONED IN PLACE.

(MD10) EXISTING SUPPLY DIFFUSER AND RELATED DUCT TO RETAIN.

(MD11) EXISTING RETURN GRILLE AND RELATED DUCT TO RETAIN.

(MD12) DISCONNECT AND REMOVE EXISTING CHILLED AND HEATING WATER PUMPS. REMOVE ALL EXISTING PIPING, VALVES, PANEL, POWER AND CONTROLS COMPLETE.

(MD13) REMOVE ALL EXISTING CHS/R AND HWS/R PIPING IN MECHANICAL ROOM WITH ASSOCIATED VALVES AND SUPPORTS, COMPLETE.

(MD14) DISCONNECT AND REMOVE EXISTING REFRIGERANT PIPING TO CONDENSING UNIT ABOVE SLAB/GRADE. REMOVE REFRIGERANT, CAP AND ABANDON U/G PIPING IN PLACE.

(MD15) DISCONNECT AND REMOVE EXISTING CHILLER AND ASSOCIATED HOUSEKEEPING PAD, PIPING, POWER AND CONTROLS, COMPLETE. PROVIDE FOR REMOVAL OF REFRIGERANT AND RETURN TO OWNER UNLESS INSTRUCTED OTHERWISE.

(MD16) DISCONNECT AND REMOVE EXISTING CHILLED WATER PUMP AND ASSOCIATED CHEMICAL TREATMENT/FEEDERS, HOUSEKEEPING PAD, PIPING, POWER AND CONTROLS, COMPLETE.

(MD17) UNDER BASE BID, EXISTING HEATING WATER BOILER AND ASSOCIATED PIPING, PUMPS, AND CONTROLS ARE TO REMAIN. UNDER ADD ALTERNATE 1, DISCONNECT AND REMOVE EXISTING HEATING WATER BOILER AND ASSOCIATED HOUSEKEEPING PAD, FLUE, PIPING, POWER AND CONTROLS, COMPLETE.

(MD18) UNDER BASE BID, EXISTING HEATING WATER BOILER AND ASSOCIATED PIPING, PUMPS, AND CONTROLS ARE TO REMAIN. UNDER ADD ALTERNATE 1, DISCONNECT AND REMOVE EXISTING HEATER WATER PUMPS AND ASSOCIATED CHEMICAL TREATMENT/FEEDERS, HOUSEKEEPING PAD, PIPING, POWER AND CONTROLS COMPLETE.

(MD19) REMOVE ALL EXISTING HYDRONIC EXPANSION TANKS AND ASSOCIATED PIPING AND SUPPORTS FOR CHILLED WATER SYSTEMS. UNDER BASE BID, HEATING WATER EXPANSION TANK AND ASSOCIATED PIPING AND ACCESSORIES ARE TO REMAIN. UNDER ADD ALTERANTE 1, THEY ARE TO BE REMOVED.

(MD20) EXISTING DOMESTIC WATER HEATER, STORAGE TANKS, AND ASSOCIATED PUMPS, PIPING, POWER AND CONTROLS TO REMAIN. PROTECT DURING DEMOLITION AND NEW CONSTRUCTION.

(MD21) EXHAUST DUCT TO 2ND FLOOR TO REMAIN.

(MD22) EXHAUST GRILLE AND RELATED DUCT TO REMAIN.

(MD23) SEE SHEET MD1.2 FOR CONTINUATION.

(MD24) REMOVE AND DISCARD EXISTING S/A DIFFUSERS AND DUCTWORK ROUTED HIGH OVERHEAD. REMOVE DUCT COMPLETELY BACK TO AHU. SEE SHEET MD1.2.

(MD25) EXISTING FLOOR DRAIN TO REMAIN.

(MD26) EXISTING ELECTRICAL EQUIPMENT TO REMAIN. PROTECT DURING DEMOLITION AND NEW CONSTRUCTION.

(MD27) REMOVE AND DISCARD EXISTING CONDENSING UNIT AND ASSOCIATED PIPING, POWER AND CONTROLS.

(MD28) EXISTING CONCRETE HOUSEKEEPING PAD TO REMAIN AND BE REUSED. SEE SHEET M1.1.

STATE OF LOUISIANA
THOMAS G. SANDERS
REG. No. 28647
REGISTERED PROFESSIONAL ENGINEER
IN MECHANICAL ENGINEERING
05/05/25

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SHREVEPORT, LOUISIANA 71106
318 425 4500
LOUISIANA Registered Engineering Firm #EF-5818
TEXAS Registered Engineering Firm #F-893

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HVAC RENOVATIONS AT WARHAWK FIELD

UNIVERSITY OF LOUISIANA MONROE

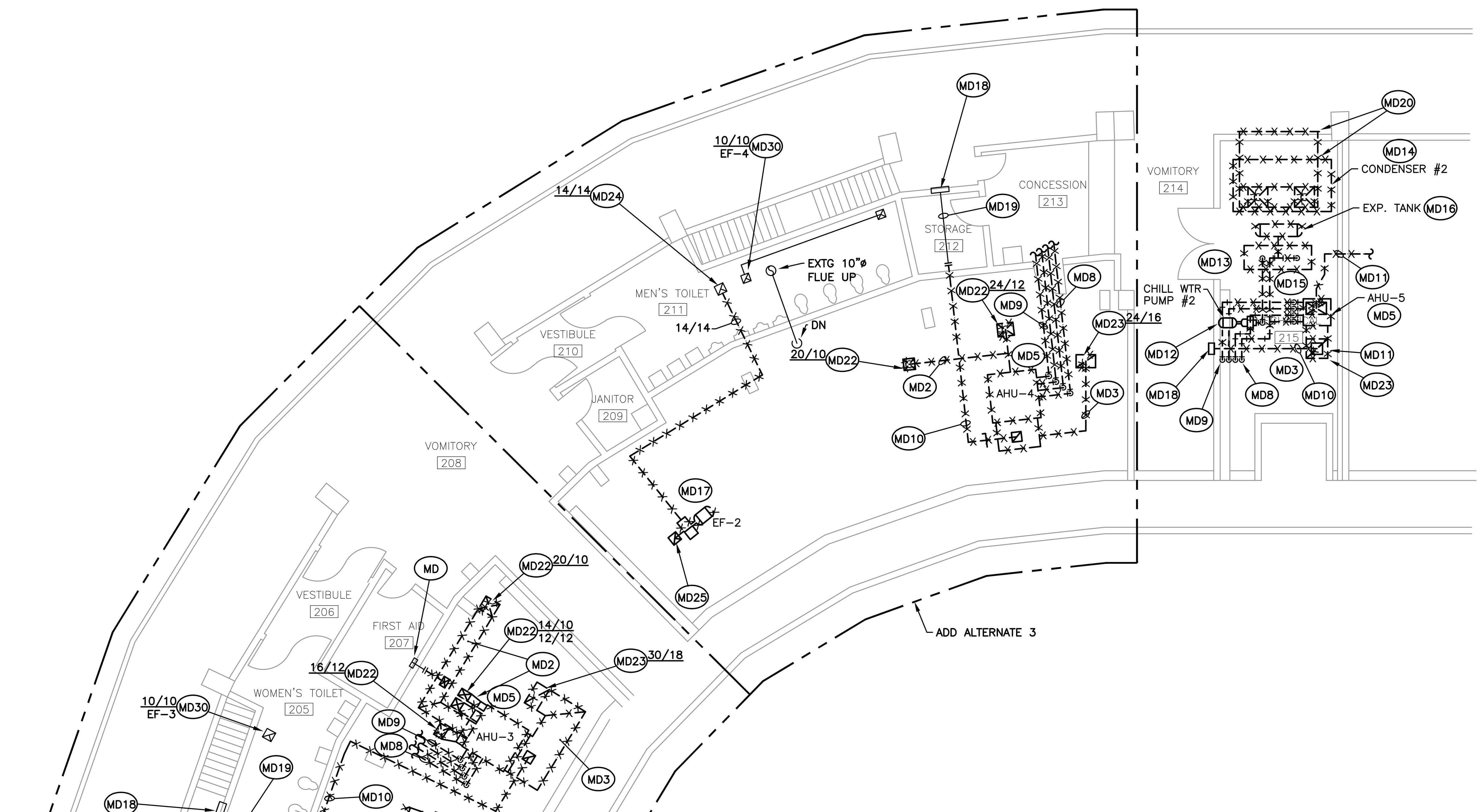
322 WARHAWK WAY
MONROE, LOUISIANA

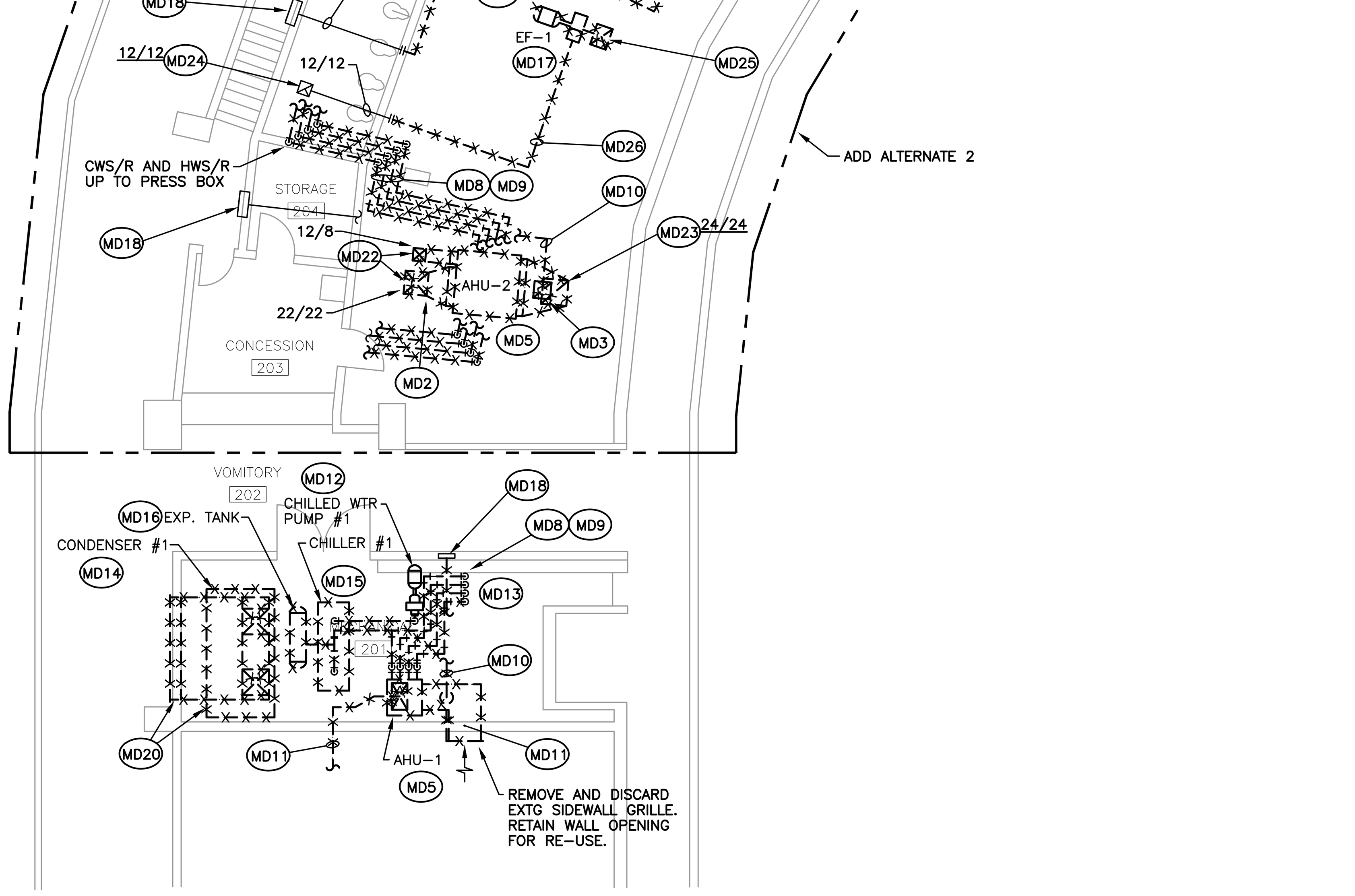
NO.	DATE	REVISIONS

JOB NO: 5-001-2338-002
CHECKED BY: RW
DRAWN BY: WJW
DATE: 5-02-2025
SCALE: AS SHOWN

SHEET

MD1.1





SECOND FLOOR PLAN – MECHANICAL DEMOLITION

SCALE: 1/8"=1'-0"

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

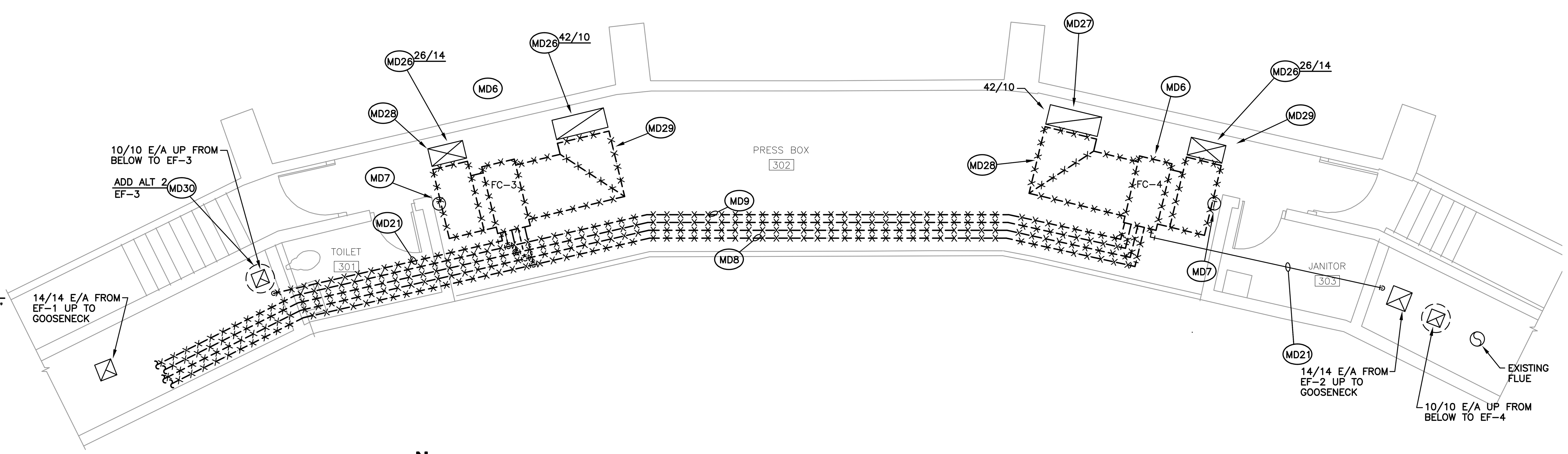
REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

MECHANICAL DEMOLITION NOTES:

* * * * EXISTING TO BE REMOVED

——— EXISTING TO REMAIN

- MD1 CONTRACTOR SHALL FIELD VERIFY EXACT SIZE, LOCATION, ELEVATION, ETC. OF EXISTING DUCTWORK, PIPING, EQUIPMENT, UTILITIES, ETC. PRIOR TO START OF DEMOLITION.
- MD2 REMOVE AND DISCARD EXISTING S/A DUCTWORK TO FLOOR PENETRATION. EXISTING DUCTWORK THRU SLAB TO FIRST FLOOR TO REMAIN. SEE NOTE "MD22"
- MD3 REMOVE AND DISCARD EXISTING R/A DUCTWORK TO FLOOR PENETRATION. EXISTING DUCTWORK THRU SLAB TO FIRST FLOOR TO REMAIN. SEE NOTE "MD23".
- MD4 BREAKOUT EXISTING CHASE/FURRINGS WALLS AS REQUIRED FOR DEMOLITION AND INSTALLATION OF NEW DUCT AND PIPING RISERS. PATCH TO MATCH EXISTING UPON COMPLETION OF NEW WORK.
- MD5 DISCONNECT AND REMOVE EXISTING AIR HANDLING UNIT (AHU) AND ASSOCIATED DUCTWORK, PIPING, POWER, AND CONTROLS.
- MD6 DISCONNECT AND REMOVE EXISTING FAN-COIL UNIT (FCU) AND ASSOCIATED DUCTWORK, PIPING, POWER AND CONTROLS.
- MD7 REMOVE AND DISCARD EXISTING THERMOSTAT. IN LOCATION WHERE NEW THERMOSTAT IS NOT BEING PROVIDED, PROVIDE BLANK METAL WALL COVER PLATE TO FULLY COVER WALL OPENING IN FINISH TO MATCH EXISTING WALL. SEE HVAC PLAN FOR NEW THERMOSTAT LOCATIONS.
- MD8 REMOVE AND DISCARD EXISTING CHS/CHR PIPING AND INSULATION. IF SPACE LIMITATIONS PROHIBIT REMOVAL OF CERTAIN SECTIONS OF PIPING, THESE SECTIONS SHALL BE DRAINED, CAPPED AND ABANDONED IN PLACE.
- MD9 REMOVE AND DISCARD EXISTING HWS/HWR PIPING AND INSULATION. IF SPACE LIMITATIONS PROHIBIT REMOVAL OF CERTAIN SECTIONS OF PIPING, THESE SECTIONS SHALL BE DRAINED, CAPPED AND ABANDONED IN PLACE.
- MD10 REMOVE AND DISCARD EXISTING O/A DUCTWORK SERVING AHU. BACK TO EXISTING LOUVER OR LOCATION AS NOTED.
- MD11 REMOVE EXISTING S/A AND R/A DUCTWORK FROM AHU. SEE SHEET MD1.1 FOR CONTINUATION.
- MD12 DISCONNECT AND REMOVE EXISTING CHILLED WATER PUMPS. REMOVE ALL EXISTING PIPING, VALVES, PANEL, POWER AND CONTROLS COMPLETE.
- MD13 REMOVE ALL EXISTING CHS/R AND HWS/R PIPING IN MECHANICAL ROOM WITH ASSOCIATED VALVES AND SUPPORTS, COMPLETE. DRAIN AND CAP ANY INACCESSIBLE PIPING AND ABANDON IN PLACE.
- MD14 DISCONNECT AND REMOVE EXISTING CONDENSING UNIT AND ASSOCIATED PIPING, POWER AND CONTROLS, COMPLETE. PROVIDE FOR LEGAL REMOVAL AND DISPOSAL OF REFRIGERANT.
- MD15 DISCONNECT AND REMOVE EXISTING CHILLER AND ASSOCIATED HOUSEKEEPING PAD, PIPING, POWER AND CONTROLS, COMPLETE. PROVIDE FOR LEGAL REMOVAL AND DISPOSAL OF REFRIGERANT.
- MD16 REMOVE EXISTING HYDRONIC EXPANSION TANK AND ASSOCIATED PIPING AND SUPPORTS.
- MD17 DISCONNECT AND REMOVE EXISTING EXHAUST FAN AND ASSOCIATED POWER AND CONTROLS. RETAIN EXISTING DUCTWORK FOR REUSE AND CONNECTION TO NEW FAN.
- MD18 EXISTING OUTSIDE AIR INTAKE TO REMAIN AND BE REUSED. CLEAN AND PAINT AS REQUIRED.
- MD19 THIS PORTION OF THE OUTSIDE AIR DUCT TO REMAIN.
- MD20 REMOVE EXISTING CONDENSER SUPPLY AND RETURN DUCTWORK TO LOUVER. BLANK-OFF BACK OF EXISTING HIGH AND LOW LOUVERS WITH INSULATED SHEET METAL CAP AND CAULK AND SEAL WATERTIGHT.
- MD21 EXISTING CONDENSATE DRAIN PIPING ABOVE CEILING TO REMAIN AND BE REUSED.
- MD22 EXISTING SUPPLY AIR DUCT TO 1ST FLOOR TO REMAIN AND BE REUSED. DUCT SIZE AS NOTED.
- MD23 EXISTING RETURN AIR DUCT UP FROM 1ST FLOOR TO REMAIN AND BE REUSED. DUCT SIZE AS NOTED.
- MD24 EXISTING EXHAUST DUCT UP TO ROOF TO REMAIN. DUCT SIZE AS NOTED.
- MD25 EXISTING EXHAUST DUCT UP FROM FIRST FLOOR TO REMAIN. DUCT SIZE AS NOTED.
- MD26 EXISTING SUPPLY AIR DUCT DOWN TO SUPPLY AIR DIFFUSER TO REMAIN. DUCT SIZE AS NOTED.
- MD27 EXISTING RETURN AIR DUCT DOWN TO RETURN AIR GRILLE TO REMAIN. DUCT SIZE AS NOTED.
- MD28 REMOVE THIS PORTION OF SUPPLY AIR DUCT.
- MD29 REMOVE THIS PORTION OF RETURN AIR DUCT.
- MD30 EXISTING EXHAUST AIR DUCT FROM CEILING GRILLE UP TO FAN ON ROOF TO REMAIN. SIZE AS NOTED. REMOVE EXISTING GRILLE FOR REPLACEMENT WITH NEW. REMOVE AND DISCARD EXISTING ROOF-MOUNTED EXHAUST FAN FOR REPLACEMENT WITH NEW. RETAIN EXISTING CURB FOR RE-USE.



PRESS BOX PLAN – MECHANICAL DEMOLITION

SCALE: 1/4"=1'-0"

THOMAS G. SANDERS
REG. No. 28647
REGISTERED PROFESSIONAL ENGINEER IN MECHANICAL ENGINEERING
STATE OF LOUISIANA
05/05/25

EMA
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HVAC RENOVATIONS AT WARHAWK FIELD

UNIVERSITY OF LOUISIANA MONROE

322 WARHAWK WAY
MONROE, LOUISIANA

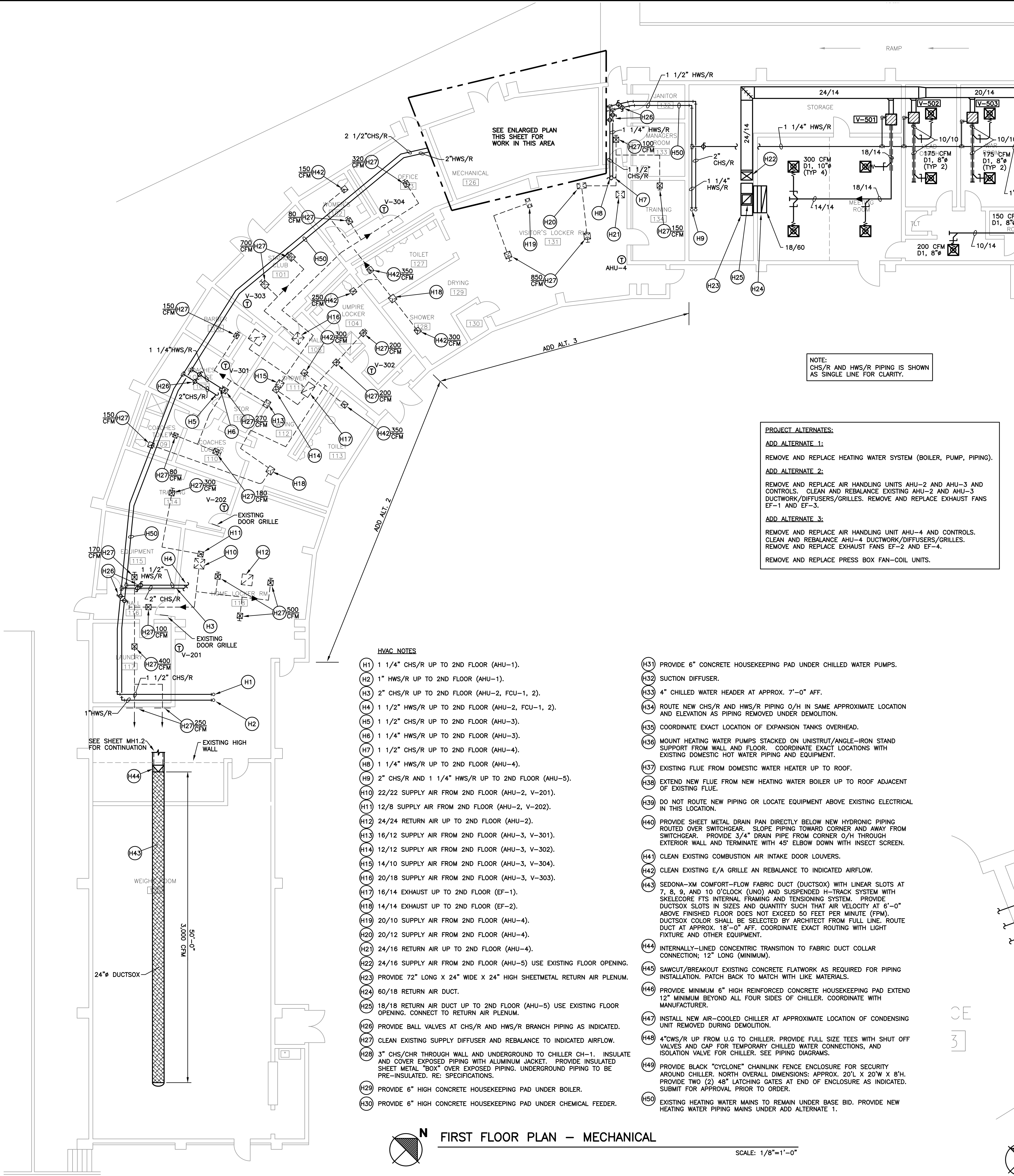
REVISIONS

NO.	DATE	

JOB NO: 5-001-2338-002
CHECKED BY: RW
DRAWN BY: WJW
DATE: 05-02-2025
SCALE: AS SHOWN

SHEET

MD1.2



NOTE:
CHS/R AND HWS/R PIPING IS SHOWN AS SINGLE LINE FOR CLARITY.

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

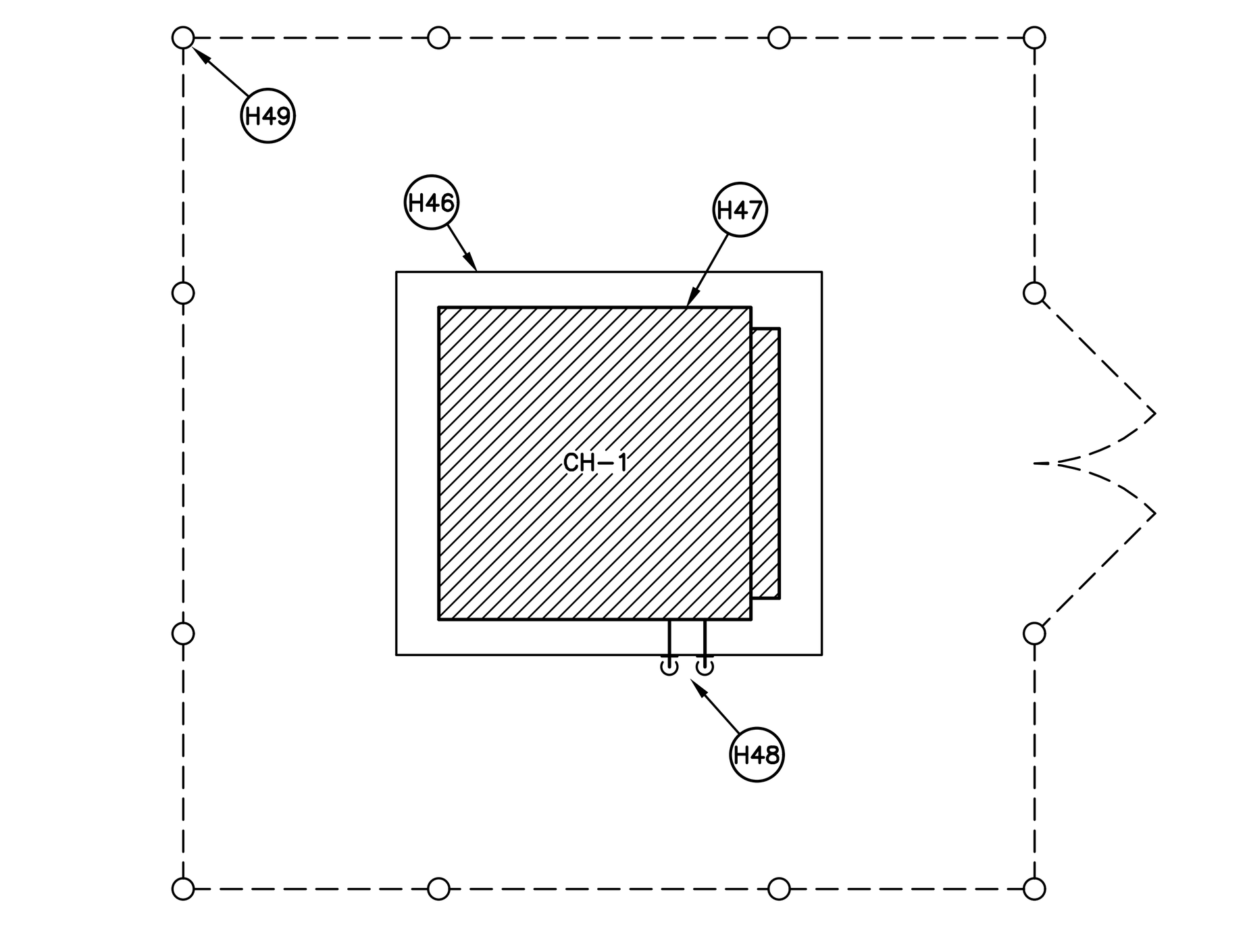
HVAC NOTES

- H1 1 1/4" CHS/R UP TO 2ND FLOOR (AHU-1).
- H2 1" HWS/R UP TO 2ND FLOOR (AHU-1).
- H3 2" CHS/R UP TO 2ND FLOOR (AHU-2, FCU-1, 2).
- H4 1 1/2" HWS/R UP TO 2ND FLOOR (AHU-2, FCU-1, 2).
- H5 1 1/2" CHS/R UP TO 2ND FLOOR (AHU-3).
- H6 1 1/4" HWS/R UP TO 2ND FLOOR (AHU-3).
- H7 1 1/2" CHS/R UP TO 2ND FLOOR (AHU-4).
- H8 1 1/4" HWS/R UP TO 2ND FLOOR (AHU-4).
- H9 2" CHS/R AND 1 1/4" HWS/R UP TO 2ND FLOOR (AHU-5).
- H10 22/22 SUPPLY AIR FROM 2ND FLOOR (AHU-2, V-201).
- H11 12/8 SUPPLY AIR FROM 2ND FLOOR (AHU-2, V-202).
- H12 24/24 RETURN AIR UP TO 2ND FLOOR (AHU-2).
- H13 16/12 SUPPLY AIR FROM 2ND FLOOR (AHU-3, V-301).
- H14 12/12 SUPPLY AIR FROM 2ND FLOOR (AHU-3, V-302).
- H15 14/10 SUPPLY AIR FROM 2ND FLOOR (AHU-3, V-304).
- H16 20/18 SUPPLY AIR FROM 2ND FLOOR (AHU-3, V-303).
- H17 16/14 EXHAUST UP TO 2ND FLOOR (EF-1).
- H18 14/14 EXHAUST UP TO 2ND FLOOR (EF-2).
- H19 20/10 SUPPLY AIR FROM 2ND FLOOR (AHU-4).
- H20 20/12 SUPPLY AIR FROM 2ND FLOOR (AHU-4).
- H21 24/16 RETURN AIR UP TO 2ND FLOOR (AHU-4).
- H22 24/16 SUPPLY AIR FROM 2ND FLOOR (AHU-5) USE EXISTING FLOOR OPENING.
- H23 PROVIDE 72" LONG X 24" WIDE X 24" HIGH SHEETMETAL RETURN AIR PLENUM.
- H24 60/18 RETURN AIR DUCT.
- H25 18/18 RETURN AIR DUCT UP TO 2ND FLOOR (AHU-5) USE EXISTING FLOOR OPENING. CONNECT TO RETURN AIR PLENUM.
- H26 PROVIDE BALL VALVES AT CHS/R AND HWS/R BRANCH PIPING AS INDICATED.
- H27 CLEAN EXISTING SUPPLY DIFFUSER AND REBALANCE TO INDICATED AIRFLOW.
- H28 3" CHS/CHR THROUGH WALL AND UNDERGROUND TO CHILLER CH-1. INSULATE AND COVER EXPOSED PIPING WITH ALUMINUM JACKET. PROVIDE INSULATED SHEET METAL "BOX" OVER EXPOSED PIPING. UNDERGROUND PIPING TO BE PRE-INSULATED. RE: SPECIFICATIONS.
- H29 PROVIDE 6" HIGH CONCRETE HOUSEKEEPING PAD UNDER BOILER.
- H30 PROVIDE 6" HIGH CONCRETE HOUSEKEEPING PAD UNDER CHEMICAL FEEDER.
- H31 PROVIDE 6" CONCRETE HOUSEKEEPING PAD UNDER CHILLED WATER PUMPS.
- H32 SUCTION DIFFUSER.
- H33 4" CHILLED WATER HEADER AT APPROX. 7'-0" AFF.
- H34 ROUTE NEW CHS/R AND HWS/R PIPING O/H IN SAME APPROXIMATE LOCATION AND ELEVATION AS PIPING REMOVED UNDER DEMOLITION.
- H35 COORDINATE EXACT LOCATION OF EXPANSION TANKS OVERHEAD.
- H36 MOUNT HEATING WATER PUMPS STACKED ON UNISTRUT/ANGLE-IRON STAND SUPPORT FROM WALL AND FLOOR. COORDINATE EXACT LOCATIONS WITH EXISTING DOMESTIC HOT WATER PIPING AND EQUIPMENT.
- H37 EXISTING FLUE FROM DOMESTIC WATER HEATER UP TO ROOF.
- H38 EXTEND NEW FLUE FROM NEW HEATING WATER BOILER UP TO ROOF ADJACENT OF EXISTING FLUE.
- H39 DO NOT ROUTE NEW PIPING OR LOCATE EQUIPMENT ABOVE EXISTING ELECTRICAL IN THIS LOCATION.
- H40 PROVIDE SHEET METAL DRAIN PAN DIRECTLY BELOW NEW HYDRONIC PIPING ROUTED OVER SWITCHGEAR. SLOPE PIPING TOWARD CORNER AND AWAY FROM SWITCHGEAR. PROVIDE 3/4" DRAIN PIPE FROM CORNER O/H THROUGH EXTERIOR WALL AND TERMINATE WITH 45° ELBOW DOWN WITH INSECT SCREEN.
- H41 CLEAN EXISTING COMBUSTION AIR INTAKE DOOR LOUVERS.
- H42 CLEAN EXISTING E/A GRILLE AN REBALANCE TO INDICATED AIRFLOW.
- H43 SEDONA-XM COMFORT-FLOW FABRIC DUCT (DUCTSOX) WITH LINEAR SLOTS AT 7, 8, 9, AND 10 O'CLOCK (UNO) AND SUSPENDED H-TRACK SYSTEM WITH SKELECORE FTS INTERNAL FRAMING AND TENSIONING SYSTEM. PROVIDE DUCTSOX SLOTS IN SIZES AND QUANTITY SUCH THAT AIR VELOCITY AT 6'-0" ABOVE FINISHED FLOOR DOES NOT EXCEED 50 FEET PER MINUTE (FPM). DUCTSOX COLOR SHALL BE SELECTED BY ARCHITECT FROM FULL LINE. ROUTE DUCT AT APPROX. 18'-0" AFF. COORDINATE EXACT ROUTING WITH LIGHT FIXTURE AND OTHER EQUIPMENT.
- H44 INTERNALLY-LINED CONCENTRIC TRANSITION TO FABRIC DUCT COLLAR CONNECTION; 12" LONG (MINIMUM).
- H45 SAWCUT/BREAKOUT EXISTING CONCRETE FLATWORK AS REQUIRED FOR PIPING INSTALLATION. PATCH BACK TO MATCH WITH LIKE MATERIALS.
- H46 PROVIDE MINIMUM 6" HIGH REINFORCED CONCRETE HOUSEKEEPING PAD EXTEND 12" MINIMUM BEYOND ALL FOUR SIDES OF CHILLER. COORDINATE WITH MANUFACTURER.
- H47 INSTALL NEW AIR-COOLED CHILLER AT APPROXIMATE LOCATION OF CONDENSING UNIT REMOVED DURING DEMOLITION.
- H48 4"CWS/R UP FROM U.G TO CHILLER. PROVIDE FULL SIZE TEES WITH SHUT OFF VALVES AND CAP FOR TEMPORARY CHILLED WATER CONNECTIONS, AND ISOLATION VALVE FOR CHILLER. SEE PIPING DIAGRAMS.
- H49 PROVIDE BLACK "CYCLONE" CHAINLINK FENCE ENCLOSURE FOR SECURITY AROUND CHILLER. NORTH OVERALL DIMENSIONS: APPROX. 20'L X 20'W X 8'H. PROVIDE TWO (2) 48" LATCHING GATES AT END OF ENCLOSURE AS INDICATED. SUBMIT FOR APPROVAL PRIOR TO ORDER.
- H50 EXISTING HEATING WATER MAINS TO REMAIN UNDER BASE BID. PROVIDE NEW HEATING WATER PIPING MAINS UNDER ADD ALTERNATE 1.

N

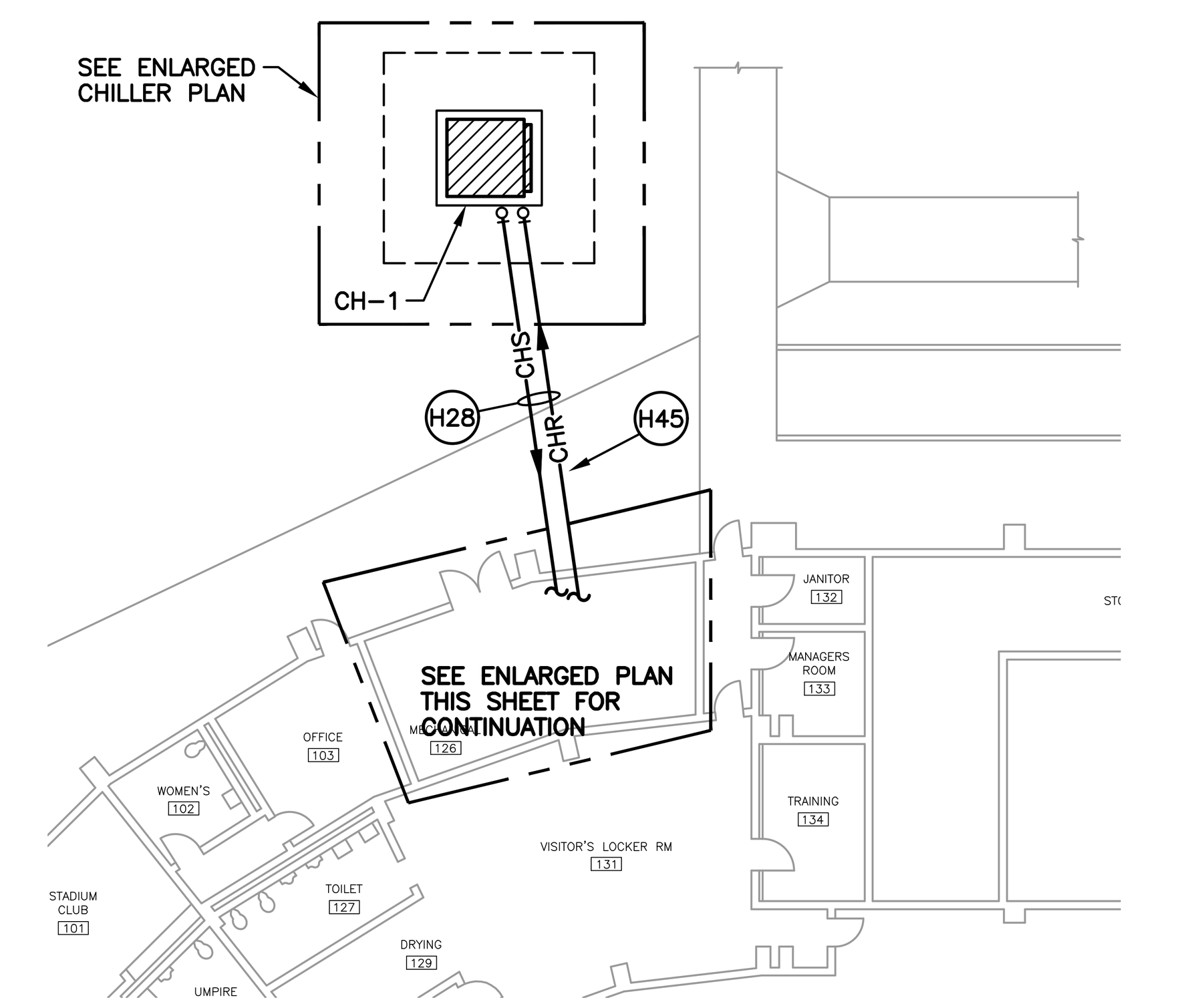
FIRST FLOOR PLAN – MECHANICAL

SCALE: 1/8"=1'-0"



ENLARGED PLAN – CHILLER CH-1

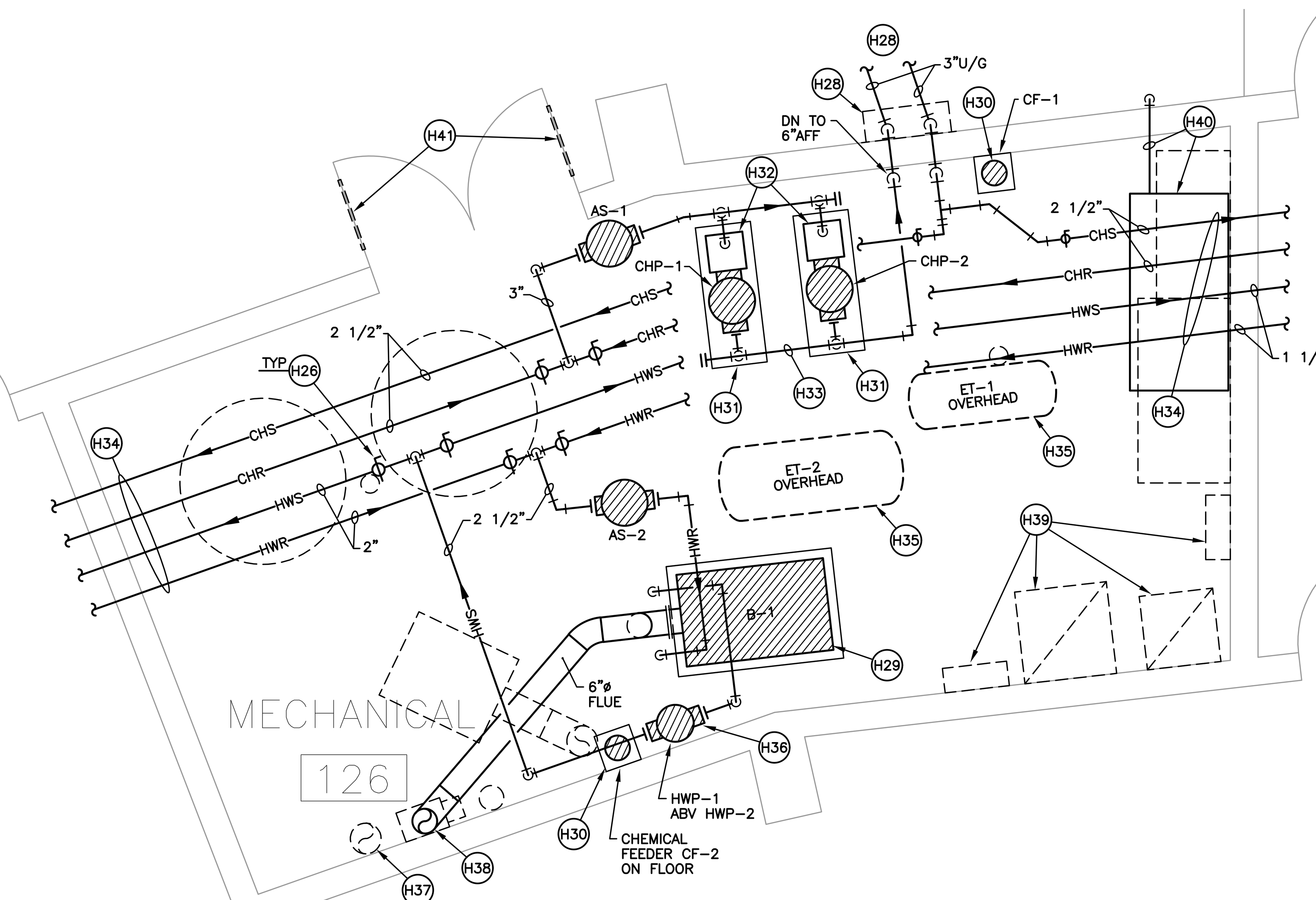
SCALE: 1/4"=1'-0"



N

PARTIAL SITE PLAN – MECHANICAL DEMOLITION

SCALE: 1/16"=1'-0"



N

ENLARGED FLOOR PLAN – MECHANICAL

(NOTE: ALL NEW HEATING WATER SYSTEM AND PIPING WORK SHALL BE PROVIDED UNDER ADD ALTERNATE 1)

SCALE: 3/8"=1'-0"

STATE OF LOUISIANA
THOMAS G. SANDERS
REG. No. 28647
REGISTERED PROFESSIONAL ENGINEER
IN MECHANICAL ENGINEERING
05/05/25

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SHREVEPORT, LOUISIANA 71106
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LOUISIANA Registered Engineering Firm #EF-5818
TEXAS Registered Engineering Firm #F-893

SUBMISSION OF BID WILL BE CONSIDERED ACKNOWLEDGEMENT THAT THE CONTRACTOR HAS VISITED THE SITE AND HAS VERIFIED ALL EXISTING JOB CONDITIONS AND INCLUDED ANY NECESSARY MODIFICATION TO EXISTING AND NEW WORK REQUIRED FOR INSTALLATION OF A COMPLETE AND WORKING SYSTEM.

HVAC RENOVATIONS AT WARHAWK FIELD

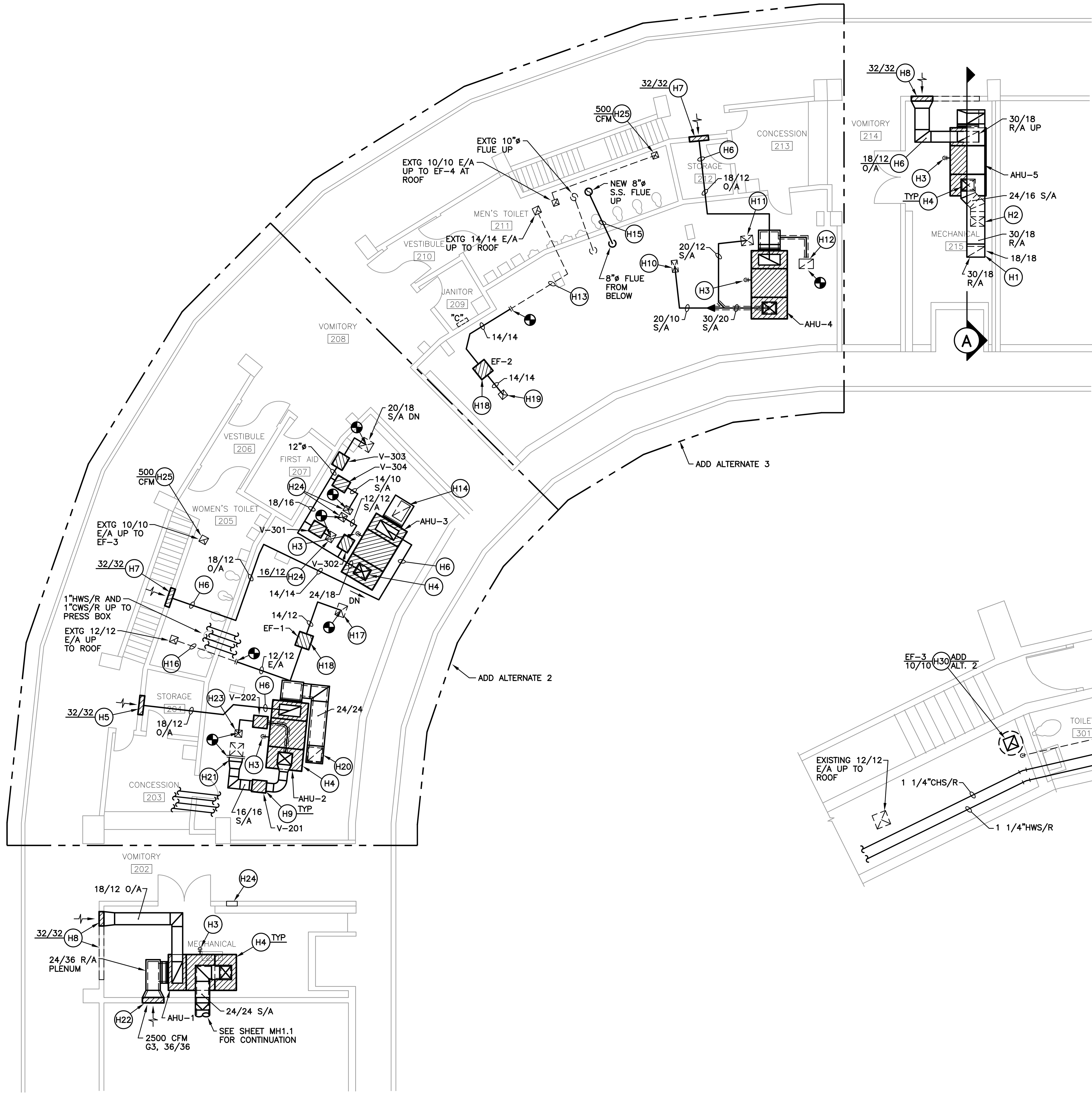
UNIVERSITY OF LOUISIANA MONROE

322 WARHAWK WAY
MONROE, LOUISIANA

NO.	DATE	REVISIONS

JOB NO: 5-001-2338-002
CHECKED BY: RW
DRAWN BY: WJW
DATE: 05-02-2025
SCALE: AS SHOWN

SHEET
MH1.1



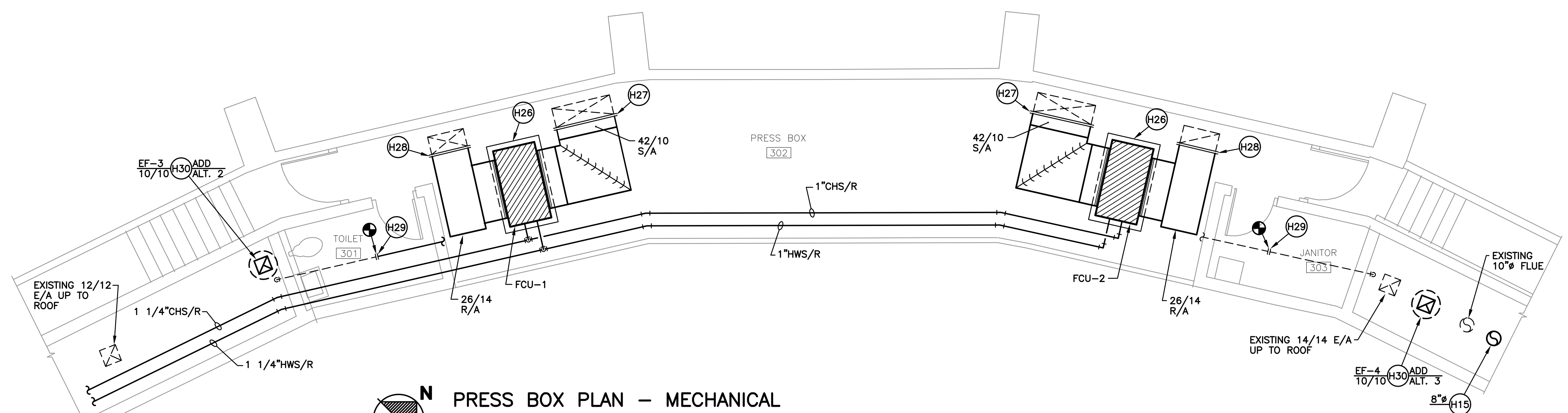
SECOND FLOOR PLAN – MECHANICAL

SCALE: 1/8"=1'-0"

HVAC NOTES:

– – – – EXISTING TO REMAIN.
——— NEW CONSTRUCTION.

- (H1) RUN 18/18 RETURN AIR DUCT THROUGH EXISTING OPENING DOWN TO 1ST FLOOR. TRANSITION TO 18/30 AND ROUTE O/H TO DROP INTO TOP OF AHU AS SHOWN. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H2) 24/16 SUPPLY AIR DOWN THROUGH EXISTING OPENING TO 1ST FLOOR. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H3) ROUTE FULL-SIZE, PROPERLY TRAPPED TYPE "L" HARD COPPER CONDENSATE DRAIN PIPING FROM AHU AND TERMINATE AT EXISTING TERMINATION POINT FOR AHU REMOVED DURING DEMOLITION.
- (H4) PROVIDE FLEXIBLE CONNECTION ON UNIT SUCTION AND DISCHARGE. RUN CONDENSATE DRAIN TO CLOSEST FLOOR DRAIN.
- (H5) EXISTING OUTSIDE AIR INTAKE FOR AHU-5 TO RETAIN AND BE REUSED. CLEAN AND PAINT AS REQUIRED.
- (H6) EXTEND OUTSIDE AIR DUCT (SIZE AS NOTED) DOWN TO AHU MIXING PLENUM. PROVIDE MANUAL VOLUME DAMPER. BALANCE TO SCHEDULED AIRFLOW..
- (H7) ENLARGE EXISTING LOUVER OPENING IN WALL AND PROVIDE NEW OUTSIDE AIR INTAKE LOUVER EQUAL TO RUSKIN ELF6375DX WITH BIRDSCREEN AND WHITE FACTORY PAINT FINISH TO MATCH EXISTING WALL. SIZE AS INDICATED.
- (H8) ROUTE PORTION OF EXISTING HIGH LOUVER (SIZE AS NOTED) AND CONNECT AND TRANSITION O/A DUCT FROM LOUVER TO AHU. BLANK OFF REMAINING LOUVER SPACE WITH INSULATED SHEET METAL PANEL AND CUALK AND SEAL WEATHERTIGHT. SLOPE O/A DUCT BACK TO LOUVER BOTTOM.
- (H9) COORDINATE EXACT MOUNTING LOCATION AND ELEVATION OF VAV BOX TO PROVIDE FULL SERVICE CLEARANCE.
- (H10) CONNECT TO EXISTING 20/10 SUPPLY AIR DUCT DOWN. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H11) CONNECT TO EXISTING 20/12 SUPPLY AIR DUCT DOWN. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H12) CONNECT TO EXISTING 24/16 RETURN AIR DUCT DOWN. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H13) EXISTING 14/14 EXHAUST DUCT TO REMAIN AND BE REUSED.
- (H14) EXISTING 30/18 RETURN AIR DUCT TO REMAIN. EXTEND UP AS REQUIRED TO CONNECT NEW RETURN AIR DUCT FULL SIZE OF AHU OPENING. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H15) UNDER ADD ALTERNATE 1, EXTEND NEW STAINLESS STEEL HEATING WATER BOILER FLUE UP THROUGH ROOF BESIDE EXISTING FLUE TO AGA APPROVED CAP.
- (H16) EXISTING 12/12 EXHAUST DUCT TO REMAIN AND BE REUSED.
- (H17) CONNECT NEW 14/14 EXHAUST DUCT TO EXISTING 16/14 EXHAUST DUCT DOWN BELOW AND EXTEND NEW DUCT AS HIGH AS POSSIBLE O/H. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H18) INSTALL NEW EXHAUST FAN AS CLOSE AS POSSIBLE TO DECK.
- (H19) CONNECT NEW 14/14 EXHAUST DUCT TO EXISTING 14/14 EXHAUST DUCT FROM BELOW AND EXTEND NEW DUCT AS HIGH AS POSSIBLE O/H. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION. REFERENCE HVAC DETAILS.
- (H20) CONNECT NEW 24/24 R/A DUCT TO EXISTING R/A DUCT UP FROM BELOW. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION.
- (H21) CONNECT NEW 24/24 S/A DUCT TO EXISTING 22/22 S/A DOWN TO FLOOR BELOW. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION.
- (H22) PROVIDE NEW R/A GRILLE AT LOCATION OF OLD GRILLE REMOVED UNDER DEMOLITION. ENLARGE EXISTING OPENING AS REQUIRED. TRANSITION TO 24/36 R/A PLENUM AND TAP BACK OF DUCT WITH R/A DUCT CONNECTION TO AHU FULL-SIZE OF UNIT R/A OPENING.
- (H23) CONNECT NEW 12/8 S/A DUCT TO EXISTING 12/8 S/A DOWN TO FLOOR BELOW. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION.
- (H24) DROP AND CONNECT S/A DUCT TO EXISTING S/A DOWN TO FLOOR BELOW. DUCT AND OPENING SIZES AS NOTED. PROVIDE NEW OUT-OF-THE-FLOOR FIRE DAMPER AT PENETRATION.
- (H25) CLEAN EXISTING E/A GRILLE AND DUCTWORK, REBALANCE TO INDICATED AIRFLOW.
- (H26) PROVIDE SHEET METAL AUXILIARY DRAIN PAN UNDER FAN COIL.
- (H27) CONNECT NEW 42/10 SUPPLY AIR DUCT TO EXISTING.
- (H28) CONNECT NEW 26/14 RETURN AIR DUCT TO EXISTING.
- (H29) CONNECT NEW 3/4" CONDENSATE DRAIN TO EXISTING.
- (H30) REPLACE EXISTING ROOF-MOUNTED EXHAUST FAN WITH NEW FAN. PROVIDE CURB ADAPTER AS REQUIRED. EXTEND AND CONNECT TO EXISTING E/A DUCT. DUCT SIZE AS INDICATED.



PRESS BOX PLAN – MECHANICAL

(ADD ALTERNATE 3 UNLESS NOTED OTHERWISE)

SCALE: 1/4"=1'-0"

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

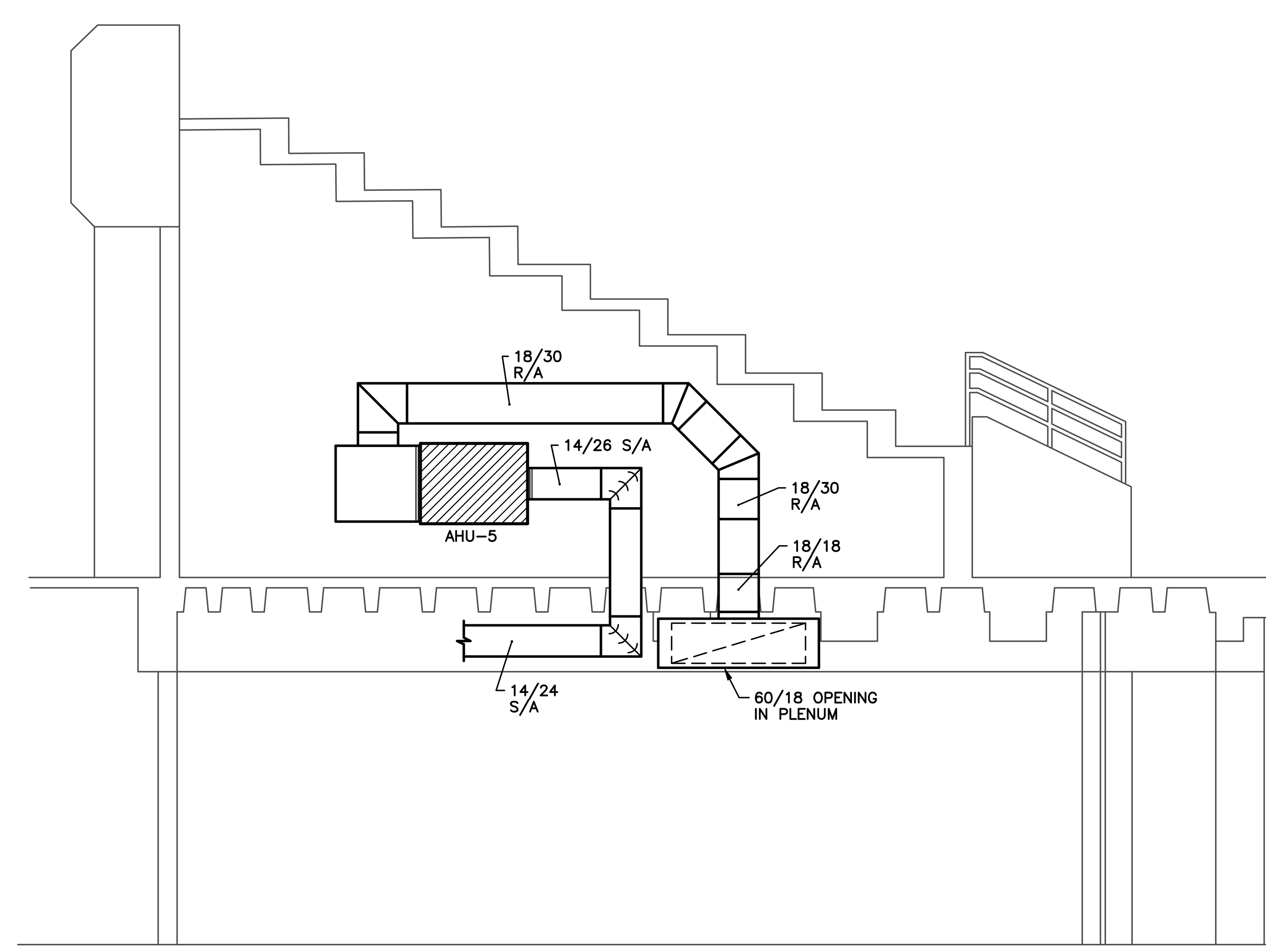
ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.



(A) SECTION (AHU-5)

SCALE: 1/4"=1'-0"

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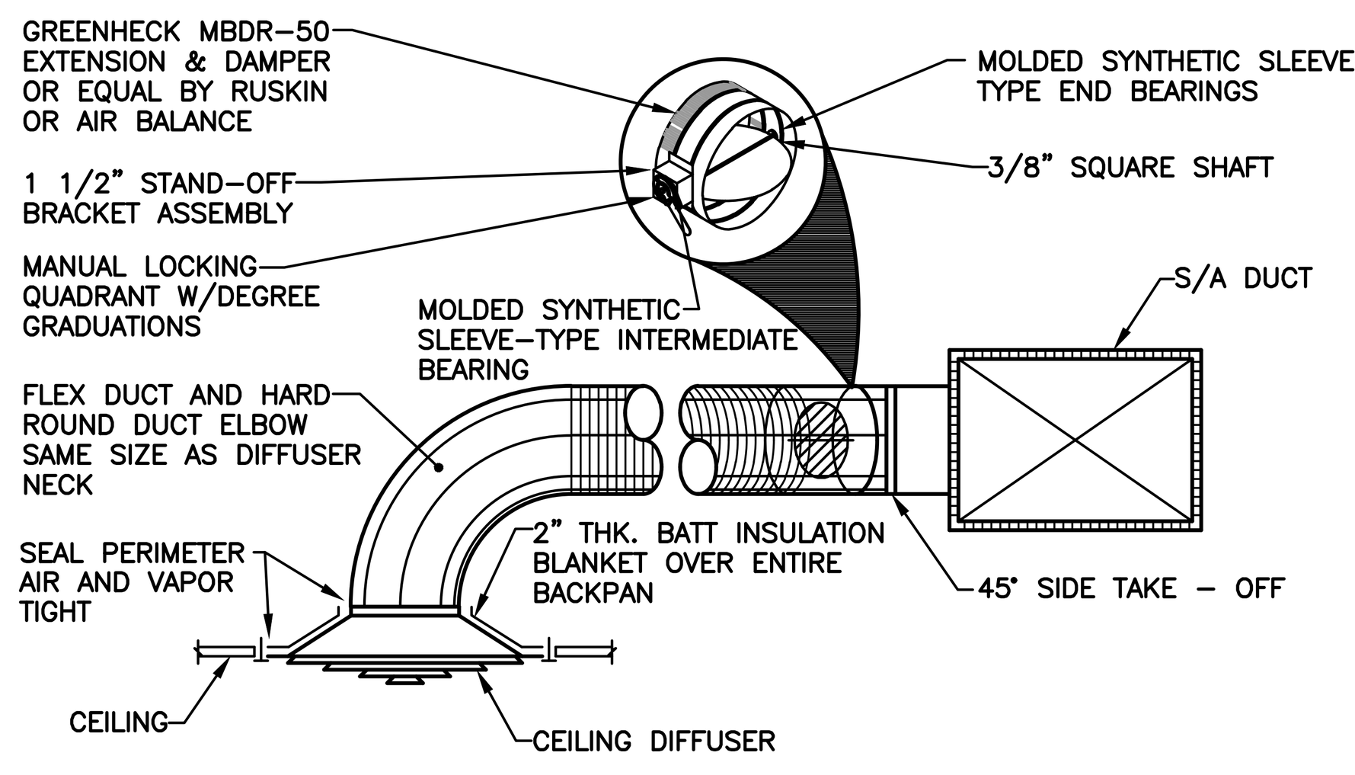
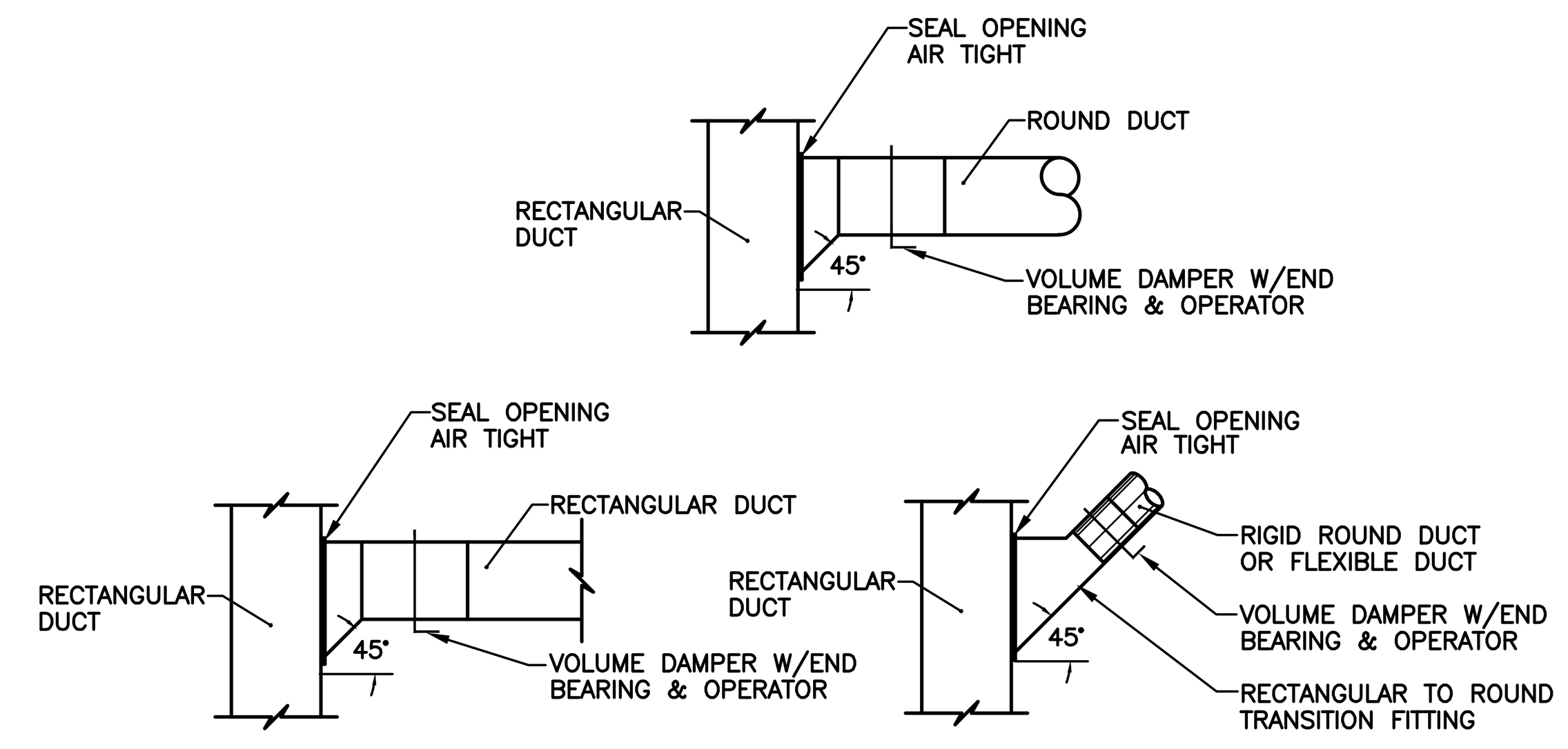


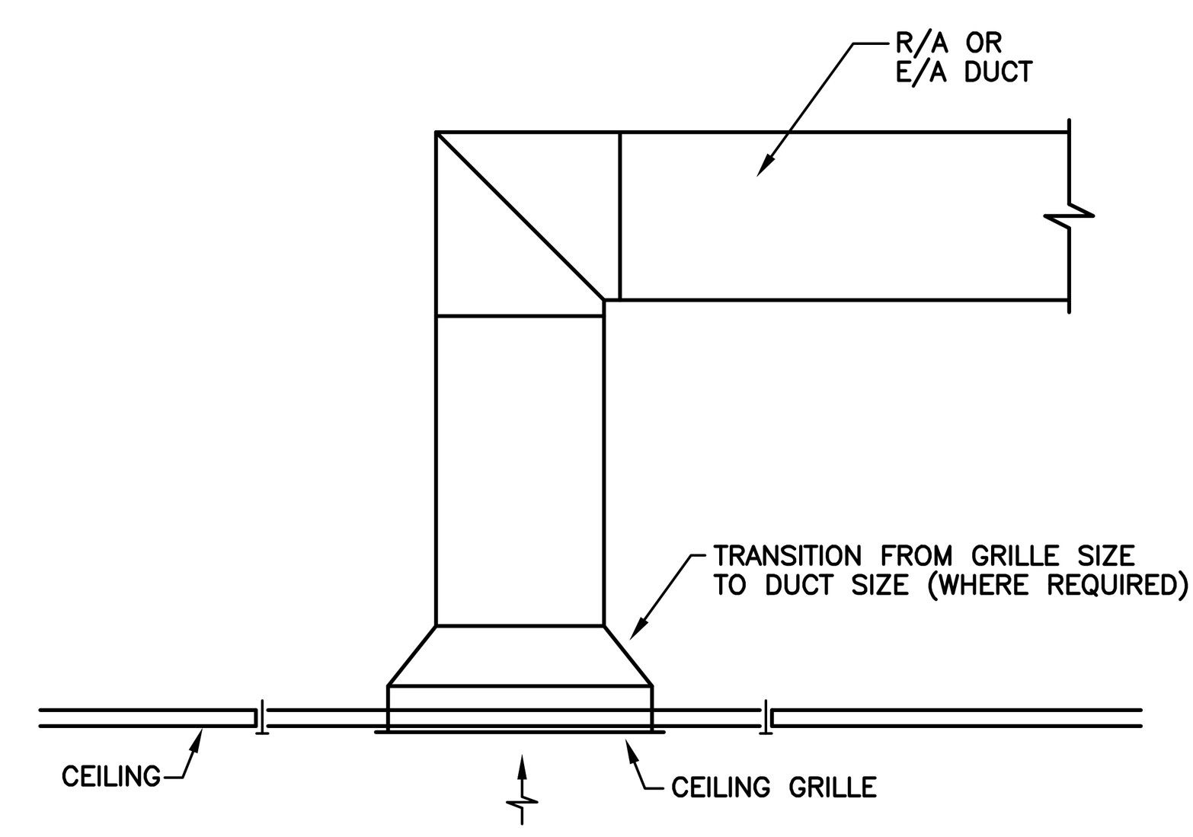
A DETAIL - DIFFUSER CONNECTION

NO SCALE



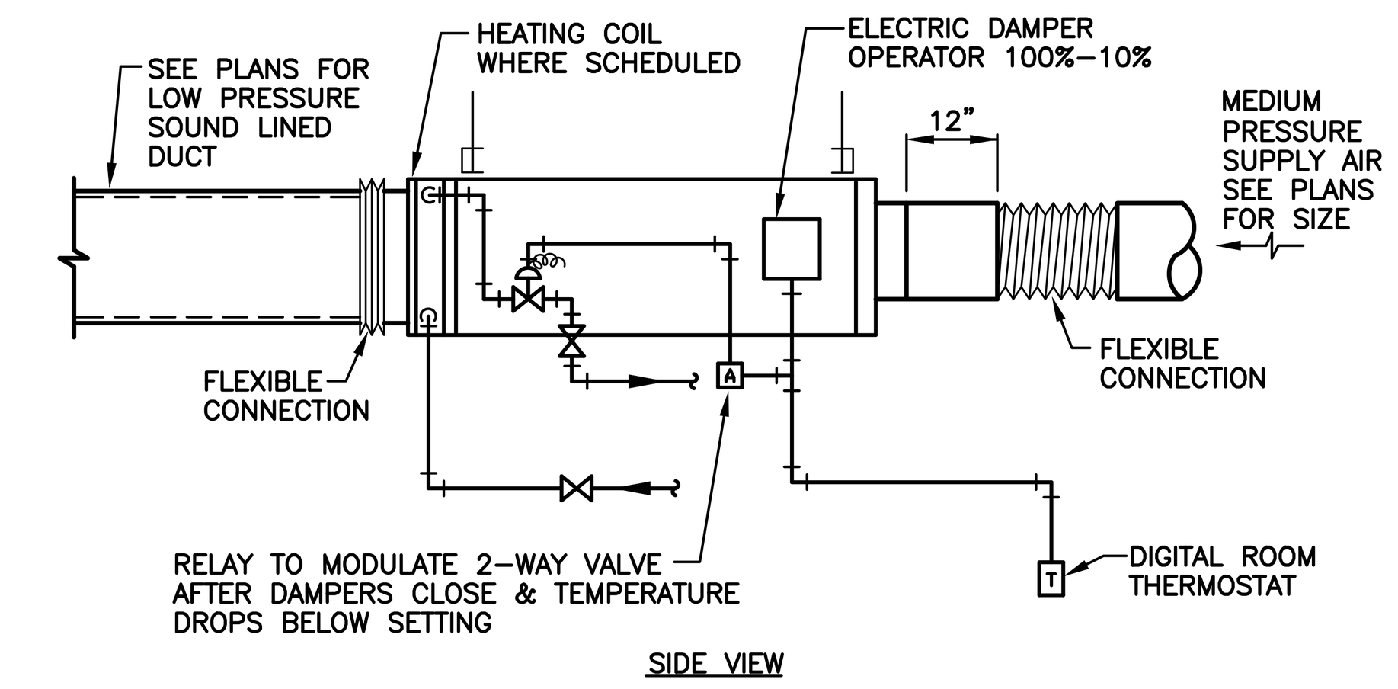
B DETAIL - DUCT TAKE-OFFS

NO SCALE



C DETAIL - RETURN/EXHAUST GRILLE

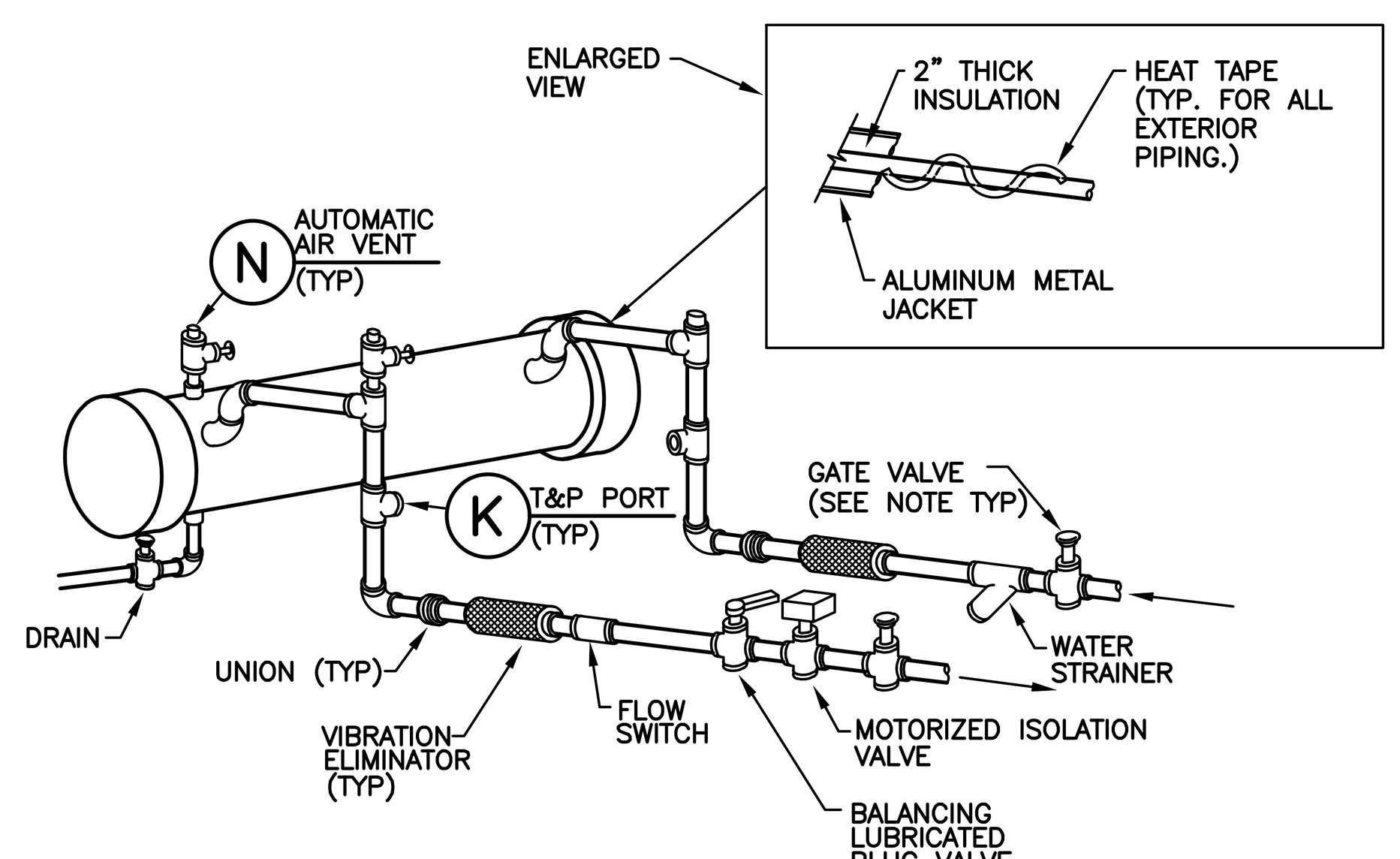
NO SCALE



D DETAIL - V.A.V. TERMINALS W/H.W. COILS

(CONSTANT VOLUME BOXES SIMILAR)

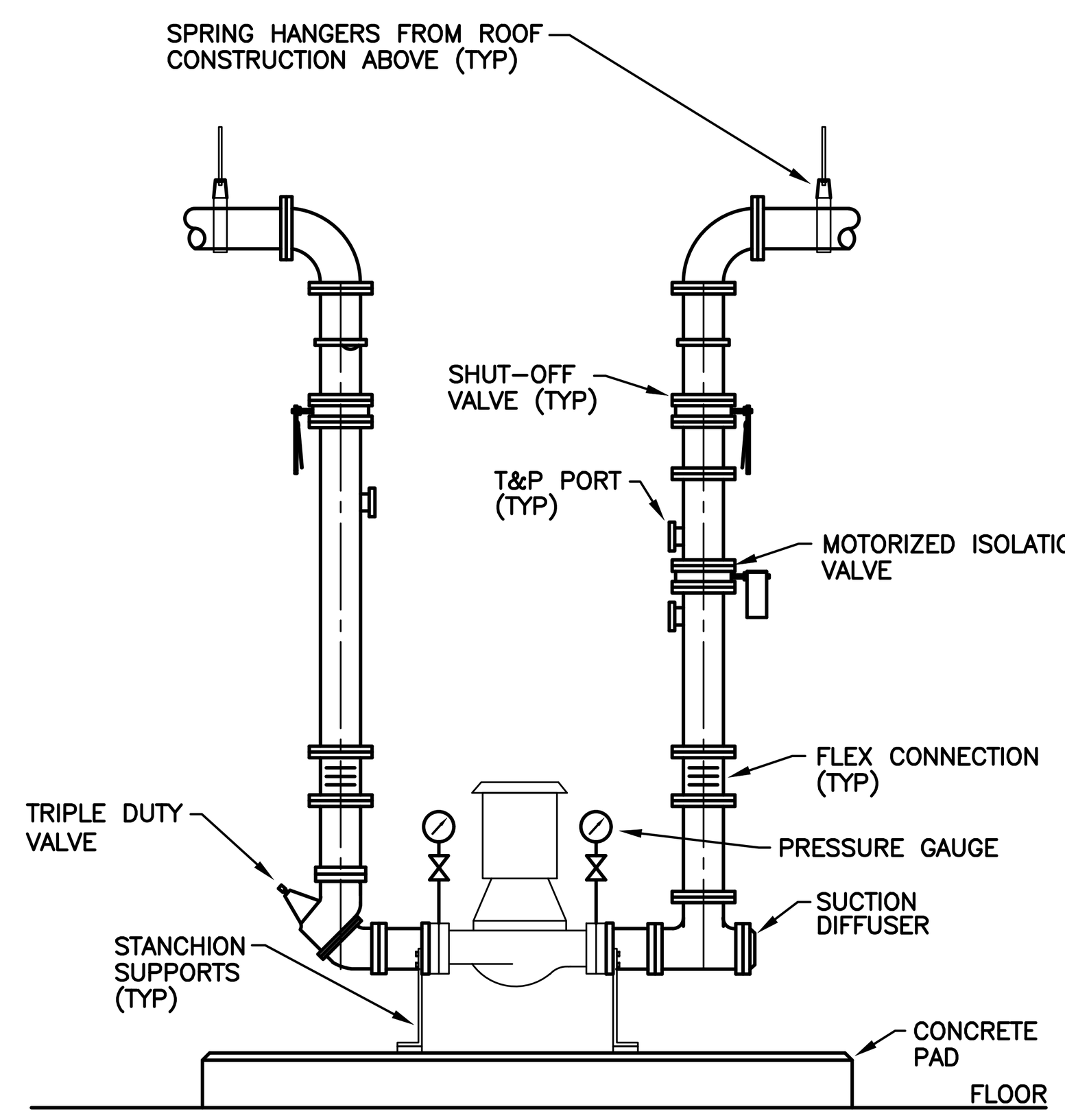
NO SCALE



E DETAIL - AIR COOLED CHILLER PIPING

NO SCALE

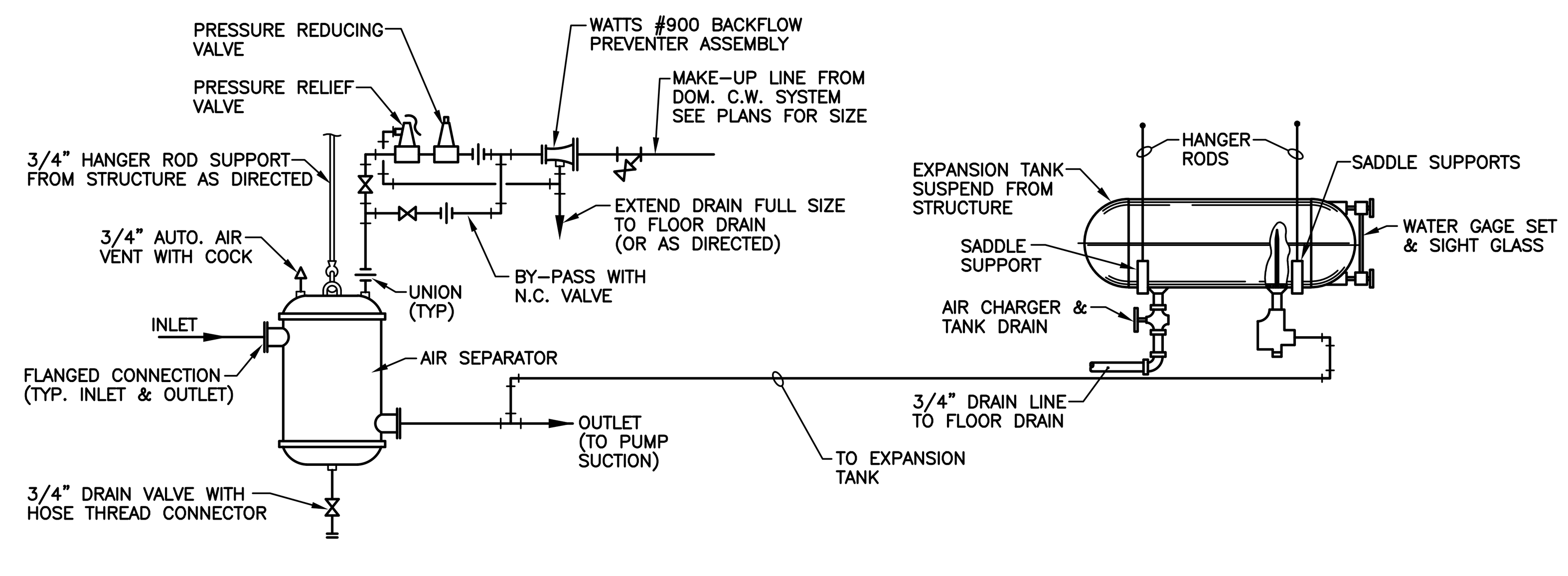
NOTES:
1. SHUTOFF VALVES SHOULD NOT BE CLOSED WITH COLD WATER IN THE CHILLER.
2. SHUT-OFF VALVES TO BE BALL OR GATE VALVES FOR SIZES 2" AND SMALLER, AND BUTTERFLY OR GATE VALVES FOR SIZES 2 1/2" AND LARGER.



F DETAIL - VERTICAL INLINE PUMP

(TYPICAL FOR CHILLED WATER PUMPS)

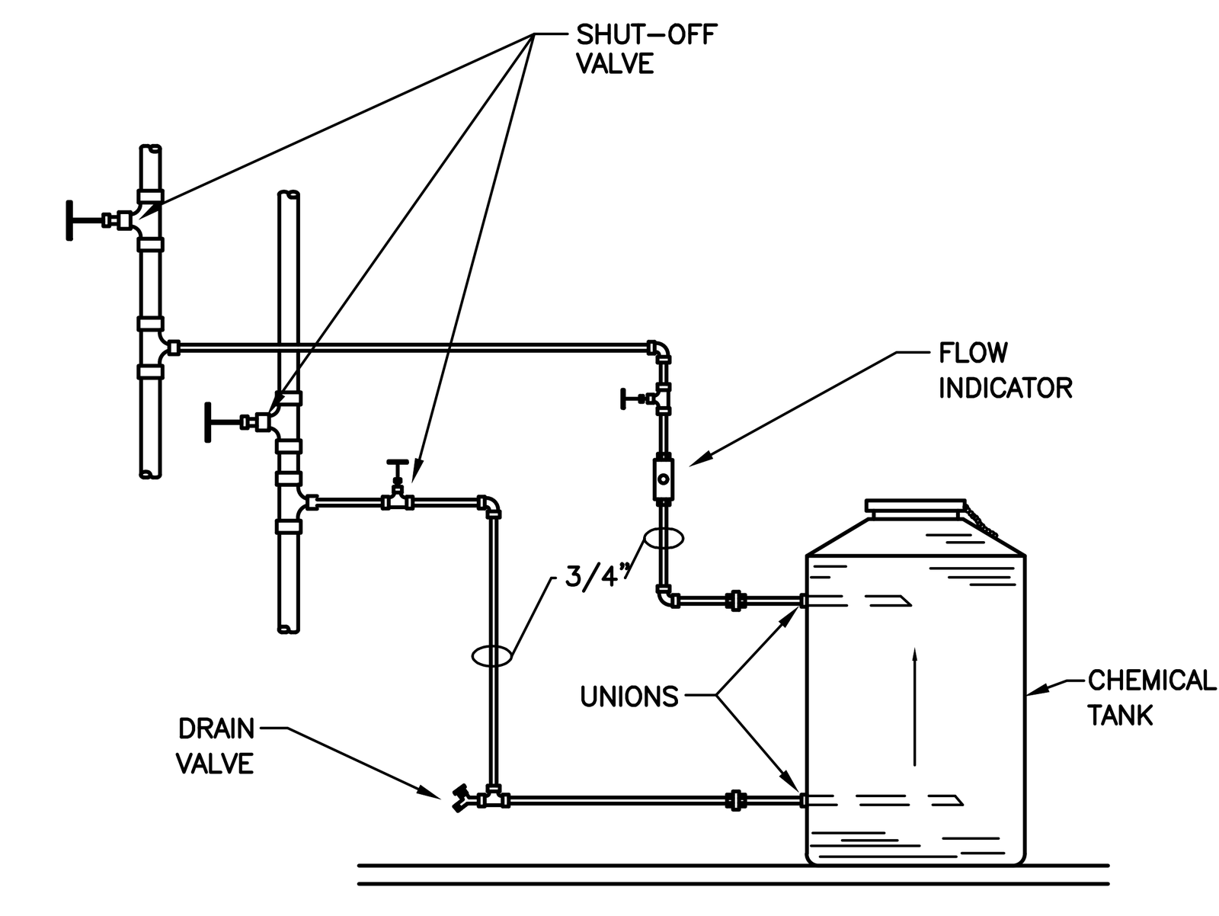
NO SCALE



G DETAIL - AIR SEPARATOR AND EXPANSION TANK

(TYPICAL FOR CHILLED AND HEATING WATER SYSTEMS)
(NOTE: HEATING WATER SYSTEM WORK UNDER ADD ALTERNATE 1)

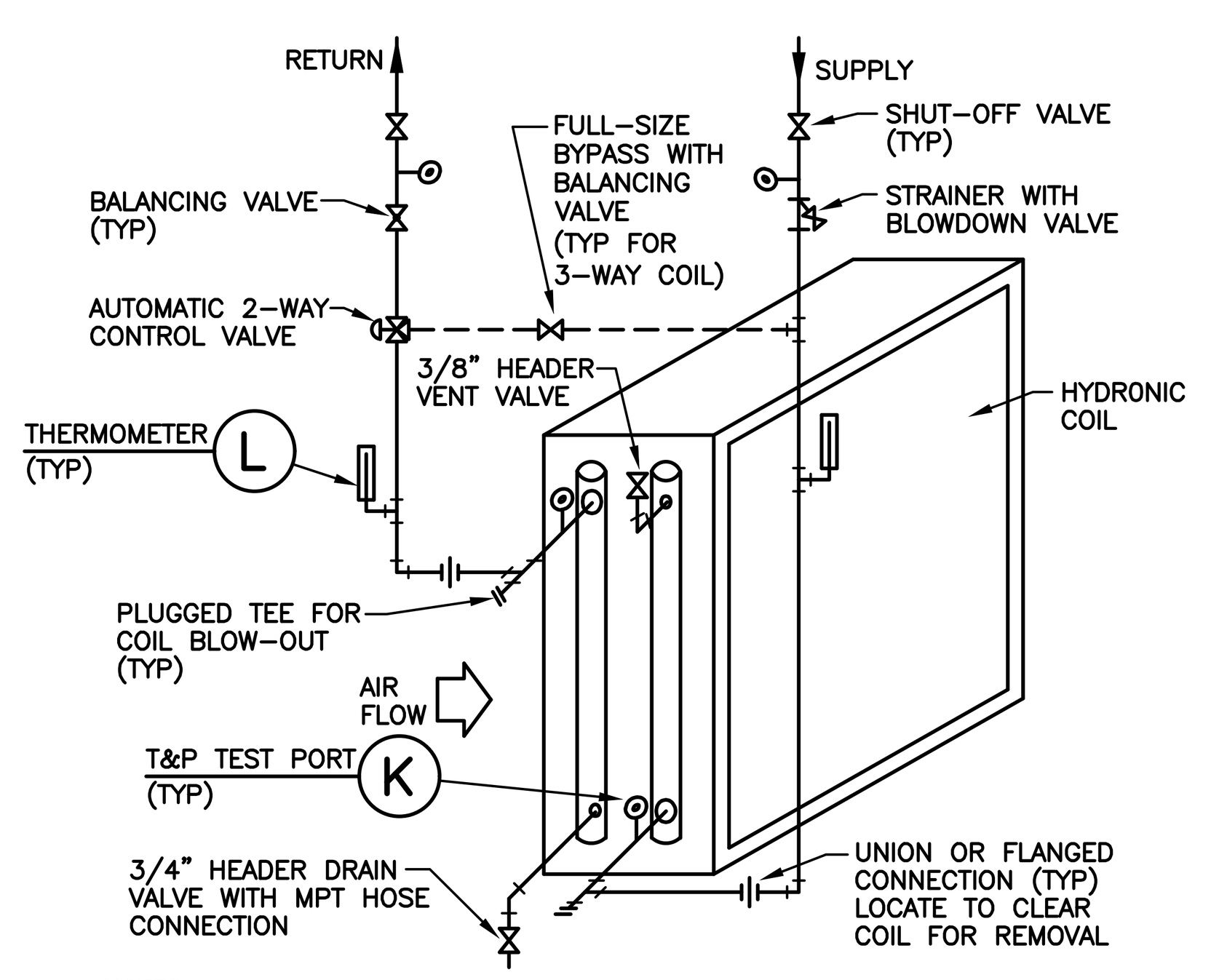
NO SCALE



H DETAIL - CHEMICAL FEEDER

NO SCALE

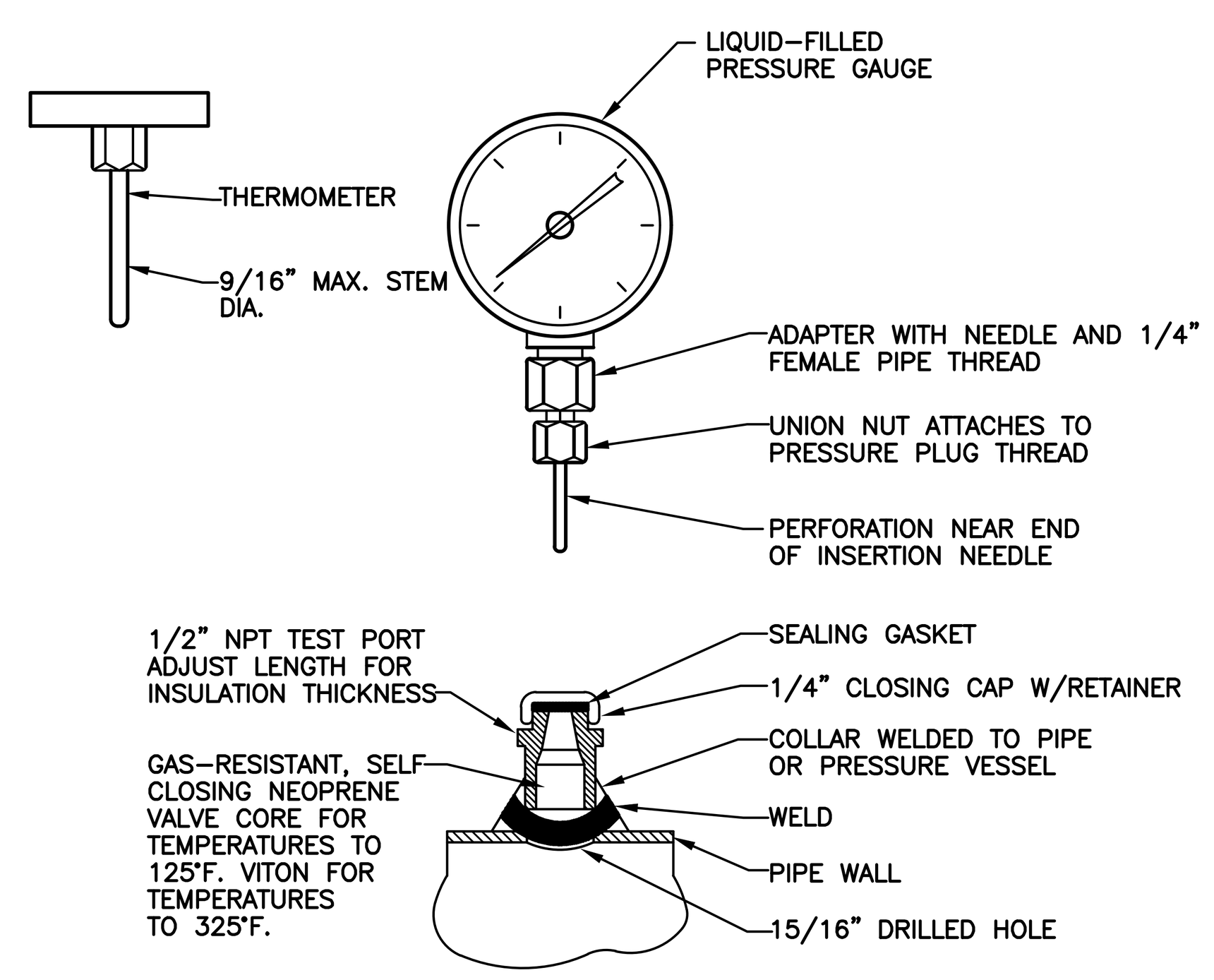
NOTES:
1. SUPPORT TANK FROM WALLS WITH BRACKETS OR FLOOR MOUNT ON 4" HIGH CONCRETE PAD WITH CHAMFERED EDGES.
2. CONTRACTOR SHALL COORDINATE CHEMICAL FEEDER REQUIREMENTS WITH THE UNIVERSITY CHEMICAL SUPPLIER.



NOTES:
1. PIPING TO COOLING AND HEATING COILS THUS.
2. SHUT-OFF VALVES TO BE BALL OR GATE VALVES FOR SIZES 2" AND SMALLER, AND BUTTERFLY OR GATE VALVES FOR SIZES 2 1/2" AND LARGER.

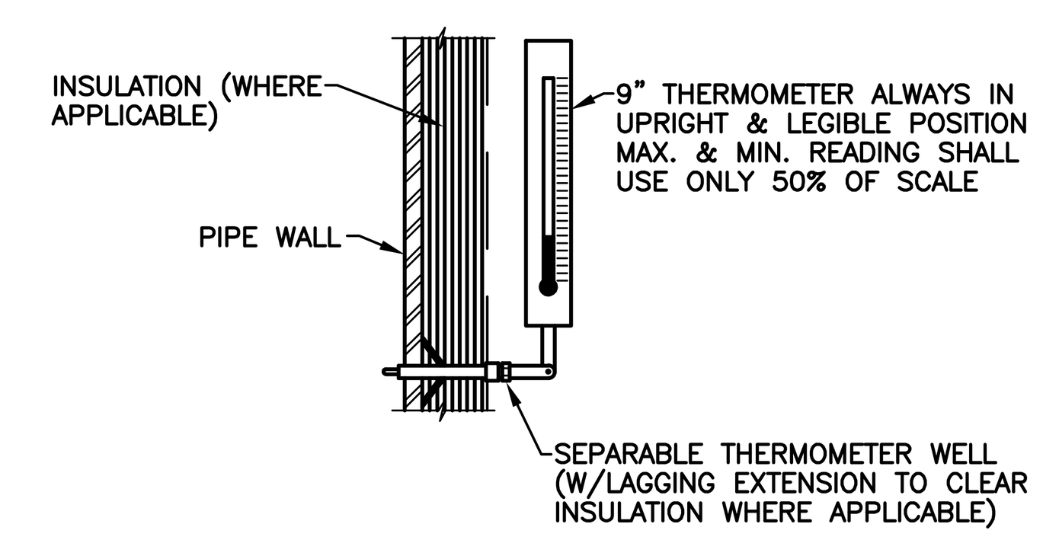
J DETAIL - HYDRONIC COIL CONN. CENTRAL STATION AIR HANDLING UNIT

NO SCALE



K DETAIL - TEMPERATURE AND PRESSURE (T/P) TEST PORT

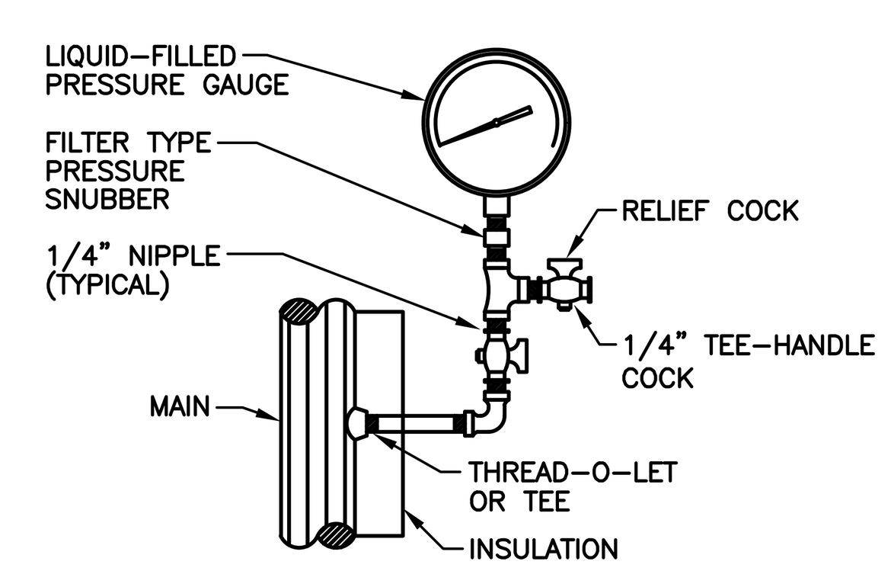
NO SCALE



L DETAIL - THERMOMETER

(HORIZONTAL UNITS SIMILAR)

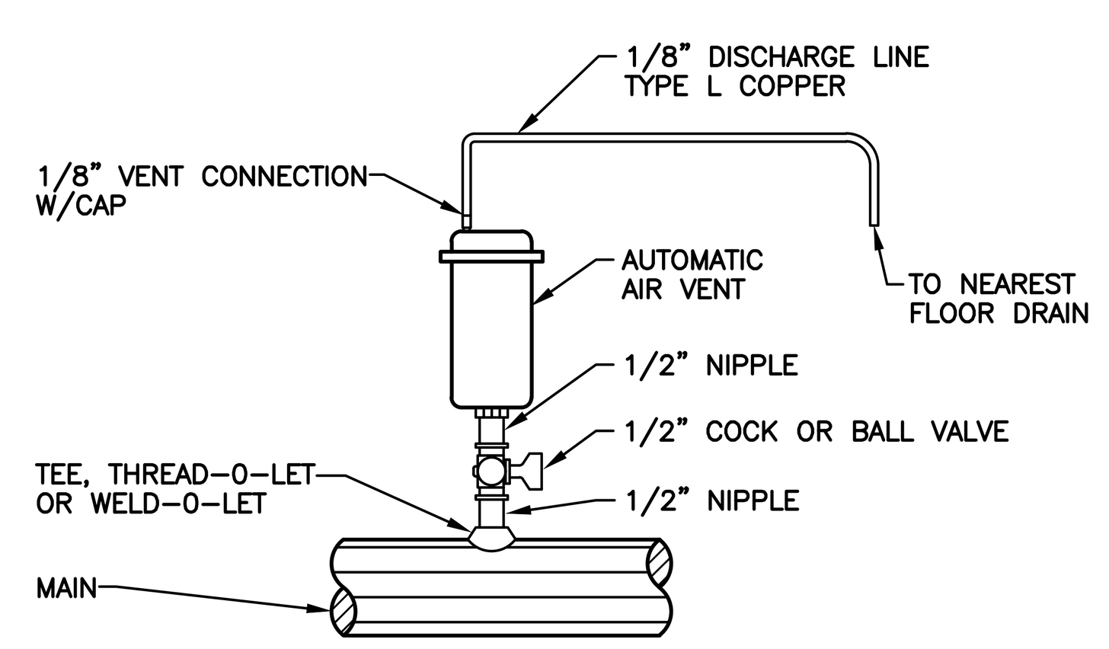
NO SCALE



M DETAIL - PRESSURE GAUGE

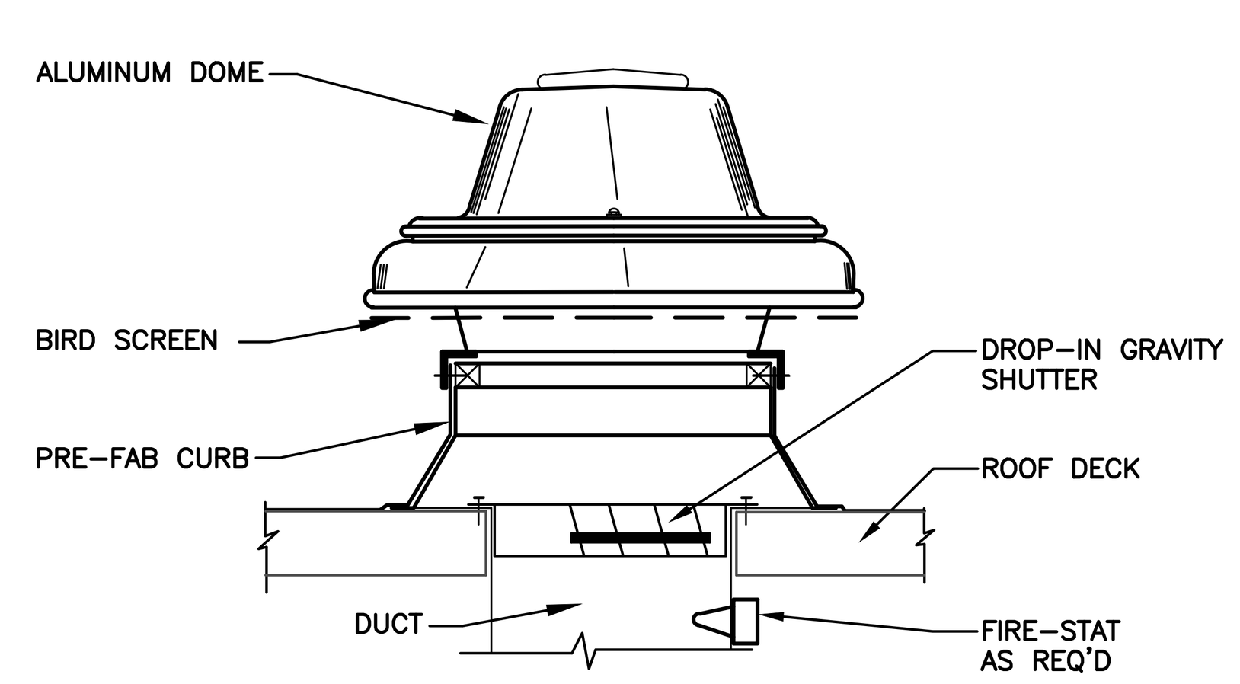
NO SCALE

NOTE: NEEDLE VALVE MAY BE SUBSTITUTED FOR TEE-HANDLE COCKS.



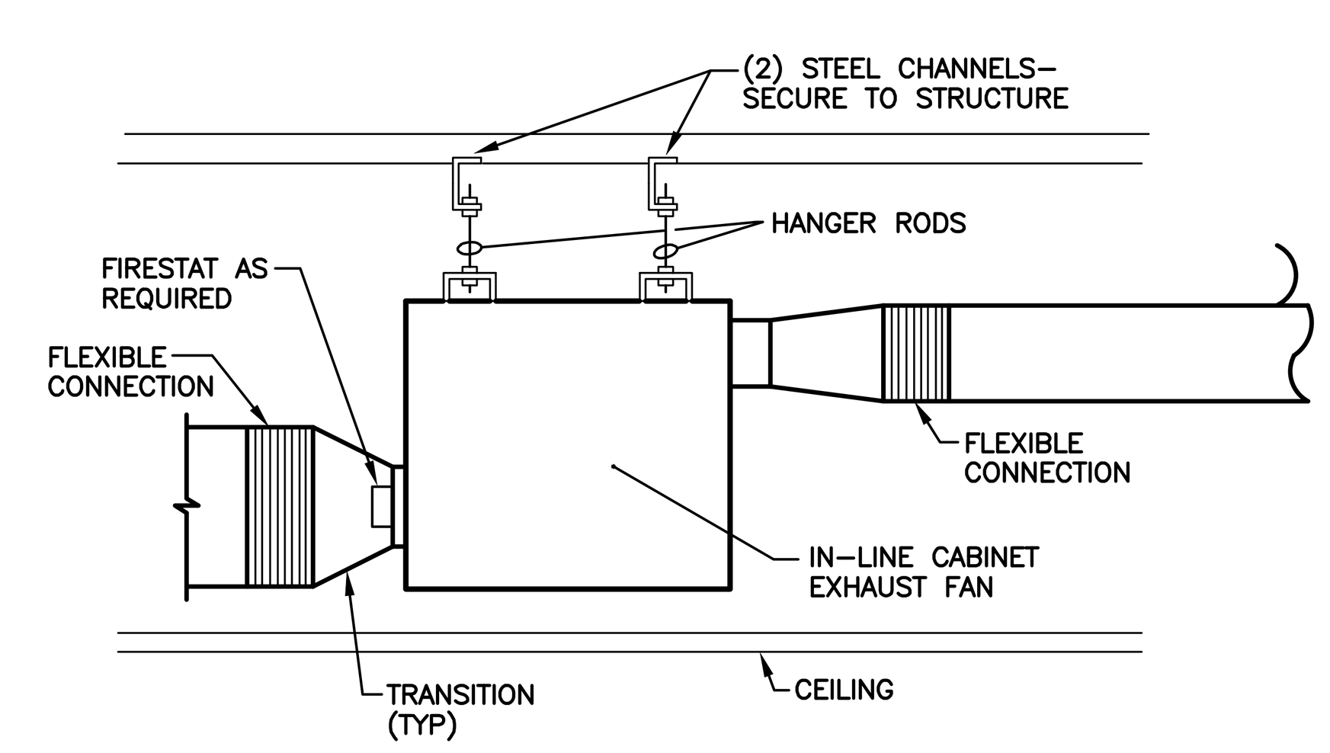
N DETAIL - AUTOMATIC AIR VENT

NO SCALE



P DETAIL - EXHAUST FAN (FLAT ROOF)

NO SCALE



R DETAIL - EXHAUST FAN (IN-LINE)

NO SCALE

HVAC GENERAL NOTES:

1. ALL DUCTWORK SIZES SHOWN ARE INSIDE FREE AREA DIMENSIONS.
2. ALL AIR DEVICES SHALL BE INDEPENDENTLY SUPPORTED FROM STRUCTURE ABOVE WITH CEILING TIE WIRES AND CONCEALED FASTENERS. PROVIDE PLASTER MOUNTING FRAMES FOR ALL AIR DEVICES TO BE MOUNTED IN HARD CEILINGS.
3. PROVIDE NECESSARY OFFSETS TO MAINTAIN MINIMUM 15'-0" DISTANCE BETWEEN OUTSIDE AIR INTAKES AND PLUMBING VENTS, AND EXHAUST AIR OUTLETS. VERIFY EXACT LOCATIONS WITH ARCHITECT AND ENGINEER PRIOR TO MATERIAL ORDER AND INSTALLATION.
4. PROVIDE FLEXIBLE DUCT CONNECTIONS AT ALL AIR HANDLING UNITS (AHUs), FAN-COIL UNITS (FCU) AND EXHAUST FANS (EF).
5. ALL DUCTWORK AND EQUIPMENT SHALL BE INSTALLED AT HIGHEST ELEVATION ACHIEVABLE (TYP). COORDINATE DUCT ROUTING WITH STRUCTURE, FRAME WALL BRACING, LIGHT FIXTURES, ETC.
6. ALL FLEXIBLE DUCT SHALL BE FULLY EXTENDED, FREE OF KINKS, NO LONGER THAN 5'-0" AND SAME SIZE AS DIFFUSER NECK. BRANCH DUCTS AND TAKE-OFFS SHALL BE THE SIZE SAME AS DIFFUSER NECKS UNLESS SPECIFICALLY NOTED OTHERWISE. PROVIDE RECTANGULAR TO ROUND TRANSITIONS OR ADAPTORS AT DIFFUSER NECKS WHERE REQUIRED BY SPECIFIC AIR DEVICE MANUFACTURER. SQUARE NECK SIZE WITH ROUND ADAPTER SHALL BE SELECTED FOR AN NC LEVEL OF 25 OR LESS AT DESIGN AIRFLOW.
7. THIS CONTRACTOR SHALL PROVIDE HVAC SYSTEMS IN STRICT ACCORDANCE WITH APPLICABLE EDITIONS OF NFPA 101 AND NFPA 90A.
8. EQUIPMENT LOCATIONS SHOWN ARE INDICATED IN THEIR GENERAL LOCATIONS. THE CONTRACTOR SHALL COORDINATE EXACT LOCATIONS OF EQUIPMENT ALONG WITH DUCTWORK ROUTING WITH THE ARCHITECTURAL AND STRUCTURAL PLANS AND DETAILS. PRIOR TO FINAL FABRICATION AND INSTALLATION OF DUCTWORK, THE CONTRACTOR SHALL FIELD VERIFY ROUTING WITH STRUCTURAL FRAMING. NOTIFY ARCHITECT/ENGINEER IMMEDIATELY OF SIGNIFICANT DISCREPANCIES AND CONFLICTS.
9. THE INSIDE OF ALL BRANCH DUCTS AND DUCT DROPS TO GRILLES AND DIFFUSERS SHALL BE PAINTED WITH TWO COATS OF FLAT BLACK ENAMEL PAINT SUCH THAT NO "RAW" GALVANIZED STEEL FINISH IS VISIBLE THROUGH THE AIR DEVICE FACE.
10. ALL RECTANGULAR DUCT ELBOWS AND SPLITTER TEES SHALL INCLUDE DOUBLE THICKNESS TURNING VANES, ANCHORED TO DUCT PER SMACNA GUIDELINES.
11. PROVIDE FULL SIZE INTERNALLY LINED DUCT DROPS TO ALL RETURN AIR GRILLES AND EXHAUST GRILLES.
12. CONDENSATE DRAIN PIPING SHALL BE TYPE "L" HARD COPPER WITH TEE FITTINGS AND THREADED CAPS (FOR CLEANOUT) AT ALL CHANGES OF DIRECTION AND AT END OF RUNS. PIPING SHALL BE TERMINATED OPEN-SIGHT AT HUB-DRAINS OR AT ROOF DRAINS AS INDICATED. PROVIDE REDUCERS AND UNIONS AT CONNECTIONS TO EQUIPMENT.
13. MANUAL VOLUME DAMPERS ABOVE RIGID INACCESSIBLE CEILINGS SHALL BE ALUMINUM YOUNG MODEL 820-1200 (RECTANGULAR) AND 5020-1200 (ROUND) OPPOSED BLADE WITH WORM GEAR SELF-LOCKING REGULATOR, FS FLEX SHAFT AND 301-FS CUP CONNECTOR WITH PRIMER COVER PLATES. (PAINT TO MATCH ADJACENT CEILING FINISHES).
14. CONTRACTOR SHALL INSTALL ALL FAN-COIL UNITS AND VAV BOXES WITH ASSOCIATED DUCTWORK, PIPING AND ACCESSORIES ABOVE CEILING, SUCH THAT A MINIMUM OF 36" CLEAR SPACE IS AVAILABLE FOR SERVICE, CLEANING, FILTER CHANGES AND ROUTINE MAINTENANCE.
15. INTERNALLY LINE SUPPLY AIR AND RETURN AIR DUCTWORK AS INDICATED. EXTERNALLY WRAP ALL DUCTWORK AS SPECIFIED.
16. COORDINATE EXACT LOCATIONS OF CEILING AIR DEVICES WITH ARCHITECTURAL REFLECTED CEILING PLANS. AIR DEVICES SMALLER THAN FULL GRID SPACING SHALL BE CENTERED IN TILES AND INSTALLED WITH SURFACE MOUNT FRAMES AND CONCEALED FASTENERS.
17. THE SIZE AND WEIGHT OF ALL HVAC EQUIPMENT IS BASED UPON THE MANUFACTURER'S PUBLISHED DATA FOR THE SPECIFIED EQUIPMENT ITEMS. CONTRACTOR SHALL VERIFY THE EXACT WEIGHT OF THE SUBMITTED HVAC EQUIPMENT WITH THE STRUCTURAL ENGINEER, PRIOR TO INSTALLATION.
18. ALL EQUIPMENT, PIPING, DUCTWORK, ETC. SUPPORTS AND INSERTS ATTACHED TO THE STRUCTURE SHALL BE INSTALLED PRIOR TO APPLYING BUILDING INSULATION. COORDINATE WITH OTHER TRADES.
19. FIRE DAMPERS AS APPROVED BY LOCAL GOVERNING AUTHORITIES SHALL BE INSTALLED IN ALL DUCTWORK PASSING THRU A ROOF, FLOOR FIRE PARTITION, OR FIRE WALL. PROVIDE ACCESS.

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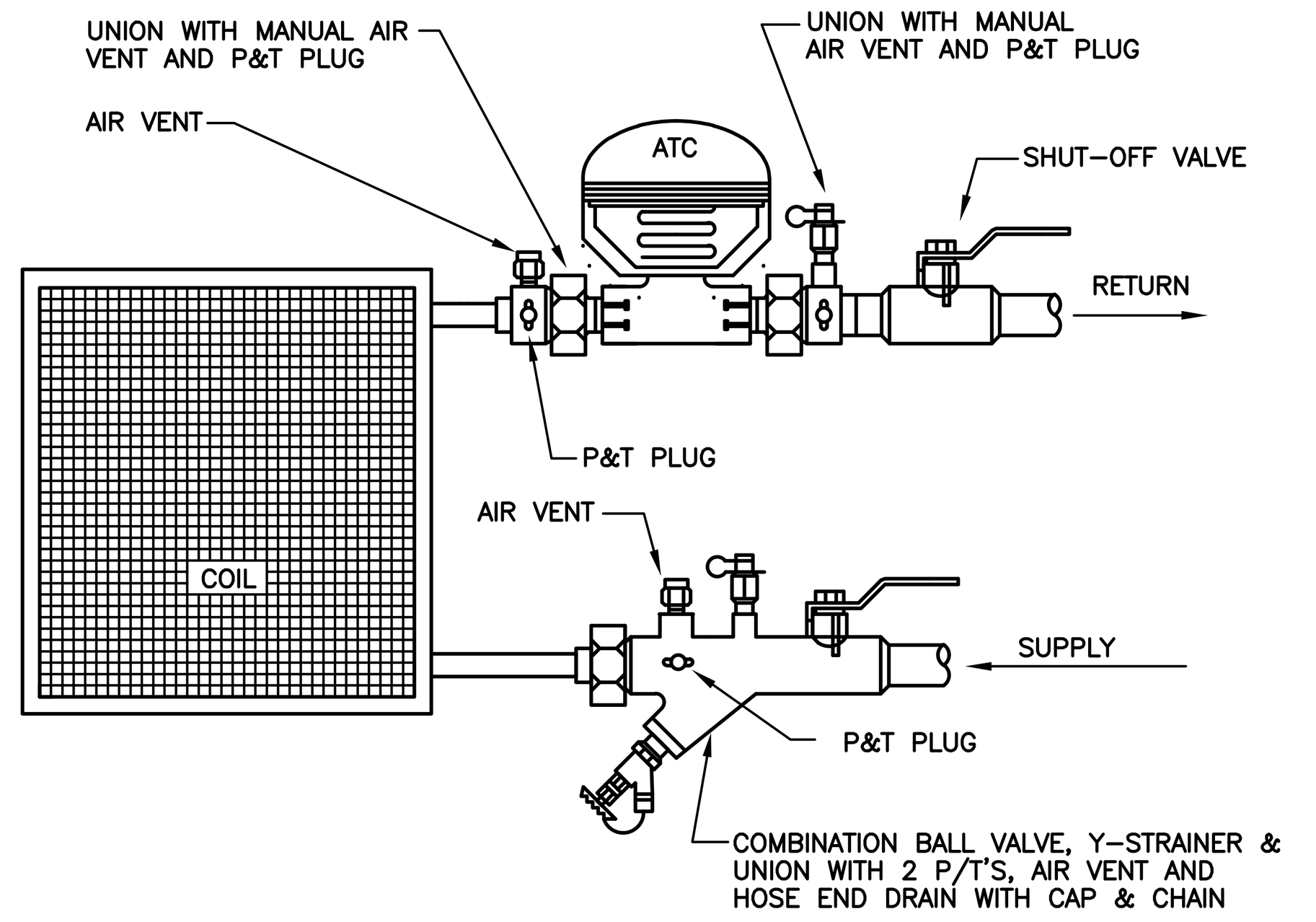
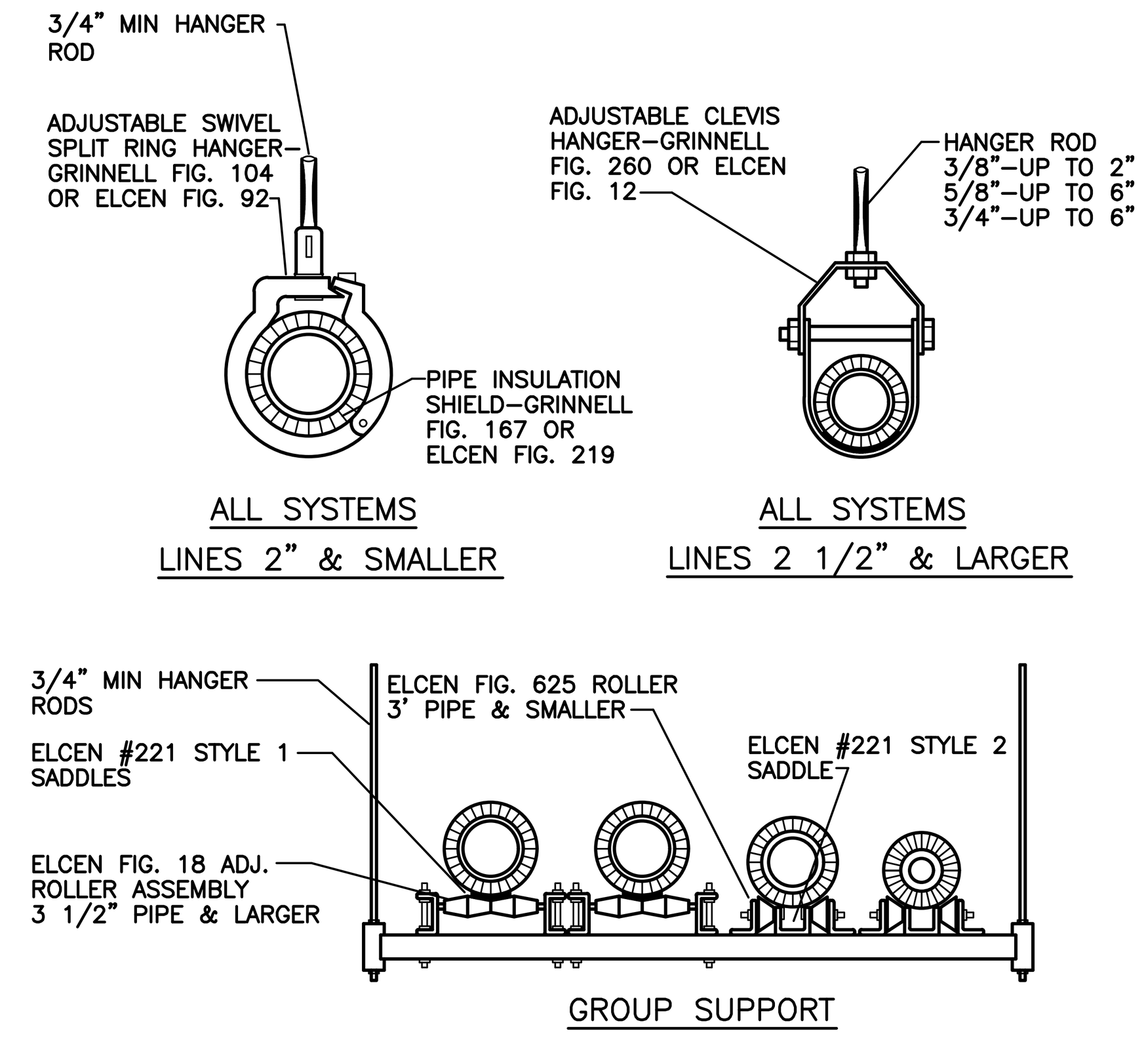
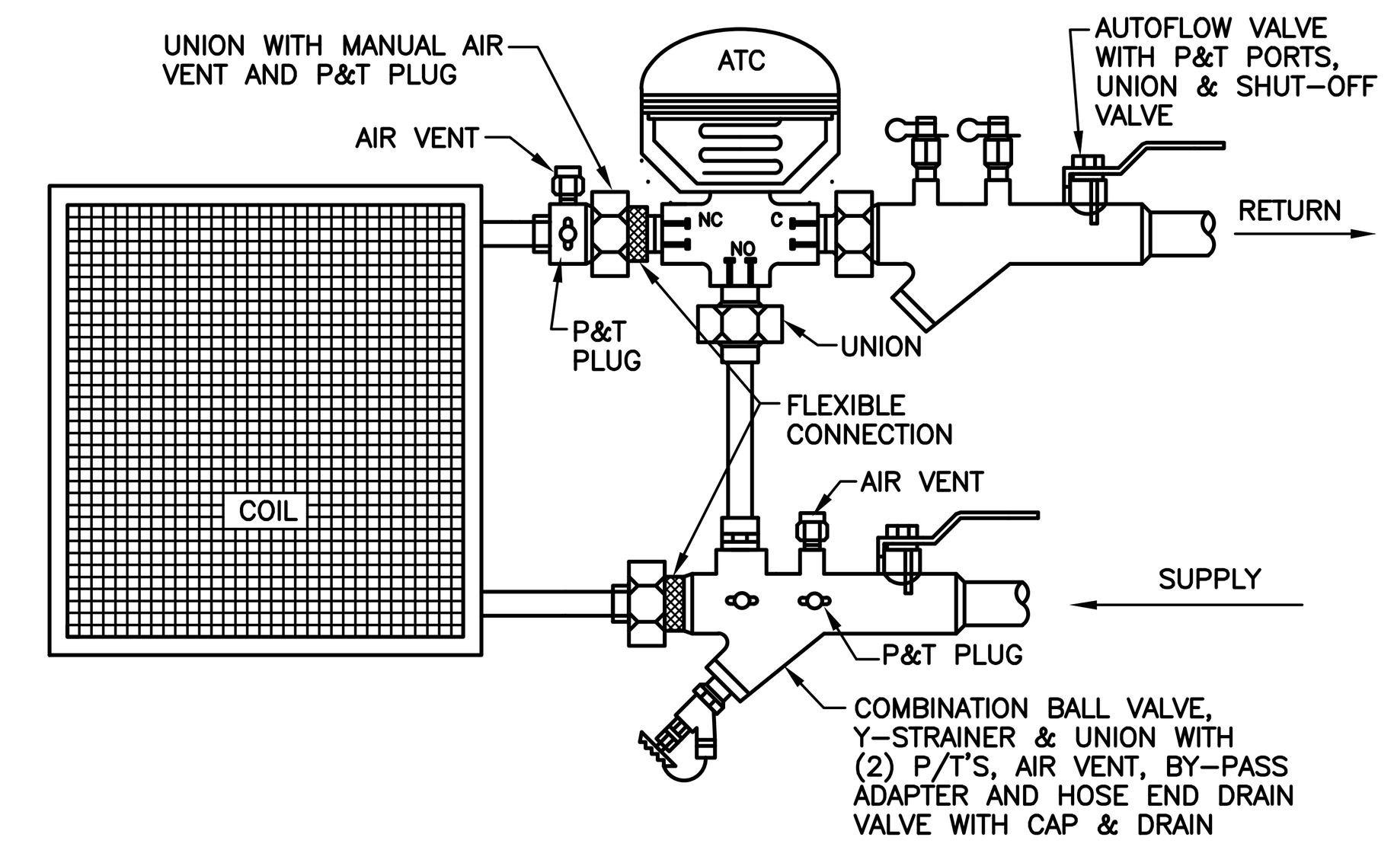


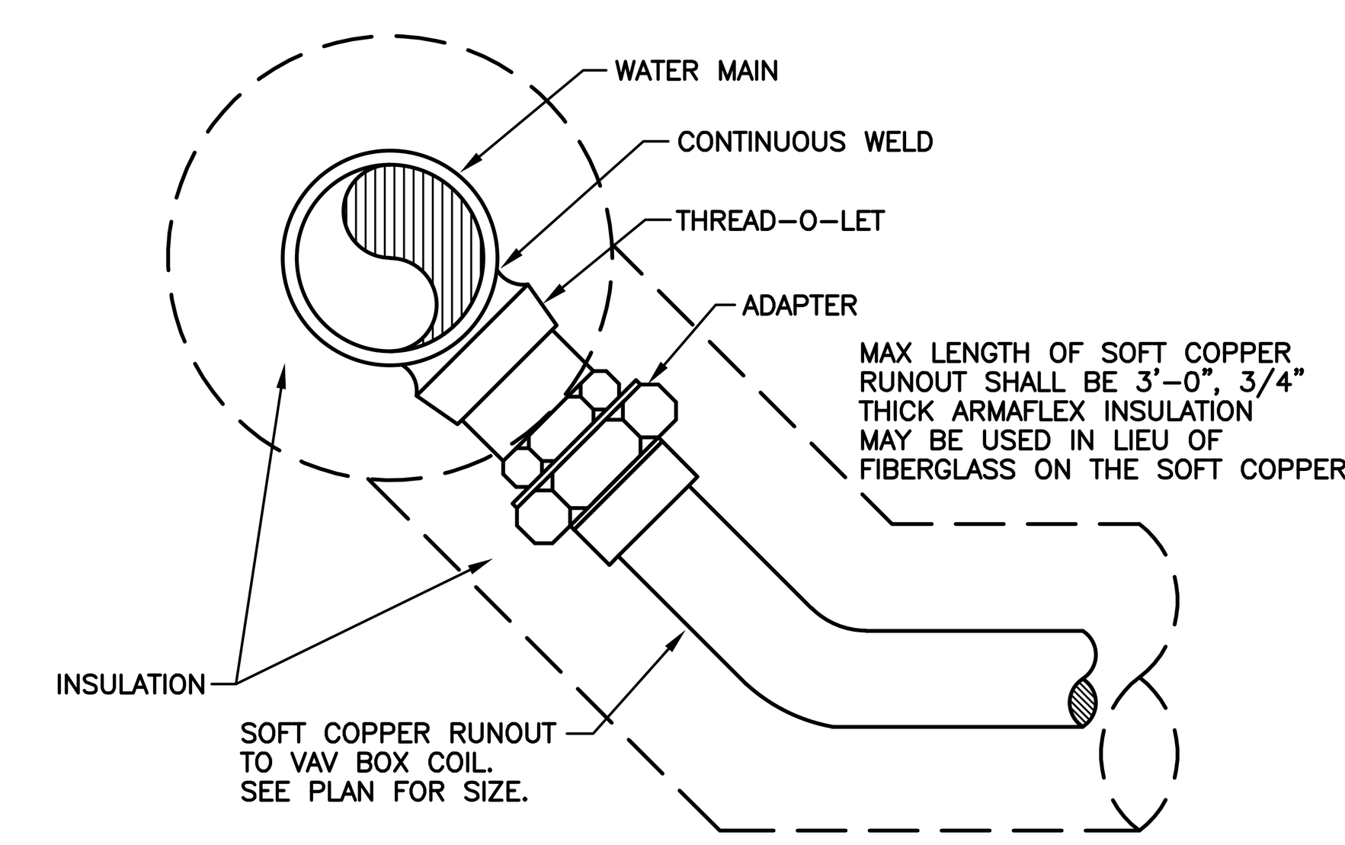
A DETAIL – 2-WAY HEATING & COOLING COILS
(TYP FOR FAN-COIL UNITS AND VAV BOXES)
NO SCALE



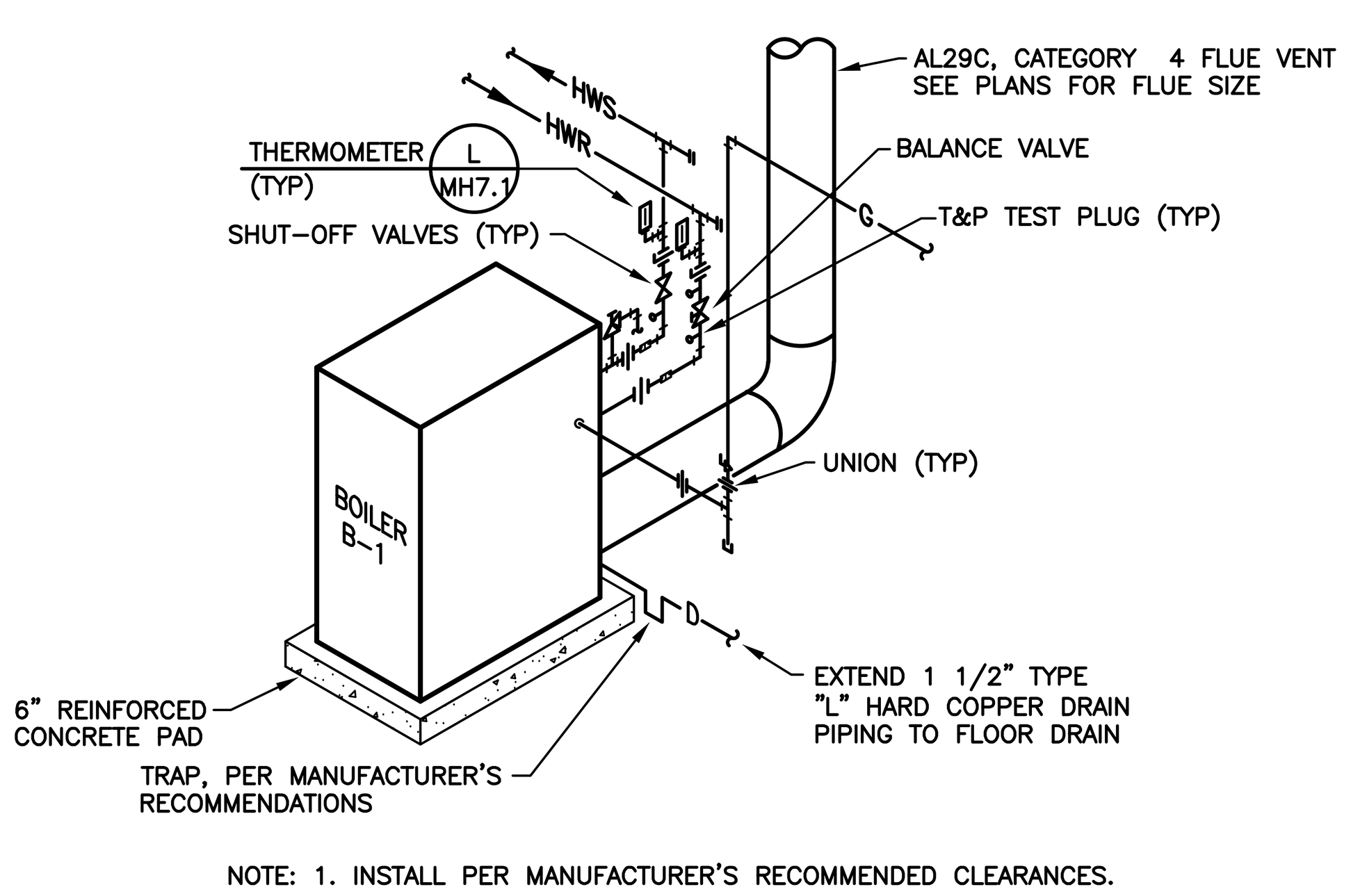
B DETAIL – PIPE SUPPORTS
NO SCALE



C DETAIL – 3-WAY N.C. COILS
NO SCALE

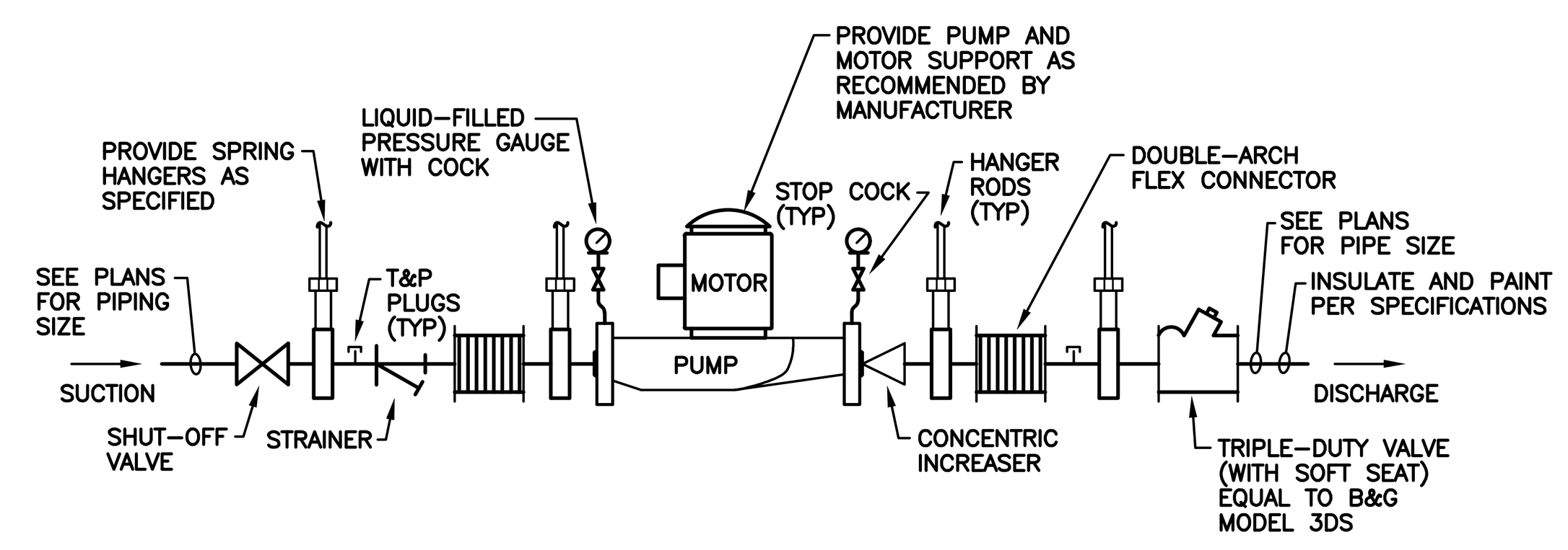


D DETAIL – PIPE RUN-OUT TO MAIN
NO SCALE

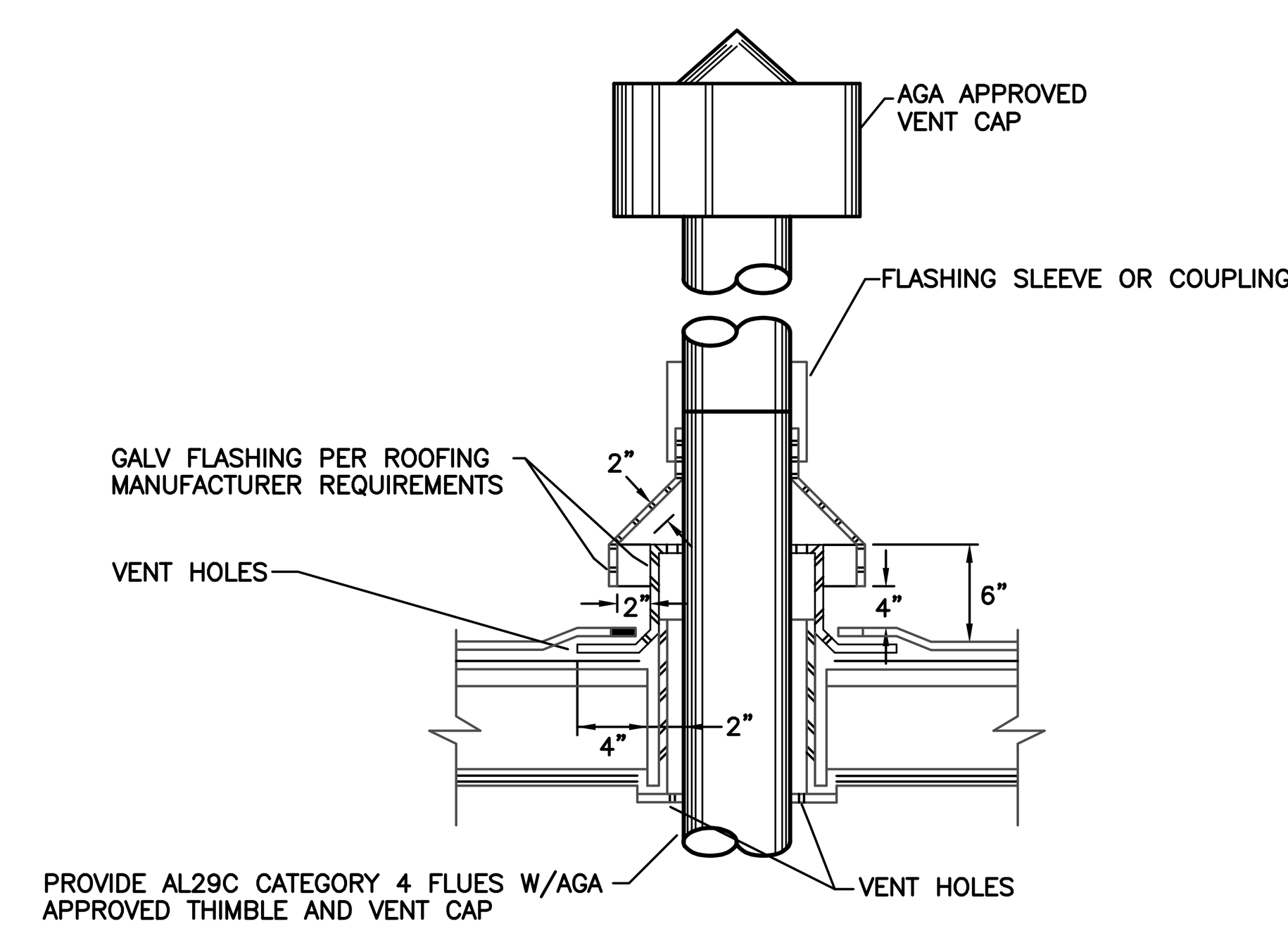


NOTE: 1. INSTALL PER MANUFACTURER'S RECOMMENDED CLEARANCES.

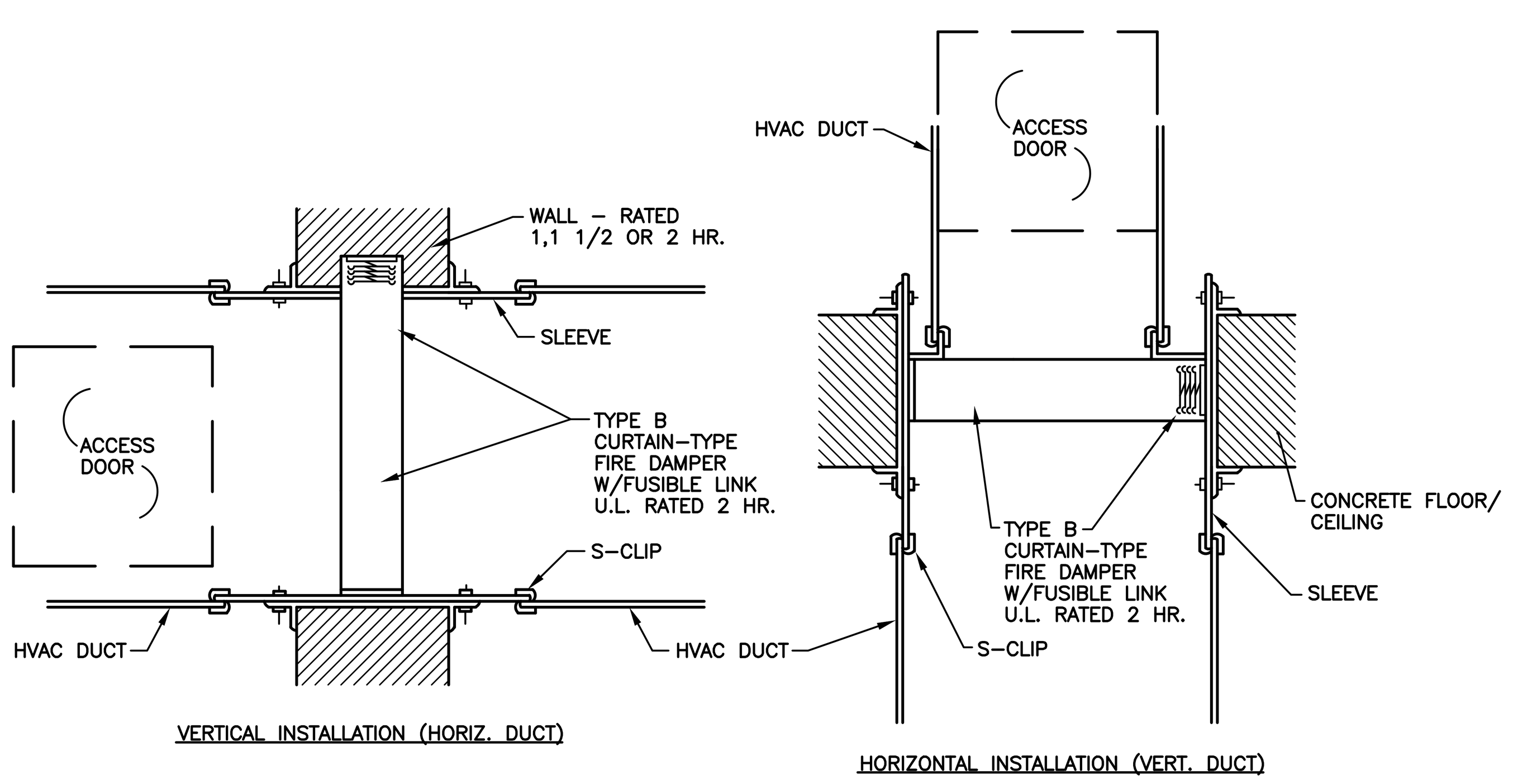
E DETAIL – HEATING WATER BOILER
(ADD ALTERNATE 1)
NO SCALE



F DETAIL – SUSPENDED IN-LINE PUMP
(TYPICAL FOR HEATING WATER PUMPS – ADD ALTERNATE 1)
NO SCALE



G DETAIL – FLUE W/FLASHING & CAP
(TYP FOR HEATING WATER BOILER – ADD ALTERNATE 1)
NO SCALE



H DETAIL – FIRE DAMPERS
NO SCALE

STATE OF LOUISIANA
THOMAS G. SANDERS
REG. No. 28647
REGISTERED PROFESSIONAL ENGINEER IN MECHANICAL ENGINEERING
05/05/25

EMA
DESIGN SOLVE ENHANCE
EMA Engineering & Consulting, INC.
9441 STEVENS ROAD, SUITE 200
SHREVEPORT, LOUISIANA 71106
318 425 4500
LOUISIANA Registered Engineering Firm #EF-5818
TEXAS Registered Engineering Firm #F-893

HVAC RENOVATIONS AT WARHAWK FIELD
UNIVERSITY OF LOUISIANA MONROE
322 WARHAWK WAY
MONROE, LOUISIANA

NO.	DATE	REVISIONS

JOB NO: 5-001-2338-002
CHECKED BY: RW
DRAWN BY: WJW
DATE: 05-02-2025
SCALE: AS SHOWN

SHEET
MH7.2

AIR HANDLING UNIT SCHEDULE

MARK		AHU-1	AHU-2	AHU-3	AHU-4	AHU-5
		BASE BID	ADD. ALT. 2	ADD. ALT. 2	ADD. ALT. 3	BASE BID
LOCATION		MECH ROOM	MECH ROOM	MECH ROOM	MECH ROOM	MECH ROOM
AREAS SERVICED		WEIGHT ROOM	HOME LOCKERS	SHOWERS/VIP	VISITOR	COACHES/MEETING
TYPE		DRAW THRU VAV	DRAW THRU VAV	DRAW THRU VAV	DRAW THRU VAV	DRAIN THRU VAV
FAN						
TYPE		PLENUM	PLENUM	PLENUM	PLENUM	PLENUM
AIRFLOW	CFM	3000	3000	3000	2000	4000
ESP	IN WG	0.75	2.00	2.00	0.75	2.50
OUTSIDE AIR	CFM	500	800	800	800	750
FAN SPEED	RPM	1435	2375	2775	1450	2375
MOTOR HORSEPOWER	HP	4.42	4.42	4.42	2 X 1/2	2 X 4.42
MOTOR TYPE		ECM	ECM	ECM	ECM	ECM
DRIVE TYPE		DIRECT	DIRECT	DIRECT	DIRECT	DIRECT
VOLTS/PHASE		208/3	208/3	208/3	208/3	208/3
PREHEAT COIL						
TYPE		HOT WATER	HOT WATER	HOT WATER	HOT WATER	HOT WATER
AIRFLOW	CFM	3000	3000	3000	2000	4000
HEATING CAPACITY	MBH	63.9	103.6	109.8	123.7	109.8
AIR PRESSURE DROP	IN WG					
ENTERING AIR TEMPERATURE (DB)	F	40.0	40.0	40.0	40.0	40.0
LEAVING AIR TEMPERATURE (DB)	F	90.0	60.0	60.0	108.6	60.0
WATER FLOW	GPM	4.3	7.0	7.4	8.3	7.4
ENTERING WATER TEMPERATURE	F	160.0	160.0	160.0	160.0	160.0
LEAVING WATER TEMPERATURE	F	130.0	130.0	130.0	130.0	130.0
WATER PRESSURE DROP	FT WG	6.5	6.0	6.5	6.0	6.5
NUMBER OF COILS		ONE	ONE	ONE	ONE	ONE
ROWS/FINS PER FOOT		1/12	1/12	1/12	2/12	1/12
HOT WATER PIPE SIZE	IN	1"	1 1/4"	1 1/4"	1 1/4"	1 1/4"
REHEAT COIL		N/A	TERMINALS	TERMINALS	N/A	TERMINALS
COOLING COIL						
TYPE		CHILLED WATER	CHILLED WATER	CHILLED WATER	CHILLED WATER	CHILLED WATER
AIRFLOW	CFM	3000	3000	3000	2000	4000
MAX FACE VELOCITY	FPM	375	375	375	375	500
TOTAL CAPACITY	MBH	66.1	108.8	125.6	96.5	134.9
SENSIBLE CAPACITY	MBH	51.8	74.8	89.5	60.7	98.9
AIR PRESSURE DROP	IN WG					
ENTERING AIR TEMPERATURE	F	79.0/65.5	83.5/68.5	81.5/67.5	86.5/71.0	80.0/66.5
LEAVING AIR TEMPERATURE	F	54.7/54.3	53.1/52.9	54.2/54.0	52.9/52.7	54.1/53.9
WATER FLOW	GPM	11.0	18.1	20.9	16.1	22.5
ENTERING WATER TEMPERATURE	F	44	44	44	44	44
LEAVING WATER TEMPERATURE	F	56	56	56	56	56
WATER PRESSURE DROP	FT WG	4.0	9.0	11.5	7.5	4.5
NUMBER OF COILS		ONE	ONE	ONE	ONE	ONE
ROWS/FINS PER INCH		6/12	6/12	6/12	6/16	6/12
CHILLED WATER PIPE SIZE	IN	1 1/4"	1 1/2"	1 1/2"	1 1/2"	2"
AIR FILTER						
TYPE/THICKNESS		T.A./2"	T.A./2"	T.A./2"	T.A./2"	T.A./2"
MERV		8	8	8	8	8
ELECTRICAL						
SINGLE POINT CONNECTION		YES	YES	YES	YES	YES
VOLTS/PHASE		208/3	208/3	208/3	208/3	208/3
MCA	AMP	14.4	26.0	26.0	13.4	26.0
OCPD	AMP	25.0	35.0	35.0	15.0	35.0
APPROX UNIT DIMENSIONS (L x W x H)	FT	5'X5'X1.5'	5'X5'X2'	5'X5'X2'	5'X5'X1.5'	5'X5'X3'
APPROX UNIT WEIGHT	LBS	750	750	750	750	1000
MANUFACTURER		DAIKIN	DAIKIN	DAIKIN	DAIKIN	DAIKIN
MODEL NUMBER		BCHE 0401	BCHE 0401	BCHE 04301	BCHE 0401	BCHE 0401
REMARKS		1,2,3	1,2,3	1,2,3	1,2,3	1,2,3

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. PROVIDE SMOKE DETECTOR ON UNIT RETURN SIDE.
2. DOUBLE WALL CONSTRUCTION.
3. PROVIDE WITH SUPPLY FAN VFD.

FAN COIL UNIT SCHEDULE (ADD ALTERNATE 3)

MARK		FCU-1	FCU-2
LOCATION		CEILING	CEILING
SERVICE		PRESS BOX	PRESS 2
TYPE		HORIZONTAL	HORIZONTAL
FAN			
TYPE		FC	FC
AIRFLOW	CFM	825	825
ESP	IN WG	0.2	0.2
OUTSIDE AIR	CFM	N/A	N/A
FAN SPEED	RPM		
MOTOR HORSEPOWER	HP	291 WATT	291 WATT
DRIVE TYPE		DIRECT	DIRECT
MOTOR TYPE		ECM	ECM
VOLTS/PHASE		208/1	208/1
HEATING COIL			
TYPE		HOT WATER	HOT WATER
AIRFLOW	CFM	825	825
ENTERING AIR TEMPERATURE (DB/WB)	F	60	60
LEAVING AIR TEMPERATURE (DB/WB)	F	131	131
CAPACITY	MBH	65.2	65.2
WATERFLOW	GPM	4.3	4.3
ENTERING WATER TEMPERATURE	F	160	160
LEAVING WATER TEMPERATURE	F	130	130
WATER PRESSURE DROP	FT WG	5.5	5.5
ROWS/FINS PER FOOT		2/12	2/12
HOT WATER PIPE SIZE		1"	1"
COOLING COIL			
TYPE		CHILLED WATER	CHILLED WATER
AIRFLOW	CFM	825	825
ENTERING AIR TEMPERATURE	F	78.0/65.0	78.0/65.0
LEAVING AIR TEMPERATURE	F	53.7/53.7	53.7/53.7
TOTAL CAPACITY	MBH	28.2	28.2
SENSIBLE CAPACITY	MBH	22.2	22.2
WATERFLOW	GPM	4.7	4.7
ENTERING WATER TEMPERATURE	F	44	44
LEAVING WATER TEMPERATURE	F	56	56
WATER PRESSURE DROP	FT WG	3.0	3.0
ROWS/FINS PER INCH		4/12	4/12
CHILLED WATER PIPE SIZE		1"	1"
FILTER			
TYPE/THICKNESS		T.A./2"	T.A./2"
MERV		8	8
ELECTRICAL			
SINGLE POINT CONNECTION		YES	YES
VOLTS/PHASE		208/1	208/1
MCA		1.4	1.4
OCPD		15.0	15.0
APPROX UNIT DIMENSIONS (L x W x H)	FT	4'X3'X1.5'	4'X3'X1.5'
APPROX UNIT WEIGHT	LBS	350	350
MANUFACTURER		"WILLIAMS"	"WILLIAMS"
MODEL NUMBER		LH-R-012	LH-R-012
REMARKS		1,2,3	1,2,3

NOTES:
1. PROVIDE MOISTURE DETECTOR IN AUXILIARY DRAIN PAN.
2. PROVIDE 2 – WAY TEMPERATURE CONTROL VALVE ON HEATING COIL.
3. PROVIDE 3 – WAY TEMPERATURE CONTROL VALVE ON COOLING COIL.

AIR COOLED CHILLER SCHEDULE

MARK		CH-1
LOCATION		MECHANICAL YARD
SERVICE		BASEBALL STADIUM
TYPE		AIR COOLED
REFRIGERANT TYPE		R 32
NOMINAL CAPACITY	TONS	
ACTUAL CAPACITY	TONS	55.77
EER		11.30
IPLV		17.45
EVAPORATOR		
ENTERING WATER TEMPERATURE	F	56
LEAVING WATER TEMPERATURE	F	44
WATERFLOW	GPM	115
WATERFLOW RANGE (MIN–MAX)	GPM	66.0–264.0
WATER PRESSURE DROP	FT WG	7.0
PRESSURE DROP (MIN–MAX)	FT WG	2.5–38.0
CONDENSER		
AMBIENT TEMPERATURE	F	99
COMPRESSOR NUMBER		4
COMPRESSOR TYPE		SCROLL
INPUT POWER	KW	59.25
ELECTRICAL		
SINGLE POINT CONNECTION		YES
VOLTS/PHASE		460/3
MCA	AMP	119.0
OCPD	AMP	125.0
APPROX OPERATING WEIGHT	LBS	3600
APPROX DIMENSIONS (L x W x H)	FT	7.5'X7.5'X8.5'
MANUFACTURER		DAIKIN
MODEL NUMBER		AGZ 004 F
REMARKS		1

NOTES:
1. MANUFACTURERS FURNISHED STRAINER.

MECHANICAL LEGEND

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	SUPPLY AIR DIFFUSER OR DUCT		DOMESTIC COLD WATER (CW)
	RETURN AIR GRILLE, REGISTER OR DUCT		DOMESTIC HOT WATER (HW)
	EXHAUST AIR GRILLE, REGISTER OR DUCT		DOMESTIC HOT WATER RETURN (HWR)
	ADJUSTABLE SPLITTER TEE W/TURNING VANES (S/A ONLY)		SANITARY SEWER OR WASTE (SS OR W)
			SANITARY VENT (V)
	DUCT TRANSITION – CONCENTRIC, ECCENTRIC		STORM DRAIN PIPING (SD)
U/G	UNDERGROUND	—G—	GAS PIPING
	FLEXIBLE DUCT	—MPG—	MEDIUM PRESSURE GAS
	LINED DUCTWORK		CLEAN OUT (CO)
	ELBOW W/DOUBLE THICKNESS VANES		CLEAN OUT – WALL (WCO)
	MANUAL VOLUME DAMPER		DOUBLE CLEAN OUT (DCO)
	ADJUSTABLE SCOOP		GATE VALVE
	MANUAL SPLITTER		FULL–PORT BALL VALVE
FD	FIRE DAMPER		UNION
SD	SMOKE DAMPER		LUBRICATED PLUG COCK
T	THERMOSTAT		BUTTERFLY VALVE
H	HUMIDISTAT		NON–SLAM SWING CHECK VALVE
—RL—	REFRIGERANT LIQUID		VALVE IN VERTICAL
—RS—	REFRIGERANT SUCTION		WALL FAUCET (WF) OR HOSE BIBB (HB)
—D—	DRAIN LINE		CONNECT TO EXISTING
—AD—	AUXILIARY DRAIN LINE	FD(/TG)	FLOOR DRAIN (WITH TRAP GUARD)
AHU	AIR HANDLING UNIT	FFCO	FINISHED FLOOR CLEAN OUT
EF	EXHAUST FAN	VTR	VENT THRU ROOF
FCU	FAN COIL UNIT	RD	ROOF DRAIN
EAT	ENTERING AIR TEMPERATURE	U/G	UNDERGROUND
LAT	LEAVING AIR TEMPERATURE	U/S	UNDER SLAB
CU	CONDENSING UNIT	U/F	UNDER FLOOR
S/A	SUPPLY AIR	AFF	ABOVE FINISHED FLOOR
R/A	RETURN AIR	TYP	TYPICAL
E/A	EXHAUST AIR	UNO	UNLESS NOTED OTHERWISE
O/A	OUTSIDE AIR	FMCS	FACILITY MANAGEMENT AND CONTROL SYSTEM
OBD	OPPOSED BLADE DAMPER	OSD	OPEN SITE DRAIN
VFD	VARIABLE FREQUENCY DRIVE	HD	HUB DRAIN
CFM	CUBIC FEET PER MINUTE	CFM	CUBIC FEET PER MINUTE

CONTROL VALVE SCHEDULE

EQUIPMENT					CONTROL VALVE							
MARK	FLUID	WATER FLOW	COIL WPD	MAIN PIPE CONN	MARK	ACTION	TYPE	POSITION	MINIMUM REQUIRED CV	SIZE	ACTUATOR	NOTES
		GPM	FT WG	IN						IN		
AHU-1	CHILLED WATER	20	4.0	1 1/4"	V-1	MODULATING	3-WAY	NORMALLY CLOSED	6.8	1"	ELECTRIC	1,3
AHU-1	HEATING WATER	4.3	6.5	1"	V-2	MODULATING	3-WAY	OPEN TO BY-PASS	3.6	3/4"	ELECTRIC	1,2
AHU-2	CHILLED WATER	20	9.0	1 1/2"	V-1	MODULATING	3-WAY	OPEN TO BY-PASS	8.5	1"	ELECTRIC	1,3
AHU-2	HEATING WATER	7.0	6.0	1 1/4"	V-2	MODULATING	3-WAY	OPEN TO BY-PASS	3.6	3/4"	ELECTRIC	1,2
AHU-3	CHILLED WATER	20	11.5	1 1/2"	V-1	MODULATING	3-WAY	OPEN TO BY-PASS	8.5	1"	ELECTRIC	1,3
AHU-3	HEATING WATER	7.4	6.5	1 1/4"	V-2	MODULATING	3-WAY	OPEN TO BY-PASS	3.6	3/4"	ELECTRIC	1,2
AHU-4	CHILLED WATER	20	7.5	1 1/2"	V-1	MODULATING	3-WAY	OPEN TO BY-PASS	8.5	1"	ELECTRIC	1,3
AHU-4	HEATING WATER	8.3	6.0	1 1/4"	V-2	MODULATING	3-WAY	OPEN TO BY-PASS	4.2	3/4"	ELECTRIC	1,2
AHU-5	HEATING WATER	7.4	6.5	1 1/4"	V-2	MODULATING	3-WAY	OPEN TO BY-PASS	3.6	3/4"	ELECTRIC	1,2
AHU-5	CHILLED WATER	30	4.5	1 1/2"	V-1	MODULATING	3-WAY	OPEN TO BY-PASS	15	1 1/4"	ELECTRIC	1,3

NOTES:
1. FINAL SELECTION BY CONTROLS CONTRACTOR.
2. PREHEAT COIL.
3. COOLING COIL.
4.

HYDRONIC EQUIPMENT SCHEDULE

AS - 1
AIR SEPARATOR - CHI LLED WATER LOOP
MANUFACTURER: "TACO" OR EQUIVALENT
MODEL NO: AC 3 F
REMOVABLE STRAINER: YES
AIR VENT: YES
INLET:3"
OUTLET: 3"

CF - 1
FILTER / CHEMICAL SHOT FEEDER, CHILLED WATER LOOP
MANUFACTURER: "UNITED FILTER" OR EQUIVALENT
MODEL NO: UFA - 6A - CS - A50 - 2
MATERIAL: STEEL
INLET:2"
OUTLET: 2"

ET - 1
EXPANSION TANK - CHILLED WATER LOOP
MANUFACTURER: "TACO" OR EQUIVALENT
TYPE: BLADDER HEAVY BUTIL RUBBER
MODEL NO: CA90 - 125
VOLUME: 23 GALLONS
ACCEPTANCE VOLUME: 23 GALLONS
DIAMETER: 20"
HEIGHT: 30"
SYSTEM CONNECTION: 1"
DRAIN CONNECTION: 3 / 4"

MPV - 1.1 MPV - 1.2
MULTI PURPOSE VALVES, CHILLED WATER PUMPS
MANUFACTURER: "TACO" OR EQUIVALENT
MODEL NO: 020 - 4
SIZE: 2"
ISOLATION, CHECK, BALANCING AND METERING VALVE

ADD ALTERNATE 1

AS - 2
AIR SEPARATOR - HOT WATER LOOP
MANUFACTURER: "TACO" OR EQUIVALENT
MODEL NO: AC 25 F
REMOVABLE STRAINER: YES
AIR VENT: YES
INLET:2 1/2"
OUTLET: 2 1/2"

CF - 2
FILTER / CHEMICAL SHOT FEEDER, HOT WATER LOOP
MANUFACTURER: "UNITED FILTER" OR EQUIVALENT
MODEL NO: UFA - 6A - CS - A50 - 2
MATERIAL: STEEL
INLET:2"
OUTLET: 2"

ET - 2
EXPANSION TANK HOT WATER LOOP
MANUFACTURER: "TACO" OR EQUIVALENT
TYPE: BLADDER - HEAVY BUTIL RUBBER
MODEL NO: CA 140 - 125
VOLUME: 37 GALLONS
ACCEPTANCE VOLUME: 37 GALLONS
DIAMETER: 20"
HEIGHT: 40"
SYSTEM CONNECTION: 1"
DRAIN CONNECTION: 3/4"
APPROX SHIPING WEIGHT: 300

MPV - 2.2 MPV- 2.2
MULTIPURPOSE VALVE, HOT WATER PUMPS
MANUFACTURER: "TACO" OR EQUIVALENT
MODEL NO:MPV 020 -4
SIZE: 2"
ISOLATION, CHECK, BALANCING AND METERING VALVE

VARIABLE AIR VOLUME TERMINAL HOT WATER REHEAT AHU–2 (ADD. ALT. 2)

MARK	SIZE	INLET SIZE	CFM RANGE	MAXIMUM CFM SETTING	MINIMUM CFM SETTING	MIN PRESS	HEAT CAPACITY	EAT	LAT	GPM	EWT	LWT	ROWS	MANUF		MODEL NO.		NOTES
		INCHES				IN WG	MBH	F	F		F	F						
V-201	16	16"RD	500–4000	2700	1200		41.1	55	97.3	2.0	160	119.0	2	TITUS	TRANE	DESV16	VCWF16	1,2
V-202	6	6"RD	80–500	300	150		9.9	55	116.0	1.0	160	140.2	2	TITUS	TRANE	DESV06	VCWF06	1,2

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. SELECTION BASED 55F ENTERING AIR TEMPERATURE AND 160F ENTERING HOT WATER TEMPERATURE.
2. TERMINAL MOTORIZED DAMPER TO FAIL IN OPEN POSITION.

VARIABLE AIR VOLUME TERMINAL HOT WATER REHEAT AHU–3 (ADD.ALT. 2)

MARK	SIZE	INLET SIZE	CFM RANGE	MAXIMUM CFM SETTING	MINIMUM CFM SETTING	MIN PRESS	HEAT CAPACITY	EAT	LAT	GPM	EWT	LWT	ROWS	MANUF		MODEL NO.		NOTES
		INCHES				IN WG	MBH	F	F		F	F						
V-301	8	8"RD	145–900	700	375		16.4	55	95.5	1.0	160	127.2	2	TITUS	TRANE	DESV08	VCWF08	1,2
V-302	6	6"RD	80–500	400	225		11.4	55	101.9	1.0	160	137.2	2	TITUS	TRANE	DESV06	VCWF06	1,2
V-303	12	12"RD	325–2000	1400	700		26.2	55	89.6	2.0	160	133.8	2	TITUS	TRANE	DESV12	VCWF12	1,2
V-304	6	6"RD	80–500	400	225		11.4	55	101.9	1.0	160	137.2	2	TITUS	TRANE	DESV06	VCWF06	1,2

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. SELECTION BASED 55F ENTERING AIR TEMPERATURE AND 160F ENTERING HOT WATER TEMPERATURE.
2. TERMINAL MOTORIZED DAMPER TO FAIL IN OPEN POSITION.

VARIABLE AIR VOLUME TERMINAL HOT WATER REHEAT AHU–5

MARK	SIZE	INLET SIZE	CFM RANGE	MAXIMUM CFM SETTING	MINIMUM CFM SETTING	MIN PRESS	HEAT CAPACITY	EAT	LAT	GPM	EWT	LWT	ROWS	MANUF		MODEL NO.		NOTES
		INCHES				IN WG	MBH	F	F		F	F						
V-501	12	12"RD	325–2000	1200	600		26.9	55	106.5	2.0	160	133.1	2	TITUS	TRANE	DESV12	VCWF12	1,2
V-502	6	6"RD	80–500	350	175		9.9	55	107.3	1.0	160	140.2	2	TITUS	TRANE	DESV06	VCWF06	1,2
V-503	6	6"RD	80–500	350	175		9.9	55	107.3	1.0	160	140.2	2	TITUS	TRANE	DESV06	VCWF06	1,2
V-504	6	6"RD	80–500	350	175		9.9	55	107.3	1.0	160	140.2	2	TITUS	TRANE	DESV06	VCWF06	1,2
V-505	10	10"RD	230–1400	1200	600		26.9	55	106.5	2.0	160	133.1	2	TITUS	TRANE	DESV10	VCWF10	1,2

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. SELECTION BASED 55F ENTERING AIR TEMPERATURE AND 160F ENTERING HOT WATER TEMPERATURE.
2. TERMINAL MOTORIZED DAMPER TO FAIL IN OPEN POSITION.

EXHAUST FAN SCHEDULE

MARK	LOCATION	SERVICE	TYPE	DRIVE	AIRFLOW	SP	SPEED	MOTOR	VOLTS	PH	SONES	CONTROL	MANUF	NOTES
					CFM	IN WG	RPM	HP						
EF-1	MECH RM	HOME LOCKER	CENTRIF IN LINE	DIRECT	800	0.500	1095	455 WATT	120	1	2.5	BAS WALL SWITCH	GREENHECK / TCF	1,2
EF-2	MECH RM	VISITOR LOCKER	CENTRIF IN LINE	DIRECT	1000	0.625	1130	550 WATT	120	1	3.5	BAS WALL SWITCH	GREENHECK / TCF	1,3
EF-3	ROOF	WOMEN'S TOILET	CENTRIF ROOF	DIRECT	500	0.5			120	1		INTERLOCK W/LIGHTS	GREENHECK / TCF	1,2
EF-3	ROOF	MEN'S TOILET	CENTRIF ROOF	DIRECT	500	0.5			120	1		INTERLOCK W/LIGHTS	GREENHECK / TCF	1,3

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. PROVIDE VARIGREEN MOTOR
2. ADD ALTERNATE 2.
3. ADD ALTERNATE 3.

PUMP SCHEDULE

MARK	LOCATION	SERVICE	TYPE	FLOW	HEAD	MOTOR	MOTOR SPEED	DRIVE TYPE	VOLTS /PH	SUCT SIZE	DISCH SIZE	MANUF	NOTES
				GPM	FT WG	HP	RPM			IN	IN		
CHP-1	MECH ROOM	CHILLED WATER	VERTICAL IN-LINE	115	80	7.5	1750	DIRECT	208/3	2"	2"	"TACO" / ARMSTRONG	1,2
CHP-2	MECH ROOM	CHILLED WATER	VERTICAL IN-LINE	115	80	7.5	1750	DIRECT	208/3	2"	2"	"TACO" / ARMSTRONG	1,2
HWP-1	MECH ROOM	HEATING WATER	HORIZONTAL IN-LINE	60	60	3	1750	DIRECT	208/1	2"	2"	"TACO" / ARMSTRONG	1,2,3
HWP-2	MECH ROOM	HEATING WATER	HORIZONTAL IN-LINE	60	60	3	1750	DIRECT	208/1	2"	2"	"TACO" / ARMSTRONG	1,2,3

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. PROVIDE WITH VFD.
2. ALTERNATE DUTY/STANDBY.
3. ADD ALTERNATE 1.

HEATING WATER BOILER SCHEDULE (ADD ALTERNATE 1)

MARK	TYPE	LOCATION	SERVICE	GAS INPUT	HEAT OUTPUT	MIN WATER FLOW	MAX WATER FLOW	DESIGN WATER FLOW	EWT/LWT	DESIGN WPD	AIR INLET SIZE	FLUE VENT SIZE	VOLTS PHASE	BOILER FLA	APPROX DIMENSIONS (W X D X H)	APPROX WEIGHT	MANUF	NOTES
				MBH	MBH	GPM	GPM	GPM	(°F)	FT WG	IN	IN		AMP	IN	LBS		
B-1	GAS FIRED CONDENSING	MECH ROOM	HEATING HOT WATER	650.0	625.9	31.3	62.6	41.7	130/160	5.5	5"RD	6"RD	120/1	12.0	50"X30"X42"	5000	RBI / LOCHINVAR	1,2,3

THE MECHANICAL CONTRACTOR SHALL COORDINATE THE EXACT VOLTAGE & PHASE OF EACH AND EVERY EQUIPMENT ITEM WITH THE ELECTRICAL CONTRACTOR, PRIOR TO ORDER.

NOTES:
1. PROVIDE STAINLESS STEEL VENT.
2. PROVIDE NEUTRALIZER.
3. 90% COMBUSTION EFFICIENCY.

AIR DISTRIBUTION DEVICE SCHEDULE

TYPE	DESCRIPTION	MOUNTING	MANUFACTURER CATALOG NO.	MATERIAL	FINISH	ACCESSORIES/REMARKS
D1	CEILING SUPPLY DIFFUSER	T-BAR CEILING	TITUS TMS-AA	ALUMINUM	BAKED WHITE ENAMEL	24/24 LOUVERED FACE, 4-WAY THROW, NECK SIZE AS INDICATED
G1	CEILING EXHAUST/ RETURN GRILLE	T-BAR CEILING	TITUS 50F	ALUMINUM	BAKED WHITE ENAMEL	24/24 PANEL, 1/2"X1/2"X2" EGGCRATE CORE
G2	CEILING EXHAUST/ RETURN GRILLE	T-BAR CEILING	TITUS 50F	ALUMINUM	BAKED WHITE ENAMEL	24/12 PANEL, 1/2"X1/2"X2" EGGCRATE CORE

MISCELLANEOUS

	CONNECT TO EXISTING	
X / X	DETAIL NUMBER / SHEET NUMBER	DETAIL DESIGNATION
300 CFM D1, 10"ø (TYP 4)	AIRFLOW DEVICE DESIGN, NECK SIZE QUANTITY (IF MORE THAN ONE)	AIR DEVICE DESIGNATION
	SECTION SHEET NUMBER	SECTION DESIGNATION

STATE OF LOUISIANA
THOMAS G. SANDERS
REG. No. 28647
REGISTERED PROFESSIONAL ENGINEER IN MECHANICAL ENGINEERING
05/05/25

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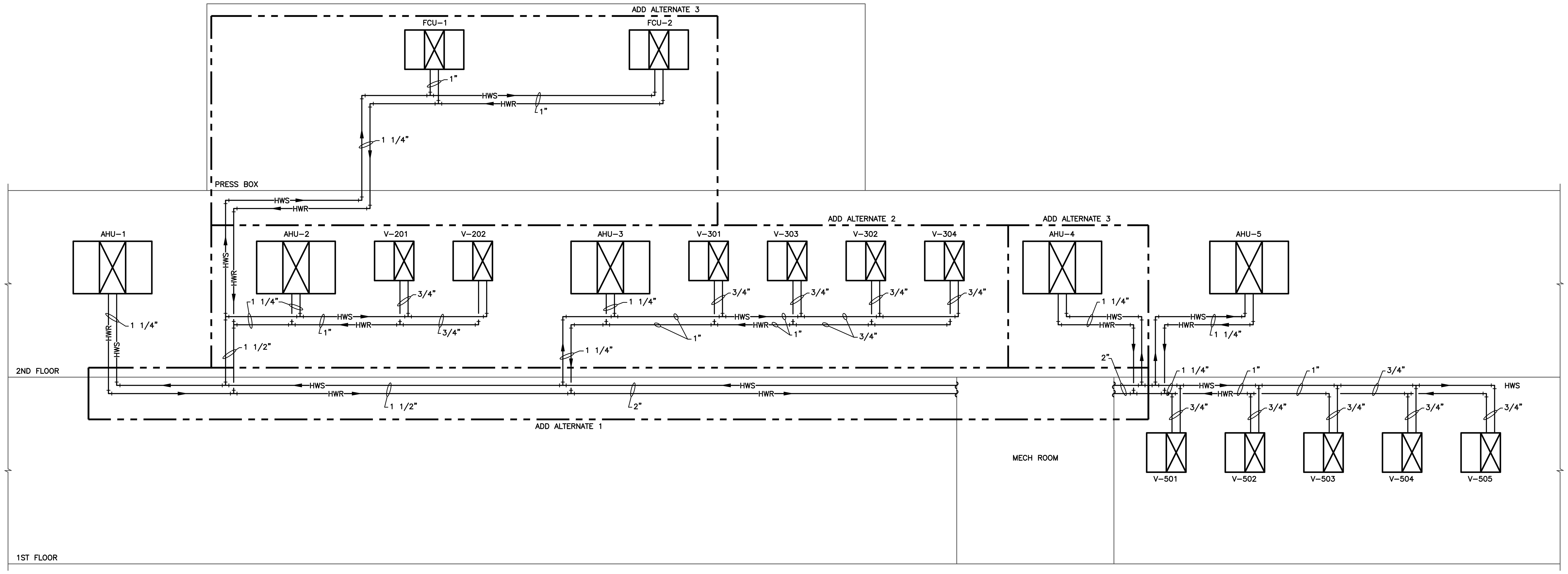
318 425 4500
LOUISIANA Registered Engineering Firm #EF-5818
TEXAS Registered Engineering Firm #F-893

SUBMISSION OF BID WILL BE CONSIDERED ACKNOWLEDGMENT THAT THE CONTRACTOR HAS VISITED THE SITE AND HAS VERIFIED ALL EXISTING JOB CONDITIONS AND INCLUDED ANY NECESSARY MODIFICATION TO EXISTING AND NEW WORK REQUIRED FOR INSTALLATION OF A COMPLETE AND WORKING SYSTEM.

HVAC RENOVATIONS AT WARHAWK FIELD
UNIVERSITY OF LOUISIANA MONROE
322 WARHAWK WAY
MONROE, LOUISIANA

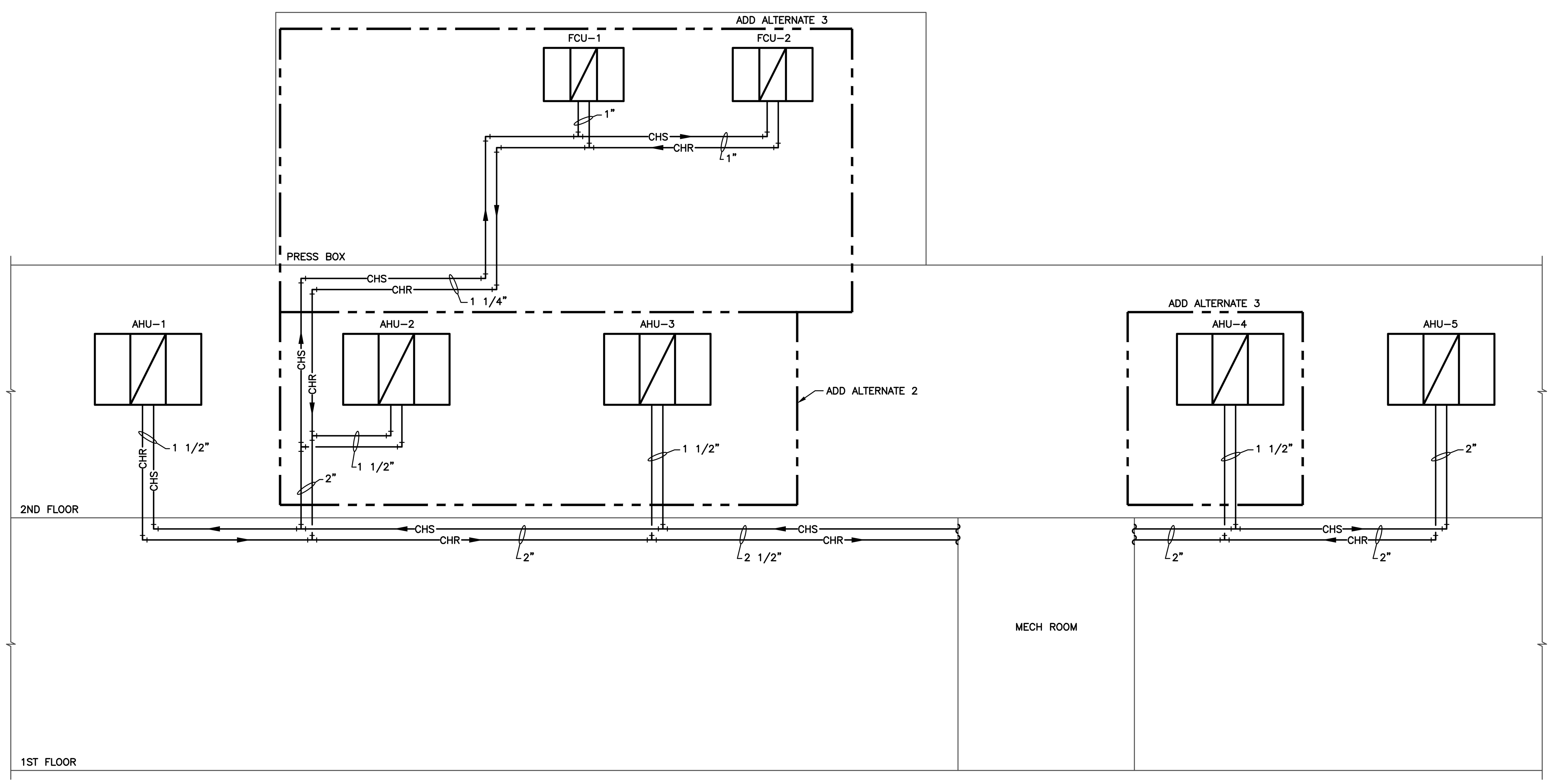
NO.	DATE	REVISIONS

JOB NO: 5-001-2338-002
CHECKED BY: RW
DRAWN BY: WJW
DATE: 05-02-2025
SCALE: AS SHOWN
SHEET
MH8.1



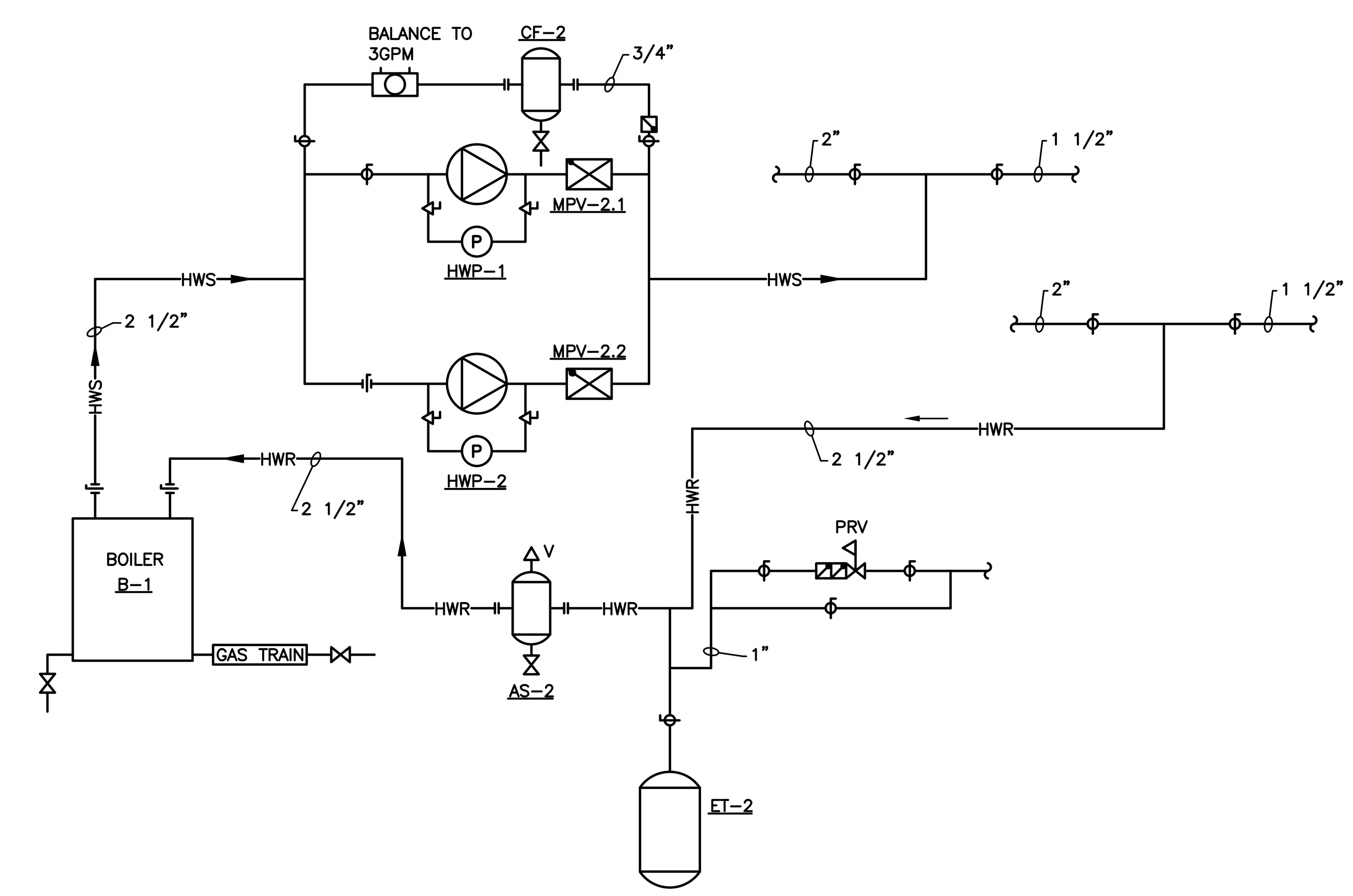
HEATING WATER PIPING DIAGRAM

NO SCALE



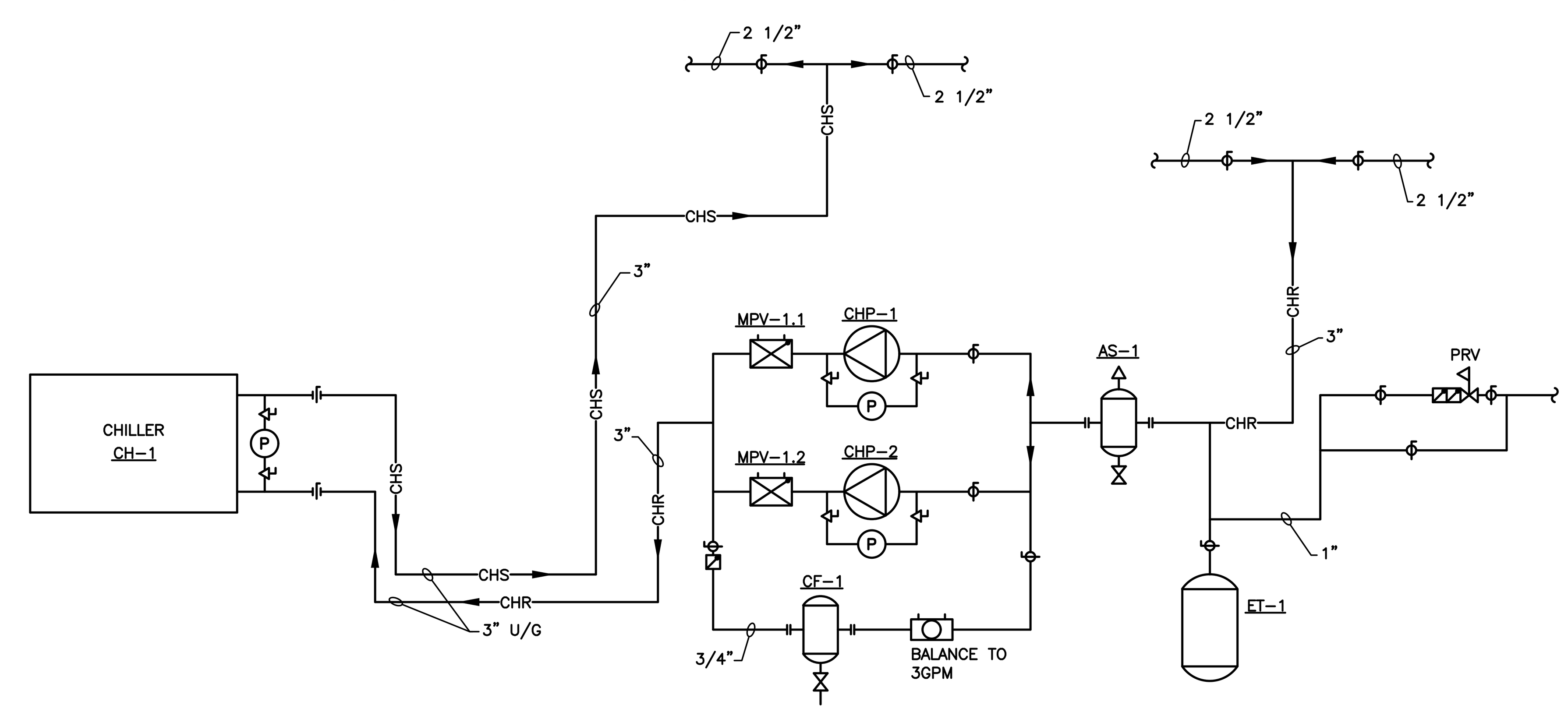
CHILLED WATER PIPING DIAGRAM

NO SCALE



MECH ROOM HEATING WATER PIPING DIAGRAM (ADD ALTERNATE 1)

NO SCALE



MECH ROOM CHILLED WATER PIPING DIAGRAM

NO SCALE

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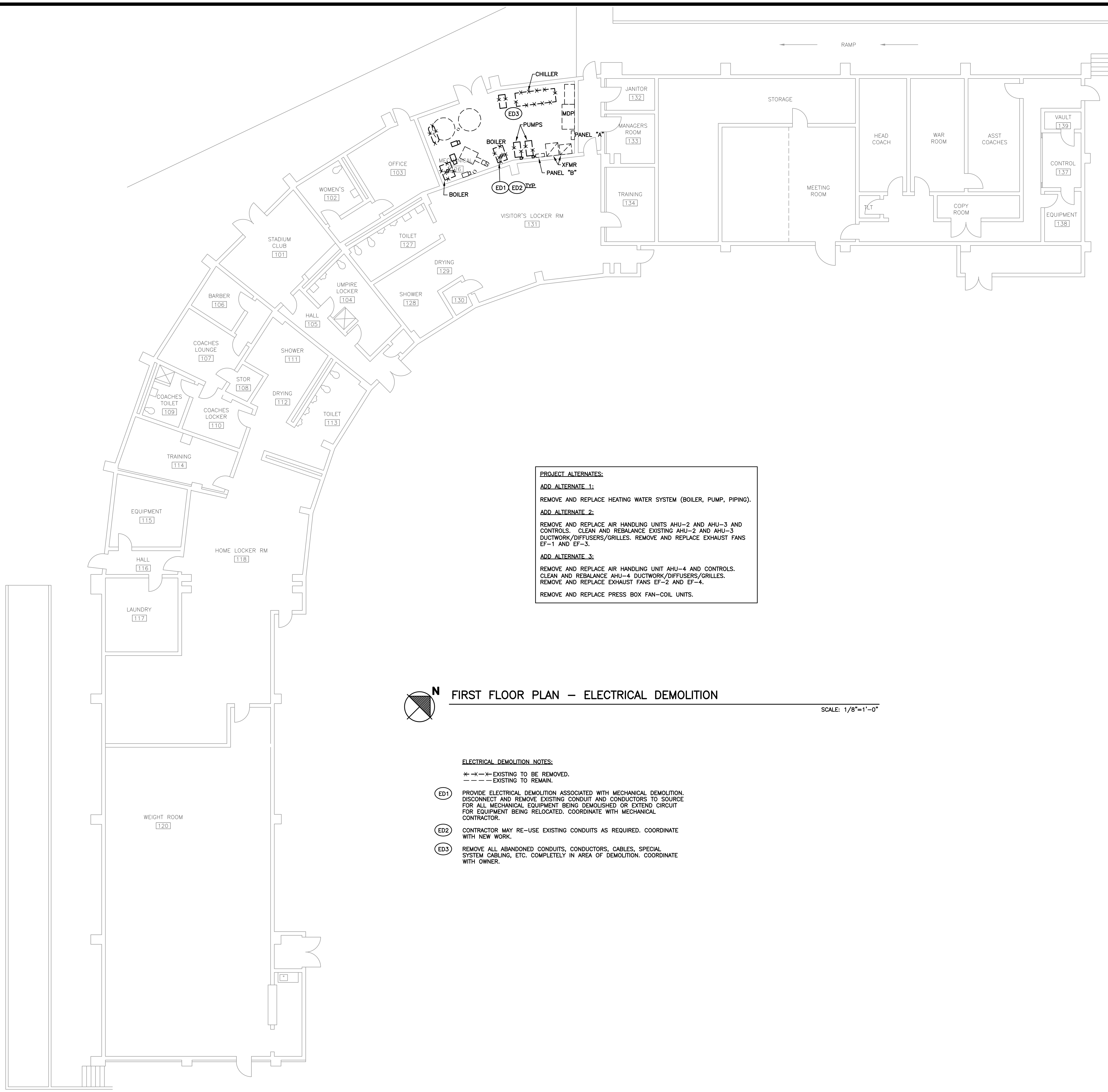


PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

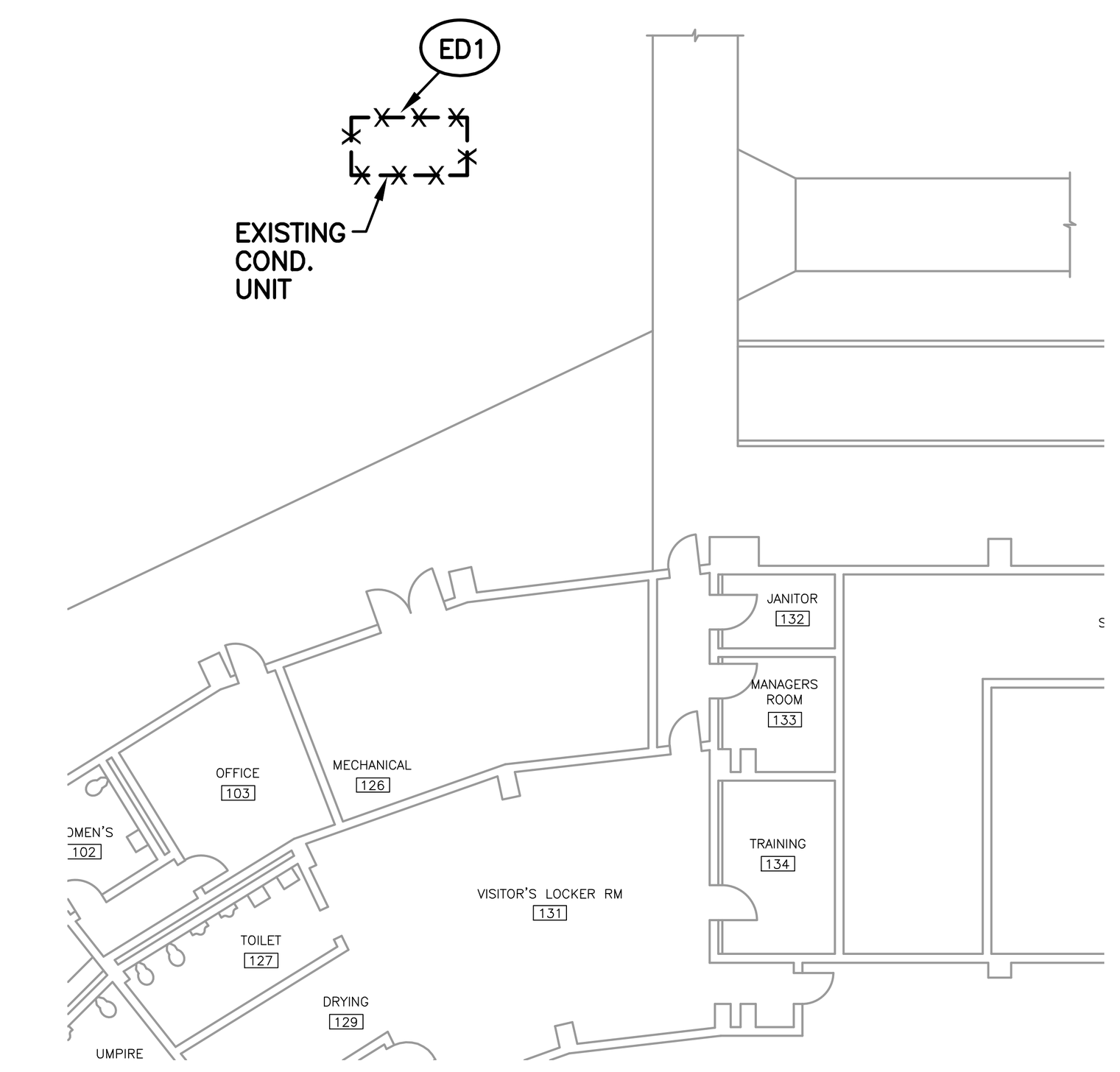
ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

FIRST FLOOR PLAN – ELECTRICAL DEMOLITION

SCALE: 1/8"=1'-0"



PARTIAL SITE PLAN – ELECTRICAL DEMOLITION

SCALE: 1/16"=1'-0"

ELECTRICAL DEMOLITION NOTES:

—x—x— EXISTING TO BE REMOVED.
– – – – EXISTING TO REMAIN.

(ED1) PROVIDE ELECTRICAL DEMOLITION ASSOCIATED WITH MECHANICAL DEMOLITION. DISCONNECT AND REMOVE EXISTING CONDUIT AND CONDUCTORS TO SOURCE FOR ALL MECHANICAL EQUIPMENT BEING DEMOLISHED OR EXTEND CIRCUIT FOR EQUIPMENT BEING RELOCATED. COORDINATE WITH MECHANICAL CONTRACTOR.

(ED2) CONTRACTOR MAY RE-USE EXISTING CONDUITS AS REQUIRED. COORDINATE WITH NEW WORK.

(ED3) REMOVE ALL ABANDONED CONDUITS, CONDUCTORS, CABLES, SPECIAL SYSTEM CABLING, ETC. COMPLETELY IN AREA OF DEMOLITION. COORDINATE WITH OWNER.

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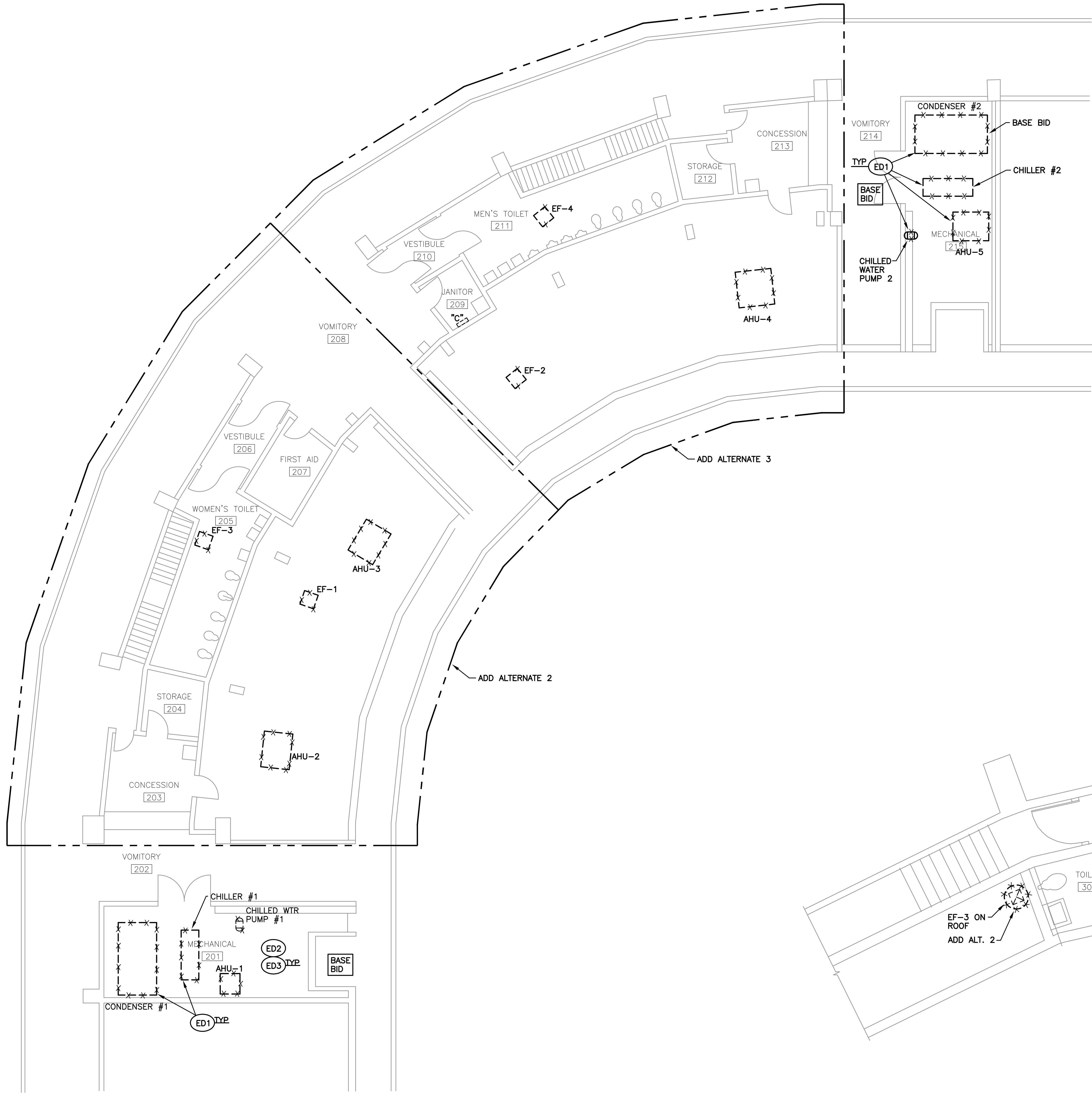
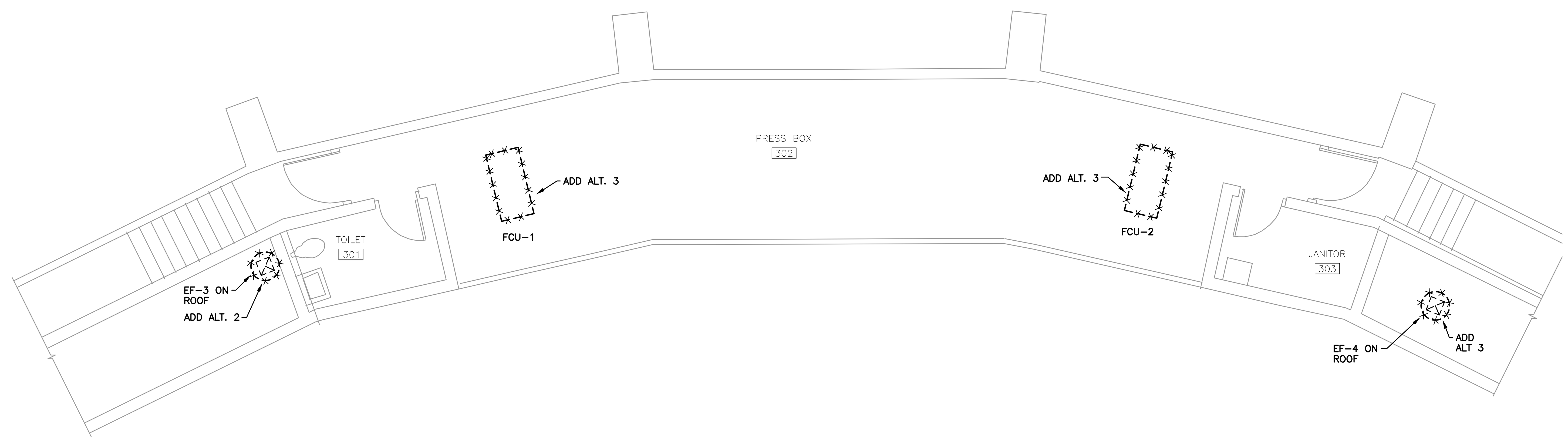


SECOND FLOOR PLAN – ELECTRICAL DEMOLITION

SCALE: 1/8"=1'-0"



PRESS BOX PLAN – ELECTRICAL DEMOLITION

(ADD ALTERNATE 3 UNLESS NOTED OTHERWISE)

SCALE: 1/8"=1'-0"

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

ELECTRICAL DEMOLITION NOTES:

- ×—×—× EXISTING TO BE REMOVED.
- – – – – EXISTING TO REMAIN.

(ED1) PROVIDE ELECTRICAL DEMOLITION ASSOCIATED WITH MECHANICAL DEMOLITION. DISCONNECT AND REMOVE EXISTING CONDUIT AND CONDUCTORS TO SOURCE FOR ALL MECHANICAL EQUIPMENT BEING DEMOLISHED OR EXTEND CIRCUIT FOR EQUIPMENT BEING RELOCATED. COORDINATE WITH MECHANICAL CONTRACTOR.

(ED2) CONTRACTOR MAY RE-USE EXISTING CONDUITS AS REQUIRED. COORDINATE WITH NEW WORK.

(ED3) REMOVE ALL ABANDONED CONDUITS, CONDUCTORS, CABLES, SPECIAL SYSTEM CABLING, ETC. COMPLETELY IN AREA OF DEMOLITION. COORDINATE WITH OWNER.

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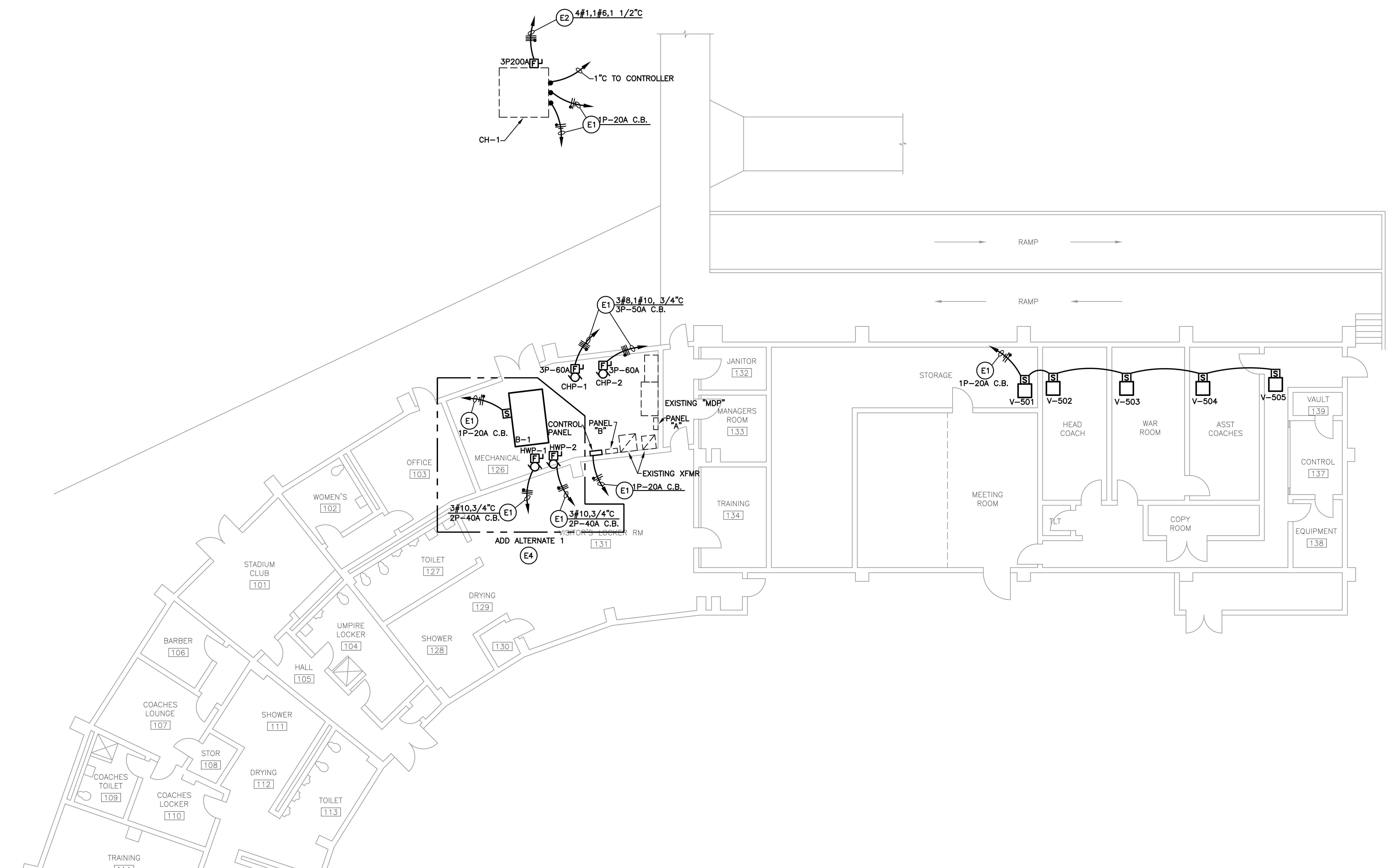

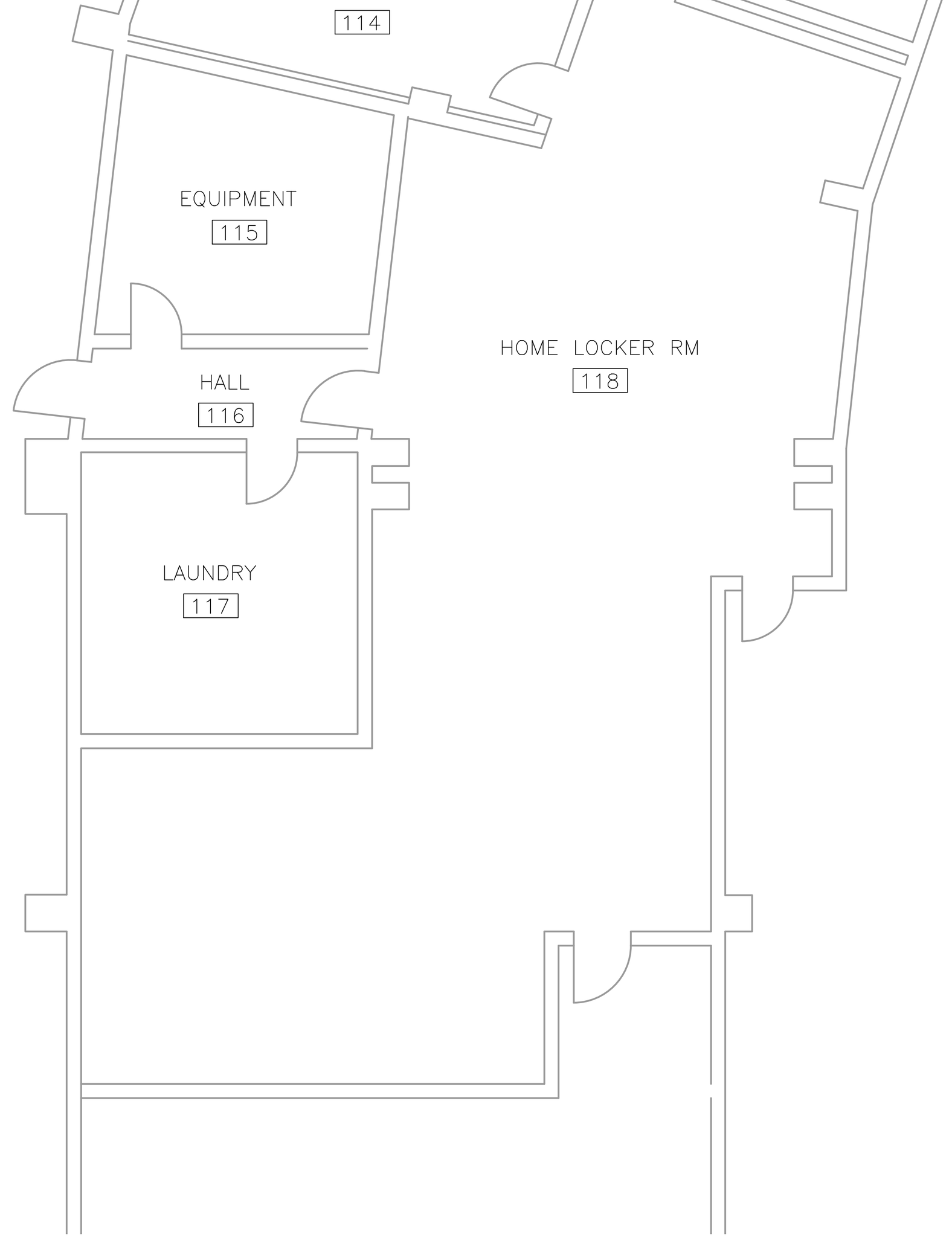

FIRST FLOOR PLAN – ELECTRICAL

SCALE: 1/8"=1'-0"

ELECTRICAL NOTES:

- - - - EXISTING TO REMAIN
——— NEW CONSTRUCTION

(E1) EXTEND AND CONNECT TO EXISTING 208Y/120V PANEL A. PROVIDE A CIRCUIT BREAKER AS INDICATED.

(E2) EXTEND AND CONNECT TO EXISTING 480V PANEL MDP. PROVIDE A 3P-125A C.B.

(E3) ELECTRICAL CONTRACTOR SHALL COORDINATE THE EXACT ELECTRICAL REQUIREMENTS OF ALL SUBMITTED MECHANICAL EQUIPMENT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH IN. ADJUST CIRCUITS AS REQUIRED.

(E4) ALL ELECTRICAL ASSOCIATED WITH NEW HEATING WATER SYSTEM SHALL BE PROVIDED UNDER ADD ALTERNATE 1.

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.

ELECTRICAL LEGEND

SYMBOL	DESCRIPTION
———	CONDUIT IN WALL OR ABOVE CEILING
- - - - -	CONDUIT UNDER FLOOR OR UNDERGROUND
◄—╫—	ARROW INDICATES HOMERUN, TICKMARKS: NEUTRAL, PHASE, GROUND
● ; ◉	JUNCTION BOX; FLUSH FLOOR JUNCTION BOX
F ; □	DISCONNECT SWITCH; FUSED; NONFUSED
⏀ ; ⏀	DUPLEX RECEPT; ABOVE COUNTER
⏀WP ; ⏀GFI	WEATHERPROOF; GROUND FAULT
AFF ; C	ABOVE FINISHED FLOOR; CEILING MOUNTED
Ø	MOTOR
S	MOTOR TOGGLE SWITCH
D	FIRE ALARM DUCT DETECTOR

STATE OF LOUISIANA
RICKEY L. WATSON
License No. 30744
PROFESSIONAL ENGINEER
IN ELECTRICAL ENGINEERING
05/05/25

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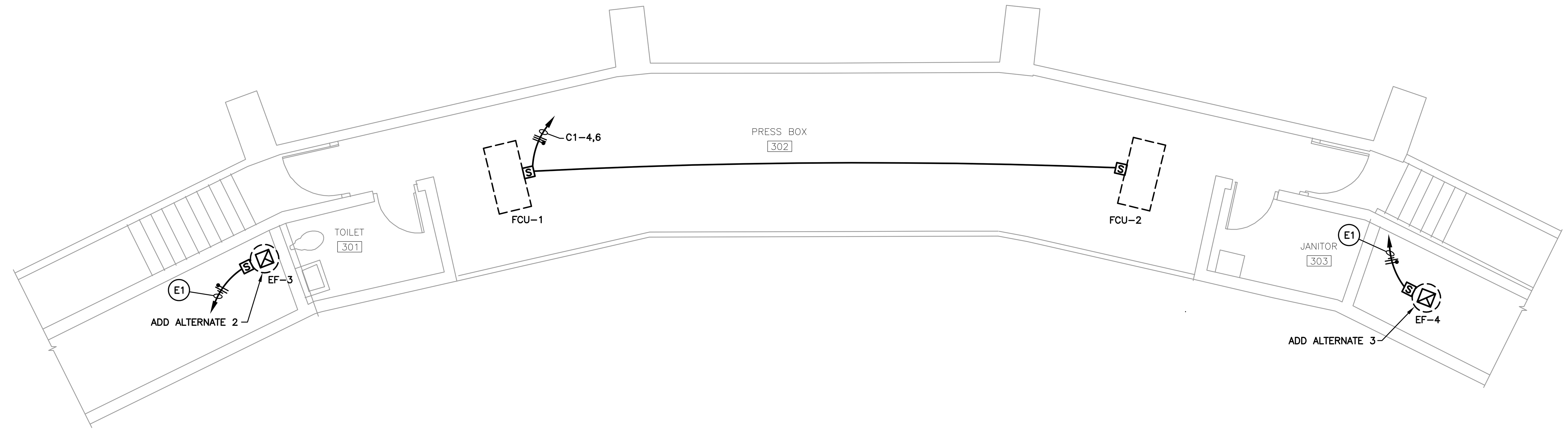
SECOND FLOOR PLAN – ELECTRICAL

SCALE: 1/8"=1'-0"



PRESS BOX PLAN – ELECTRICAL

(ADD ALTERNATE 3 WORK UNLESS NOTED OTHERWISE)

SCALE: 1/4"=1'-0"

PANEL "C1"

208Y/120 VOLTS, 3 PHASE, 4 WIRE, 125 AMPS, MAIN LUGS ONLY

10,000 AMPS. RMS. SYM. I.C.
INTEGRATED EQUIPMENT RATING

SERVES	TRIP	CKT	CKT	TRIP	SERVES
AHU-3	35/3	1	2	20	VAV
↓		3	4	20/2	FCU
↓		5	6		↓
AHU-5	35/3	7	8	20	SPARE
↓		9	10	↓	↓
↓		11	12	↓	↓
AHU-4	20/3	13	14	↓	↓
↓		15	16	↓	↓
↓		17	18	↓	↓
SPARE	20	19	20	↓	↓
↓	↓	21	22	↓	↓
↓	↓	23	24	↓	↓

A ø B ø C ø

TOTAL CONN. LOAD ________ KVA

ELECTRICAL NOTES:

– – – – EXISTING TO REMAIN
——— NEW CONSTRUCTION

(E1) CONNECT TO EXISTING EF. CIRCUIT RETAINED FROM DEMOLITION. COORDINATE AND PROVIDE ALL ALL CONTROLS WITH MECHANICAL PLANS.

(E2) EXTEND AND CONNECT TO EXISTING 208Y/120V PANEL C. PROVIDE A C.B. AS INDICATED.

(E3) ELECTRICAL CONTRACTOR SHALL COORDINATE THE EXACT ELECTRICAL REQUIREMENTS OF ALL SUBMITTED MECHANICAL EQUIPMENT WITH MECHANICAL CONTRACTOR PRIOR TO ROUGH IN. ADJUST CIRCUITS AS REQUIRED.

(E4) EXTEND AND CONNECT TO EXISTING FIRE ALARM PANEL. PROVIDE A COMPLETE AND OPERATIONAL FIRE ALARM EXTENSION. FIELD VERIFY EXACT PANEL TYPE AND LOCATION.

PROJECT ALTERNATES:

ADD ALTERNATE 1:

REMOVE AND REPLACE HEATING WATER SYSTEM (BOILER, PUMP, PIPING).

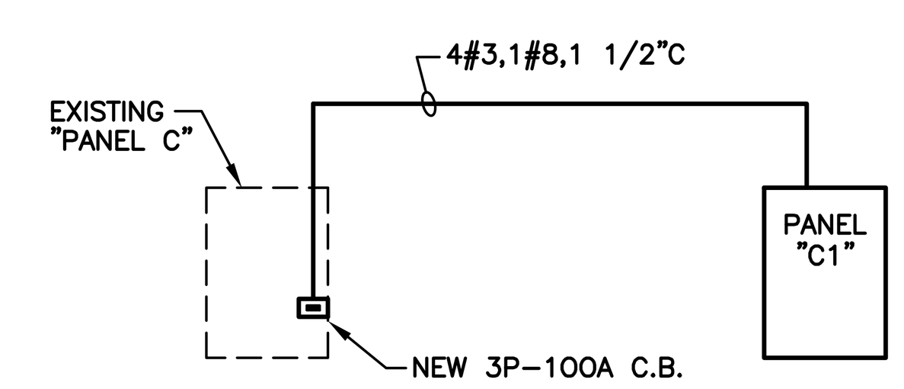
ADD ALTERNATE 2:

REMOVE AND REPLACE AIR HANDLING UNITS AHU-2 AND AHU-3 AND CONTROLS. CLEAN AND REBALANCE EXISTING AHU-2 AND AHU-3 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-1 AND EF-3.

ADD ALTERNATE 3:

REMOVE AND REPLACE AIR HANDLING UNIT AHU-4 AND CONTROLS. CLEAN AND REBALANCE AHU-4 DUCTWORK/DIFFUSERS/GRILLES. REMOVE AND REPLACE EXHAUST FANS EF-2 AND EF-4.

REMOVE AND REPLACE PRESS BOX FAN-COIL UNITS.



ELECTRICAL RISER

NO SCALE

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