

**SUBMIT BID TO:**  
**PROCUREMENT SERVICES**  
**UNIVERSITY OF FLORIDA**  
**971 ELMORE DRIVE**  
**GAINESVILLE, FL 32611**

Phone: (352) 392-1331 - FAX: (352) 392-8837

Web Address: <https://procurement.ufl.edu/>



# INVITATION TO BID

## Construction Acknowledgment Form

Page 1 of 324 pages Plus Attachment A (28 pages)		BID WILL BE OPENED: <b>February 26, 2020 at 3:00 PM</b> local time and may not be withdrawn within 90 days after such date and time. Mandatory Pre-bid: <b>January 28, 2020 at 10:30 AM</b> local time at the site.		BID NO.: <b>ITB20DB-127</b>	
DATE: <b>01/16/2020</b>		PROCUREMENT AGENT: <b>DB/jh</b>		BID TITLE: Air Handling Unit Replacement at Communicore Building	
VENDOR NAME					
VENDOR MAILING ADDRESS		REASON FOR NOT SUBMITTING BID			
CITY - STATE - ZIP CODE		<b>POSTING OF BID TABULATIONS</b>  Bid tabulations with intended award(s) will be posted electronically for review by interested parties at <a href="https://procurement.ufl.edu/">https://procurement.ufl.edu/</a> and will remain posted for a period of 72 hours excluding Saturdays, Sundays, or state holidays. Failure to file a protest in accordance with Board of Governors (BOG) Regulation 18.002 or failure to post the bond or other security as required in the BOG regulations 18.002 and 18.003(3), shall constitute a waiver of protest proceedings.			
AREA CODE	TELEPHONE NO.				
	FAX NO.				
	WEB ADDRESS				
	EMAIL ADDRESS				

*I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm or person submitting a bid for the same materials, supplies, or equipment and is in all respects fair and without collusion or fraud. I agree to abide by all conditions of this bid and certify that I am authorized to sign this bid for the vendor and that the vendor is in compliance with all the requirements of the Invitation to Bid, including but not limited to, certification requirements. In submitting a bid on behalf of the Board of Trustees, hereinafter known as the University, the vendor offers and agrees that if the bid is accepted the vendor will convey, sell, assign, or transfer to the University all rights, title and interest in and to all causes of action it may now or hereafter acquire under the Anti-trust laws of the United States and the University for price fixing relating to the particular commodities or services purchased or acquired by the University. At the University's discretion, such assignment shall be made and become effective at the time the purchasing agency tenders final payment to the vendor.*

\_\_\_\_\_  
 AUTHORIZED SIGNATURE (MANUAL)

\_\_\_\_\_  
 NAME AND TITLE (TYPED)

### GENERAL CONDITIONS

**SEALED BIDS:** All bid sheets and this form must be executed and submitted in a sealed envelope. (DO NOT INCLUDE MORE THAN ONE BID PER ENVELOPE.) The face of the envelope shall contain, in addition to the above address, the date, and time of the bid opening and the bid number. Bids not submitted on the attached bid form shall be rejected. All bids are subject to the conditions specified herein. Those which do not comply with these conditions are subject to rejection.

1. **EXECUTION OF BID:** Bid must contain an original manual signature of authorized representative in the space provided above. Bid must be typed or printed in ink. Use of erasable ink is not permitted. All corrections to prices made by vendor must be initialed.

2. **NO BID:** If not submitting a bid, respond by returning only this vendor acknowledgment form, marking it "NO BID", and explain the reason in the space provided above. Failure to respond to a procurement solicitation without giving justifiable reason for such failure, nonconformance to contract conditions, or other pertinent factors deemed reasonable and valid shall be cause for removal of the supplier's name from the bid mailing list. NOTE: To qualify as a respondent, vendor must submit a "NO BID", and it must be received no later than the stated bid opening date and hour.

3. **BID OPENING:** Shall be public, on the date, location and the time specified on the bid form. It is the vendor's responsibility to assure that the bid is delivered at the proper time and place of the bid opening. Bids which for any reason are not so delivered will not be considered. A bid may not be altered after opening of the bids. NOTE: Bid tabulations will be posted electronically at <https://procurement.ufl.edu/>. Bid tabulations will not be provided by telephone.

4. **PRICES, TERMS AND PAYMENT:** Firm prices shall be bid and will include all packing, handling, shipping charges, and delivery to the destination shown herein.

(a) **TAXES:** The University does not pay Federal Excise and Sales taxes on direct purchases of tangible personal property or services. The Florida Tax Exempt Number is 11-06-024056-57C. This exemption does not apply to purchases of tangible personal property or services made by vendors who use the tangible personal property or services in the performance of contracts for the improvement of University-owned real property as defined in Chapter 192, F.S.

(b) **DISCOUNTS:** Vendors are encouraged to reflect trade discounts in the unit prices quoted; however, vendors may offer a discount for prompt payment. Prompt payment discounts will not be considered in the bid award. However, every effort will be made to take the discount within the time offered.

(c) **MISTAKES:** Vendors are expected to examine the specifications, delivery schedule, bid prices, extensions, and all instructions pertaining to supplies and

services. Failure to do so will be at vendor's risk. In case of a mistake in extensions the unit price will govern.

(d) **INVOICING AND PAYMENT:** Payment will be made by the University of Florida after the items awarded to a vendor have been received, inspected, and found to comply with award specifications, free of damage or defect and properly invoiced. All invoices shall bear the purchase order number. Payment for partial shipments shall not be made unless specified. An original invoice shall be submitted. Failure to follow these instructions may result in delay in processing invoices for payment. Payment shall be made in accordance with Section 215.422 (1) (2) F.S. **VENDOR OMBUDSMAN:** The University's vendor ombudsman, whose duties include acting as an advocate for vendors may be experiencing problems in obtaining payment from the University, may be contacted at 352-392-1241.

(e) **ANNUAL APPROPRIATIONS:** The University's performance and obligation to pay under any contract awarded is contingent upon an annual appropriation by the Legislature.

(f) **CONDITION AND PACKAGING:** It is understood and agreed that any item offered or shipped as a result of this bid shall be a new, current standard production model available at the time of this bid. All containers shall be suitable for storage or shipment, and all prices shall include standard commercial packaging.

(g) **SAFETY STANDARDS:** Unless otherwise stipulated in the bid, all manufactured items and fabricated assemblies shall comply with applicable requirements of Occupational Safety and Health Act and any standards hereunder.

5. **CONFLICT OF INTEREST:** The award hereunder is subject to the provisions of Chapter 112, F.S. All vendors must disclose with their bid the name of any officer, director, or agent who is also an employee of the University of Florida. Further, all vendors must disclose the name of any University employee who owns, directly or indirectly, an interest of five percent (5%) or more in the vendor's firm or any of its branches.

6. **AWARDS:** As the best interest of the University may require, the right is reserved to make award(s) by individual item, group of items, all or none or a combination thereof; to reject any and all bids or waive any minor irregularity or technicality in bids received. When it is determined there is no competition to the lowest responsible vendor, evaluation of other bids are not required. Vendors are cautioned to make no assumptions unless their bid has been evaluated as being responsive.

7. **INTERPRETATIONS/DISPUTES:** Any questions concerning conditions or specifications shall be directed in writing to Procurement Services. Inquiries must reference the date of bid opening and bid number. No interpretations shall be considered binding unless provided in writing by the University in response to requests in full compliance with this provision.



8. **NOTICE OF BID PROTEST BONDING REQUIREMENT:** Any person or entity who files an action protesting a decision or an intended decision pertaining to a competitive solicitation shall at the time of filing the formal protest, post with the University a bond payable to the University in an amount equal to: 10% of the estimated value of the protestor's bid or proposal; 10% of the estimated expenditure during the contract term; \$10,000.00; or whichever is less. The bond shall be conditioned upon the payment of all costs which may be adjudged against the person or entity filing the protest action. In lieu of a bond, the University may accept a cashier's check, bank official check or money order in the amount of the bond. **FAILURE OF THE PROTESTING PERSON OR ENTITY TO FILE THE REQUIRED BOND, CASHIER'S CHECK, BANK OFFICIAL CHECK OR MONEY ORDER AT THE TIME OF THE FILING THE FORMAL PROTEST SHALL RESULT IN DENIAL OF THE PROTEST.**

9. **GOVERNMENTAL RESTRICTIONS:** In the event any governmental restrictions may be imposed which would necessitate alteration of the material, quality, workmanship or performance of the items offered in this bid prior to their delivery, it shall be the responsibility of the successful vendor to notify the purchaser at once, indicating in writing the specific regulation which requires an alteration. The University reserves the right to accept any such alteration, including any price adjustments occasioned thereby, or to cancel the contract at no expense to the University.

10. **LEGAL REQUIREMENTS:** Applicable provision of all Federal, State, county and local laws, and of all ordinances, rules and regulations shall govern development, submittal and evaluation of all bids received in response hereto and shall govern any and all claims and disputes which may arise between person(s) submitting a bid response hereto and the University, by and through its officers, employees and authorized representatives, or any other person, natural or otherwise; and lack of knowledge by any vendor shall not constitute a cognizable defense against the legal effect thereof.

11. **LOBBYING:** Vendor is prohibited from using funds provided under any contract or purchase order for the purpose of lobbying the Legislature or any official, officer, commission, board, authority, council, committee, or department of the executive branch or the judicial branch of state government.

12. **ADVERTISING:** In submitting a bid, the vendor agrees not to use the results therefrom as a part of any commercial advertising. Vendor may not use the names, logos, or trademarks of the University, its employees, or affiliates without the prior written consent of the University.

13. **ASSIGNMENT:** Any contract or purchase order issued pursuant to this Invitation to Bid and the monies which may become due hereunder are not assignable except with the prior written approval of the purchaser.

14. **LIABILITY:** The vendor agrees to indemnify and save the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, and employees harmless from any and all judgments, orders, awards, costs and expenses, including attorney's fees, and also all claims on account of damages to property, including loss of use thereof, or bodily injury (including death) which may be hereafter sustained by the vendor, its employees, its subcontractors, or the University of Florida, the State of Florida and the Florida Board of Governors, their officers, agents, or employees, or third persons, arising out of or in connection with any contract awarded and which are the result of the vendor's breach of contract or of the negligent acts of the vendor, its officers, agents, and employees. This clause does not apply to contracts between government agencies.

15. **FACILITIES:** The University reserves the right to inspect the vendor's facilities at any time with prior notice.

16. **ADDITIONAL QUANTITIES:** For a period not exceeding ninety (90) days from the date of acceptance of any offer by the University of Florida, the right is reserved to acquire additional quantities up to but not exceeding those shown on bid or the bid level at the prices bid in this invitation. If additional quantities are not acceptable, the bid sheets must be noted "BID IS FOR SPECIFIED QUANTITY ONLY".

17. **SERVICE AND WARRANTY:** Unless otherwise specified, the vendor shall define any warranty service and replacements that will be provided during and subsequent to this contract. Vendors must explain on an attached sheet to what extent warranty and service facilities are provided.

18. **SAMPLES:** Samples of items, when called for, must be furnished free of expense, on or before bid opening time and date, and if not destroyed, may upon request, be returned at the vendor's expense. Each individual sample must be labeled with vendor's name, manufacturer's brand name and number, bid number and item reference. Request for return of samples shall be accompanied by instructions which include shipping authorization and name of carrier and must be received with the bid. If instructions are not received within this time, the commodities shall be disposed of by the University.

19. **INSPECTION, ACCEPTANCE AND TITLE:** Inspection and acceptance will be at destination unless otherwise provided. Title and risk of loss or damage of all items shall be the responsibility of the contract supplier until accepted by the University, unless loss or damage results from negligence by the University. The contract supplier shall be responsible for filing, processing and collecting all damage claims. However, to assist him in the expeditious handling of damage claims, the University will:

(a) Record any evidence of visible damage on all copies of the delivering carrier's Bill of Lading.

- (b) Report damage (Visible or Concealed) to the carrier and contract supplier confirming such reports in writing within 15 days of delivery, requesting that the carrier inspect the damaged merchandise.
- (c) Retain the item and its shipping container, including inner packing material until inspection is performed by the carrier, and disposition given by the contract supplier.
- (d) Provide the contract supplier with a copy of the carrier's Bill of Lading and damage inspection report.

20. **PATENTS, COPYRIGHTS, TRADEMARKS, ROYALTIES** and other Intellectual Property: The vendor, without exception, shall indemnify and save harmless the University and its employees from liability of any nature or kind, including cost and expenses for or on account of any copyrighted, patented, or unpatented invention, process, or article manufactured or used in the performance of the contract, including its use by the University of Florida. If the vendor uses any design, device, or materials covered by letters, patent or copyright, it is mutually agreed and understood without exception that the bid prices shall include all royalties or costs arising from the use of such design, device, or materials in any way involved in the work.

21. **CONFLICT BETWEEN DOCUMENTS:** If any terms and conditions contained within the documents that are a part of this ITB or resulting contract are in conflict with any other terms and conditions contained therein, then the various documents comprising this ITB or resulting contract, as applicable, shall govern in the following order of precedence: change order, purchase order, addenda, special conditions, general conditions, specifications, departmental description of work, and bid.

22. **MANUFACTURERS' NAMES AND APPROVED EQUIVALENTS:** Any manufacturer's names, trade names, brand names, information and/or catalog numbers listed in a specification are for information and not intended to limit competition. If bids are based on equivalent products, indicate on the bid form the manufacturer's name and number. Vendor shall submit with the bid, cuts, sketches, and descriptive literature, and/or complete specifications. Reference to literature submitted with a previous bid will not satisfy this provision. The vendor shall also explain in detail the reasons why the proposed equivalent will meet the specifications and not be considered an exception thereto. The University of Florida reserves the right to determine acceptance of item(s) as an approved equivalent. Bids which do not comply with these requirements are subject to rejection. Bids lacking any written indication of intent to quote an alternate brand will be received and considered in complete compliance with the specifications as listed on the bid form.

23. **NONCONFORMANCE TO CONTRACT CONDITIONS:** Items may be tested and/or inspected for compliance with specifications by any appropriate testing facilities. Should the items fail, the University may require the vendor to reimburse the University for costs incurred by the University in connection with the examination or testing. The data derived from any tests for compliance with specifications are public records and open to examination thereto in accordance with Chapter 119, F.S. Items delivered not conforming to specifications may be rejected and returned at vendor's expense. These items and items not delivered as per delivery data in bid and/or purchase order may result in vendor being found in default in which event any and all procurement costs may be charged against the defaulting vendor. Any violation of these conditions may also result in the vendor's name being removed from the University of Florida's vendor file.

24. **PUBLIC RECORDS:** Any material submitted in response to this Invitation to Bid will become a public document pursuant to Section 119.07 F.S. This includes material which the responding vendor might consider to be confidential or a trade secret. Any claim of confidentiality is waived upon submission, effective after opening pursuant to Section 119.07 F.S.

25. **DELIVERY:** Unless actual date of delivery is specified (or if specified delivery cannot be met), show number of days required to make delivery after receipt of purchase order in space provided. Delivery time may become a basis for making an award (see Special Conditions). Delivery shall be within the normal working hours of the University of Florida, Monday through Friday, unless otherwise specified.

26. **PUBLIC PRINTING - PREFERENCE GIVEN PRINTING WITHIN THE STATE:** The University of Florida shall give preference to vendors located within the state when awarding contracts to have materials printed, whenever such printing can be done at no greater expense than, and at a level of quality comparable to, that obtainable from a vendor located outside of the state.

(a) **CONTRACTS NOT TO BE SUBLET:** In accordance with Class B Printing Laws and Regulations "Printing shall be awarded only to printing firms. No contract shall be awarded to any broker, agent, or independent contractor offering printing manufactured by other firms or persons."

(b) **DISQUALIFICATION OF VENDOR:** Reasonable grounds for believing that a vendor is involved in more than one bid for the same work will be cause for rejection of all bids in which such vendors are believed to be involved. Any or all bids will be rejected if there is reason to believe that collusion exists between vendors. Bids in which the prices obviously are unbalanced will be subject to rejection.

(c) **TRADE CUSTOMS:** Current trade customs of the printing industry are recognized unless accepted by Special Conditions or Specifications herein.

(d) **COMMUNICATIONS:** It is expected that all materials and proofs will be picked up and delivered by the printer or his representative, unless otherwise specified. Upon request, materials will be forwarded by registered mail.

(e) **RETURN OF MATERIAL:** All copy, photos, artwork, and other materials supplied by the University of Florida must be handled carefully and returned in good condition upon completion of the job. Such return is a condition of the contract and payment will not be made until return is affected.

## END OF SECTION



**Bid Number: ITB20DB-127**

**Title: Air Handling Unit  
Replacement at Communicore  
Building**

**UF Project Number: MP05285**





**Authorized representatives and contact information:**

**UF PROCUREMENT**

Representative: Debbie Berrier, Procurement Agent II  
Address: UF Procurement Services, 971 Elmore Drive  
City, State, Zip: Gainesville, FL 32611  
Telephone/Fax: (352) 294-1160  
Web and E-mail: <https://procurement.ufl.edu>; [dberrier@ufl.edu](mailto:dberrier@ufl.edu)

**DESIGN PROFESSIONAL**

Name: Mitchell Gullledge Engineering, Inc.  
Address: 210 SW 4<sup>th</sup> Avenue  
City, State, Zip: Gainesville, FL 32601



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### V. **Forms, Applications, and Illustrations**

The following forms or documents can be found on the Planning Design & Construction website at [www.facilities.ufl.edu](http://www.facilities.ufl.edu):

- Owner-Contractor Agreement
- Application and Certificate for Partial Payment
- Builder Application and Certificate of Partial Payment
- Change Order Form and COP Justification Form
- Utility Outage Request
- Construction Administration and Substantial Completion Guide
- Assignment of Antitrust Claims
- Certificate of Non-Segregated Facilities
- Owner Direct Purchase P.O. Requisition
- Inspection Requests and Checklists
- Project Management Guides

The following form can be found on Facilities Services website at <https://www.facilityservices.ufl.edu/information/forms/>:

- Dig Permit

The following forms or documents can be found on the Environmental Health & Safety website at <http://www.ehs.ufl.edu/programs/buildcode/forms/>:

- EH&S Inspection Request Form

### VI. **TECHNICAL SPECIFICATIONS**

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## **00020 - INVITATION TO BID**

The Invitation to Bid shall be in accordance with the University of Florida, Procurement Services "Invitation to Bid Acknowledgement Form" with all relevant information provided therein.

END OF SECTION



## **00100 - INSTRUCTIONS TO BIDDERS**

### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms & Conditions and other Sections in Divisions 0 and 1 of these Specifications.

### **1.2 THE WORK**

PROJECT TITLE: **ITB20DB-127 Air Handling Unit Replacement at Communicore Building**

### **1.3 SECURING DOCUMENTS**

Copies of the proposed Contract Documents may be obtained from:

University of Florida Procurement Services website.  
<https://procurement.ufl.edu/vendors/schedule-of-bids/>

### **1.4 BID FORM**

In order to be considered responsive and responsible, make bids in strict accordance with the following:

- A. Make bids upon the forms provided, properly signed and with all items completed. Do not change the wording of the bid form and do not otherwise alter or add words to the bid form. Unauthorized conditions, limitations, or provisions attached to the bid may be cause for rejection of the bid.
- B. Include with bid a completed and signed Invitation to Bid Construction Acknowledgment Form.
- C. Include completed Section 00310 - Bid Form.
- D. Include list of subcontractors as described in Section 00430 - Subcontractor Listing.
- E. **Bids must be submitted no later than February 26, 2020 at 3:00 PM, local time.** No bids received after the time fixed for receiving them will be considered. Late bids will be returned to the bidder unopened.
- F. Address bids to Debbie Berrier, Procurement Agent II, and deliver to:  
University of Florida  
Procurement Services  
971 Elmore Drive / PO Box 115250  
Gainesville, FL 32611-5250  
Submit bid in a sealed envelope that includes the bid number, contractor name and date and time of the bid opening on the outside of the envelope. Submit one (1) original bid and one (1) electronic copy on flash drive or CD/DVD. It is the sole responsibility of the bidder to see that bids are received on time. Faxed and/or emailed bids will not be accepted.

### **1.5 PROOF OF COMPETENCY OF BIDDER**

A bidder may be required to furnish evidence, satisfactory to the Owner, that the bidder and the bidder's



proposed subcontractors have sufficient means and experience in the types of work required to assure completion of the Contract in a satisfactory manner.

## **1.6 WITHDRAWAL OF BIDS**

- A. A bidder may withdraw his bid, either personally or by written request, at any time prior to the scheduled time for opening bids.
- B. No bidder may withdraw his bid for a period of forty-five calendar days after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

## **1.7 QUALIFICATION OF BIDDERS**

- A. A contract will be awarded only to a responsible bidder, qualified by experience and in a financial position to perform the work specified.
- B. If the bidder has not been pre-qualified with UF Procurement Services within the fiscal year (July 1 through June 30), the bidder may be required to submit the following evidence of eligibility:
  - 1. Evidence that bidder is licensed by the appropriate government agency to perform the work specified.
  - 2. Experience record showing bidder's training and experience in similar work.
  - 3. List a brief description of projects of similar size and/or complexity satisfactorily completed, with location, dates of contracts, names of contracts, and names and addresses of owners.

## **1.8 SUBCONTRACTS**

If the Bidder intends to subcontract any of the Work:

- A. A list of all proposed subcontractors shall be provided with the bid for scopes/packages in excess of \$10,000. See Section 00430 - Subcontractor Listing.
- B. Each subcontractor performing work in excess of \$10,000 must present evidence of being qualified in and licensed for the applicable trade. Such proof of subcontractor licensure shall be provided by the successful bidder after award, but prior to commencement of Work.

## **1.9 PERFORMANCE AND PAYMENT BONDS**

See General Terms & Conditions, Article 20.

## **1.10 BID DEPOSIT**

Not required.

## **1.11 AWARD OR REJECTION OF BIDS**

The Contract, if awarded, will be awarded to the responsible and responsive bidder who has proposed the lowest Contract Sum and has met the prequalification requirements as described on the prequalification form, subject to the owner's right to reject any or all bids and to waive informality and irregularity in the bids and in the bidding. Owner may choose to award base bid plus any alternates or none at all. Acceptance or rejection of any bid will be at the owner's sole discretion.



#### **1.12 MANDATORY PRE-BID CONFERENCE:**

A mandatory Pre-bid Conference will be held prior to the scheduled bid opening for the purpose of considering questions posed by bidders. The conference will be open to interested bidders, prospective subcontractors, and any other interested parties. This conference will be held **January 28, 2020 at 10:30 AM local time. Meeting will begin in the Biomedical Sciences Building Lobby (Bldg #0213), located at 1275 Center Drive, Gainesville, FL 32610.**

#### **1.13 EXECUTION OF AGREEMENT**

- A. A Purchase Order (PO) will be issued for purposes of fiscal encumbrance and payment. The PO itself serves as the form of contract.
- B. Upon notice of Bid Award, the bidder to whom the Contract is awarded shall deliver to UF those Certificates of Insurance and Payment & Performance Bonds required by the Contract Documents.
- C. Bonds and Certificates of Insurance shall be approved by UF before the successful bidder may proceed with the Work.

#### **1.14 INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING**

- A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the Contract Documents, or finds discrepancies in or omissions from any part of the Contract Documents, they may submit a written request for interpretation thereof no later than **February 10, 2020 at 5:00PM**, local time, to Debbie Berrier, Procurement Agent II at [dberrier@ufl.edu](mailto:dberrier@ufl.edu). The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretations or corrections of proposed Contract Documents will be made only by Addendum and will be available on the Procurement Services "Schedule of Bids" webpage <https://procurement.ufl.edu/vendors/schedule-of-bids/>. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents.

#### **1.15 TIME OF COMPLETION:**

- A. Date of beginning, rate of progress and time for completion of all Work for this Project are ESSENTIAL CONDITIONS of Contract. Successful Bidder hereby agrees that shop drawings, product data, and any other submittals will be delivered to the design professional within seven (7) calendar days of receiving Purchase Order and/or Notice to Proceed and equipment will be ordered within seven (7) days of approved submittals. Successful Bidder hereby agrees that all Work required by this Contract shall commence; that all insurance and permits will be obtained; that all documents and notices will be filed; that all requirements as specified will be met; and that Work shall be prosecuted regularly, diligently and uninterruptedly at such rate of progress as will ensure Substantial Completion of entire Project within six (6) weeks from delivery of equipment and shall be finally completed within seven (7) days after the date of Substantial Completion.

END OF SECTION



## **00310 - BID FORMS**

### **BID PROPOSAL**

FROM:

\_\_\_\_\_  
(Name of Bidder)

TO: UNIVERSITY OF FLORIDA  
PROCUREMENT SERVICES  
971 Elmore Drive  
P.O. Box 115250  
Gainesville, Florida 32611-5250

The undersigned, hereinafter called "Bidder", having reviewed the Contract Documents for the Project entitled **ITB20DB-127, Air Handling Unit Replacement at Communicore Building** and having visited and thoroughly inspected the site of the proposed Project and familiarized himself/herself with all conditions affecting and governing the construction of said Project, hereby proposes to furnish all labor, materials, equipment and other items, facilities and services for the proper execution and completion of the Project, in strict compliance with the Contract Documents, Addenda, and all other Documents relating thereto on file in Procurement Services, and, if awarded the Contract, to complete the said Work within the time limits called for in the Documents and as stated herein, for the sums as enumerated on this and the following pages:

### **BASE BID:**

	<b>AHU-7</b>	<b>AHU-8</b>	<b>Both AHU-7&amp;8</b>
<b>Sheet metal Cost:</b>	\$	\$	\$
<b>Insulation Cost:</b>	\$	\$	\$
<b>Bld Automation System (BAS) Cost:</b>	\$	\$	\$
<b>Electrical Cost:</b>	\$	\$	\$
<b>Equipment Purchase Price:</b>	\$	\$	\$
<b>Lead Time:</b>			
<b>Total Base Bid (Contract Sum):</b>			<b>\$</b>



**ADDITIVE ALTERNATE #1-** All work associated with AHU-5 including replacement of all penthouse level Fire Damper.

	AHU-5
Sheet metal Cost:	\$
Insulation Cost:	\$
Building Automation System (BAS) Cost:	\$
Electrical Cost:	\$
Fire Damper:	\$
Equipment Purchase Price:	\$
Lead Time:	
Total Price Alternate #1:	\$

**ADDITIVE ALTERNATE #2-** All work to replace the penthouse level fire dampers for AHU-7&8.

AHU-7 fire damper: \$\_\_\_\_\_

AHU-8 fire damper: \$\_\_\_\_\_

TOTAL ALTERNATE #2: \$\_\_\_\_\_

**DEDUCTIVE UNIT PRICING FOR FIRE DAMPER (FOR INFORMATION ONLY)**

	8 Sq Ft or less	8-12 Sq Ft	12 Sq Ft or more
Price:	\$	\$	\$



**ADDENDA**

Receipt of the following Addenda to the Construction Documents is acknowledged:

ADDENDUM # \_\_\_\_\_ Dated \_\_\_\_\_

ADDENDUM # \_\_\_\_\_ Dated \_\_\_\_\_

ADDENDUM # \_\_\_\_\_ Dated \_\_\_\_\_

**COMPLETION DATE:**

All Work covered by the Bidding Documents and the foregoing Base Bid shall be completed and ready for Owner's occupancy as specified in the contract documents.

**SIGNATURE:**

I hereby certify that for all statements and amounts herein made on behalf of

\_\_\_\_\_  
(Name of Bidder)

a (Corporation) (Partnership) (Individual) organized and existing under the laws of the State of Florida, I have carefully prepared this Bid Proposal from Contract Documents described hereinbefore, I have examined Contract Documents and local conditions affecting execution of Work before submitting this Bid Proposal, I have full authority to make the statements and commitment herein and submit this Bid Proposal in (its) (their) behalf, and all statements are true and correct.

Signed and sealed this \_\_\_\_\_ day of \_\_\_\_\_, 2020.

\_\_\_\_\_  
(Signature of Bidder)

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

\_\_\_\_\_  
(Title)

**WITNESS:**

\_\_\_\_\_  
(Signature of Witness)

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

Address: \_\_\_\_\_

\_\_\_\_\_  
(City)

\_\_\_\_\_  
(State)

\_\_\_\_\_  
(Zip Code)

\_\_\_\_\_  
(Email)

END OF SECTION

00310-6



## **00430 - SUBCONTRACTOR LISTING**

### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms & Conditions and other Sections in Divisions 0 and 1 of these Specifications.

### **1.2 SUBCONTRACTOR LISTS**

- A. Each bidder shall furnish with its bid a list of all subcontractors for subcontracted scopes/packages of work valued at more than \$10,000.
- B. This list shall identify – for each subcontracted package in excess of \$10,000 – the name and address of the proposed subcontractor and the approximate value of the subcontract.
- C. If the bidder does not intend to subcontract portions of the Work in amounts greater than \$10,000, then a statement to that effect shall be furnished with the bid.
- D. See Section 00100 - Instruction to Bidders regarding subcontractor licensure requirements.

END OF SECTION



UF JHMHSC Communicore AHU 5, 7 & 8  
Replacement MP-05285  
PREQUALIFICATION FORM

**MANDATORY REQUIREMENT: PROVIDE TYPED RESPONSES AND COMPLETE ALL FIELDS – SUBMIT WITH BID FORM**

Provide evidence of at least three (3) completed renovation projects by your firm within the last five (5) years with a minimum mechanical bid price of \$300,000. Each project should be representative of the proposed project scope of work with phased construction and have included installation of knock-down custom AHUs in an occupied building. Information must be contained only on this form. No supplemental information will be evaluated.

**REPRESENTATIVE PROJECT #1**

Project Name: \_\_\_\_\_  
Name of project owner (Reference): \_\_\_\_\_  
Owner mailing address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Owner phone number: \_\_\_\_\_ Owner email address: \_\_\_\_\_  
Description of Work Performed: \_\_\_\_\_  
Mechanical work performed by: \_\_\_\_\_  
Mechanical foreman name: \_\_\_\_\_ Proposed Mechanical foreman: \_\_\_\_\_  
Architect/Engineer: \_\_\_\_\_  
Original Contract Amount: \_\_\_\_\_ Change Order Amount: \_\_\_\_\_ Bond Amount: \_\_\_\_\_  
Date Commenced: \_\_\_\_\_ Date Completed: \_\_\_\_\_  
Was time extension necessary? \_\_\_\_\_  
Were any penalties imposed? \_\_\_\_\_  
Were liens, claims, or stop notices filed? \_\_\_\_\_

**REPRESENTATIVE PROJECT #2**

Project Name: \_\_\_\_\_  
Name of project owner (Reference): \_\_\_\_\_  
Owner mailing address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Owner phone number: \_\_\_\_\_ Owner email address: \_\_\_\_\_  
Description of Work Performed: \_\_\_\_\_  
Mechanical work performed by: \_\_\_\_\_  
Mechanical foreman name: \_\_\_\_\_ Proposed Mechanical foreman: \_\_\_\_\_  
Architect/Engineer: \_\_\_\_\_  
Original Contract Amount: \_\_\_\_\_ Change Order Amount: \_\_\_\_\_ Bond Amount: \_\_\_\_\_  
Date Commenced: \_\_\_\_\_ Date Completed: \_\_\_\_\_  
Was time extension necessary? \_\_\_\_\_  
Were any penalties imposed? \_\_\_\_\_  
Were liens, claims, or stop notices filed? \_\_\_\_\_

**REPRESENTATIVE PROJECT #3**

Project Name: \_\_\_\_\_  
Name of project owner (Reference): \_\_\_\_\_  
Owner mailing address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_  
Owner phone number: \_\_\_\_\_ Owner email address: \_\_\_\_\_  
Description of Work Performed: \_\_\_\_\_  
Mechanical work performed by: \_\_\_\_\_  
Mechanical foreman name: \_\_\_\_\_ Proposed Mechanical foreman: \_\_\_\_\_  
Architect/Engineer: \_\_\_\_\_  
Original Contract Amount: \_\_\_\_\_ Change Order Amount: \_\_\_\_\_ Bond Amount: \_\_\_\_\_  
Date Commenced: \_\_\_\_\_ Date Completed: \_\_\_\_\_  
Was time extension necessary? \_\_\_\_\_  
Were any penalties imposed? \_\_\_\_\_  
Were liens, claims, or stop notices filed? \_\_\_\_\_





# **GENERAL TERMS and CONDITIONS**

*for Construction Management At-Risk and Design-Bid-Build Projects*

Revised May 2017

Business Affairs  
Planning Design & Construction  
[www.facilities.ufl.edu](http://www.facilities.ufl.edu)



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## ARTICLE 1 – DEFINITIONS

When one of the following capitalized words, terms, or phrases is used in the Contract for Construction, it shall be interpreted or construed first as defined below, second according to its generally accepted meaning in the construction industry, and third according to its common and customary usage.

**Authority Having Jurisdiction (AHJ):** That person or entity who has the delegated authority to determine, mandate, and enforce building code requirements established by jurisdictional governing bodies. For University of Florida projects, the University's Division of Environmental Health & Safety is normally the primary AHJ.

**BIM Execution Plan:** A detailed and project-specific guide for the development, sharing, use, and finalization of BIM models and model-related documents and information.

**Building Information Modeling (BIM):** A process involving the generation and management of digital representations of physical and functional characteristics of a facility through the use of three-dimensional, intelligent design information. The resulting building information models become shared knowledge resources to support decision-making about a facility from the earliest conceptual stages, through design, construction, and the facility's operational life.

**Builder:** An entity, including but not limited to a general contractor, a trade contractor or a construction manager, engaged directly by the Owner pursuant to a Contract for Construction.

**Certificate of Substantial Completion:** Document declaring the Work Substantially Complete and suitable for occupancy or beneficial use by the Owner.

**Commissioning:** A process – normally handled by one or more independent consultants working directly for the Owner – to ensure that particular building systems are planned, designed, installed, tested, optimized, and capable of being operated and maintained to perform in accordance with the Owner's goals and requirements.

**Construction Documents:** Drawings, specifications, revisions, addenda, and other information which set forth in detail the Work.

**Construction Price:** The dollar amount for which a Builder agrees to perform the Work set forth in a Contract for Construction.

**Construction Schedule:** The timetable which sets forth pertinent dates for timely completion of the Work.

**Contract for Construction:** The entire agreement between Owner and Builder, consisting of the Owner-Builder Agreement and all exhibits thereto; these General Terms and Conditions; special conditions, if any; proposal(s) submitted by the Builder and accepted by Owner, if any; the Construction Documents; any amendments or addenda executed by the Owner and the Builder hereafter; and Owner-approved change order(s) or field orders. Documents not included or expressly contemplated in this definition do not, and shall not, form any part of the Contract for Construction. Without limiting the generality of the foregoing, shop drawings and other submittals from the Builder or its subcontractors and suppliers do not constitute a part of the Contract for Construction.



**Final Completion:** The stage of construction when the Work has been completed in accordance with the Contract for Construction and the Owner has received all documents and items necessary for closeout of the Work. Final Completion of the Work shall be deemed to have occurred on the later of: (i) the date that the Work passes a Final Completion inspection, or (ii) the date that the Builder has produced all required Final Completion close-out documentation and items. Final Completion shall not be deemed to have occurred and no final payment shall be due the Builder or any of its subcontractors or suppliers until the Work has passed the Final Completion inspection and Builder has provided all required Final Completion closeout documentation and items to the Owner.

**Hazardous Substances:** The term "Hazardous Substances" means all hazardous or toxic substances, materials, wastes, pollutants and contaminants which are listed, defined, or regulated under applicable laws, rules, regulations, codes, ordinances, orders and directives pertaining or related to health, safety, or the environment, including, but not limited to, the Comprehensive Environmental Response Compensation and Liability Act as amended, (42 U.S.C. § 9601 et seq), the Resource Conservation and Recovery Act as amended, (42 U.S.C. § 6901 et seq), the Federal Water Pollution Control Act (33 U.S.C.A. §§ 1251 to 1387), the Clean Air Act (42 U.S.C.A. §§ 7401 to 7671q), the Emergency Planning and Community Right to Know Act (42 U.S.C.A. §§ 11001 to 11050), the Toxic Substances Control Act (15 U.S.C.A. §§ 2601 to 2692), the Solid Waste Disposal Act (42 U.S.C.A. §§ 6901 to 6992k), the Oil Pollution Act (33 U.S.C.A. §§ 2701 to 2761) and all rules and regulations promulgated pursuant thereto. Without limiting the generality of the foregoing, "Hazardous Substances" shall specifically include polychlorinated biphenyl, asbestos (friable and non-friable), radon, urea formaldehyde, gasoline, diesel, oil, hydrocarbons, petroleum derived constituents, biomedical waste, or hazardous or toxic residue.

**Owner:** The University of Florida Board of Trustees, a public body corporate of the State of Florida.

**Owner's Related Parties:** The Board of Governors and its officers, trustees, and employees; and the Owner and its officers, trustees, and employees.

**Professional:** An entity, including but not limited to a licensed architect or engineer, engaged directly by the Owner to provide design or engineering services.

**Project:** Owner's undertaking to effect the construction, installation, renovation, or demolition of a facility or improvement, as the case may be, that is the subject of the Contract for Construction between Owner and Builder.

**Site:** The geographical location of a Project, usually defined by legal boundary lines, and the location characteristics including, but not limited to, grades and lines of streets, alleys, pavements and adjoining structures, rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, existing buildings and improvements, and service and utility lines.

**Substantial Completion (or Substantially Complete):** The stage of construction when the Owner can occupy or beneficially use satisfactorily completed Work for its intended purpose and a certificate of occupancy has been issued. Substantial Completion of the Work shall be deemed to have occurred on the later of: (i) the date the Work passes all Substantial Completion inspections, (ii) the date Builder has produced the required Substantial Completion documentation and items, or (iii) the date Authorities Having Jurisdiction provide a certificate of occupancy.



**Work:** Any and all computers, construction machinery, documents, equipment, facilities, fixtures, furnishings, goods, heat, items, labor, licenses, management, materials, permits, products, services, supervision, supplies, systems, taxes, testing, tools, utilities, transportation, vehicles, and water, required to be performed or supplied and/or necessary for proper execution and completion of the Project, or some portion thereof, whether or not incorporated or to be incorporated into the Project; provided, however, that Work does not include performance of pre-construction services by a construction manager.

## **ARTICLE 2 – CONSTRUCTION DOCUMENTS**

### **2.1 Quantity and Format of Documents**

The Owner shall provide the Builder with one printed set of Construction Documents, one set of electronic documents (plans and specifications) in PDF format, and one set of BIM files.

### **2.2 Minimum Requirements**

In every case, requirements established by the Construction Documents shall be considered as the minimum acceptable standard.

### **2.3 Owner Disclaimer of Warranty**

The Owner has requested that its Professional(s) prepare Construction Documents for the Project, including the plans and specifications, which are to be complete, accurate, coordinated, and adequate for bidding, negotiating, and constructing the Work. However, the Owner makes no representation or warranty of any nature whatsoever to the Builder concerning the Construction Documents or BIM documents. The Builder hereby acknowledges and represents that it has not relied, and does not and will not rely, upon any representations or warranties by the Owner concerning such documents, as no such representations or warranties have been or are hereby made.

### **2.4 Conflicts in Documents**

In the event of any conflict, discrepancy, or inconsistency among any of the documents comprising the Contract for Construction, the following shall control:

- 2.4.1 As between figures given on plans and scaled measurements, the figures shall govern;
- 2.4.2 As between large-scale plans and small-scale plans, the large-scale plans shall govern;
- 2.4.3 As between plans and specifications, the requirements of the specifications shall govern;
- 2.4.4 As between plans or specifications and BIM models, the requirements of the plans or specifications shall govern.
- 2.4.5 As between architectural drawings and (structural, civil, mechanical, electrical, plumbing, or fire protection) engineering drawings, the engineering drawings shall govern.

### **2.5 Contract Changes**



The Builder understands and agrees that the Contract for Construction – including the Construction Documents – cannot be changed except as provided herein. No act, omission, or course of dealing by the parties shall alter the requirement that modifications of the Contract for Construction must be accomplished by written documents signed by the parties.

## **ARTICLE 3 – BUILDER’S REVIEWS AND EVALUATIONS**

### **3.1 Sufficiency of Construction Documents**

The Builder acknowledges its continuing duty to review and evaluate the Construction Documents during the performance of its services and shall immediately notify the Owner and the Professional(s) of any (i) problems, conflicts, defects, deficiencies, inconsistencies, or omissions it discovers in or between the Construction Documents; and (ii) variances it discovers between the Construction Documents and applicable laws, statutes, building codes, rules, or regulations.

3.1.1 If the Builder performs any Work it knows or should have known involves (i) a recognized problem, conflict, defect, deficiency, inconsistency or omission in the Construction Documents; or (ii) a variance between the Construction Documents and requirements of applicable laws, statutes, building codes, rules, regulations, or the Owner’s design and construction standards without notifying the Professional(s) and prior to receiving written authorization to proceed, the Builder shall be responsible for the consequences of such performance.

3.1.2 Drawings are generally drawn to scale; however, the figured dimensions or notes thereon shall govern. Before ordering any materials or doing any Work, the Builder and subcontractors shall verify all measurements at the Site and shall be responsible for the correctness of same. Discrepancies shall be reported in writing to the Professional prior to proceeding with the Work. No extra charge or compensation will be entertained due to differences between actual measurements and dimensions indicated on drawings, if such differences do not result in a change in the scope of Work or if the Professional failed to receive written notice before the Work was performed.

### **3.2 Sufficiency of Site**

Prior to signing the Contract for Construction, the Builder has:

- (i) visited the Site and become familiar with local conditions under which the Project is to be constructed and operated; and
- (ii) reviewed and familiarized itself with the Site survey and any existing structures on the Site, and gathered all other information necessary for a full understanding of the Work.

In addition, if the Work involves modifications to or remodeling of an existing structure(s) or other man-made feature(s) on the Site, the Builder has also:

- (iii) reviewed all as-built and record drawings, plans and specifications of which Owner has informed Builder; and



- (iv) thoroughly inspected the structure(s) and man-made feature(s) to be modified or remodeled prior to submission of bid, if any, but in all events prior to signing the Contract for Construction.

Claims resulting from the Builder's failure to familiarize itself with the Site or pertinent documents shall be deemed waived.

## **ARTICLE 4 – BUILDER'S DUTIES, OBLIGATIONS, AND RESPONSIBILITIES**

### **4.1 Performance Of Work**

The Builder shall perform and complete its obligations under the Contract for Construction using its best skill and attention, and covenants with the Owner to furnish management, supervision, coordination, labor, and services (i) which expeditiously, economically and properly complete the Work in the manner most consistent with the Owner's interests and objectives; (ii) which comply with the Contract for Construction; and (iii) which are in accordance with the highest standards currently practiced by persons and entities performing or providing management, supervision, coordination, labor and services on projects similar in size, complexity, and cost to the Project.

- 4.1.1 The Builder shall not be required to provide professional services which constitute the practice of architecture or engineering, unless provided in the Construction Documents and relating to those divisions of the Work for which it is appropriate for Builder's subcontractors to engage or employ licensed engineers for design associated with the Work, such as trusses.
- 4.1.2. All services rendered by the Builder for the Project shall be performed by or under the immediate supervision of persons possessing expertise in the discipline of the service being rendered.
- 4.1.3 The Builder shall, in the course of providing the Work, cooperate and communicate with the Owner, the Professional, the Owner's Commissioning consultants, and all other persons or entities as required for satisfactory completion of the Project.
- 4.1.4 The Builder understands and acknowledges that the Work referred to in the Contract for Construction may be only part of the Project and that the Project may include the construction of other structures or other construction activities on the same Site. The Builder shall conduct all its activities so as not to interfere with the construction of, or operations within or from, other structures on the Site.
- 4.1.5 The Builder shall not damage, endanger, compromise, or destroy any part of the Project or the Site, including by way of example and not limitation, work being performed by others on the Site, monuments, stakes, benchmarks and other survey points, utility services, and existing features or structures on the Site. Should the Builder damage, compromise or destroy any part of the Project or the Site, the Builder shall be fully and exclusively responsible for and bear all costs associated therewith.



## **4.2 Compliance With Laws**

- 4.2.1 The Builder shall comply with all applicable laws, statutes, building codes, rules, regulations, and lawful orders of all governmental, public, and quasi-public authorities and agencies having jurisdiction over the Project.
- 4.2.2 The Builder shall prepare and file documents required to obtain, and shall obtain, all necessary approvals and permits, including building permit(s), of all governmental authorities having jurisdiction over the Work, provided Owner shall pay all building permit and state fire marshal inspection fees directly.
- 4.2.3 The Builder shall give all notices required of it by governmental authorities relating to the Project.

## **4.3 Safety**

Safety shall be a prime concern of the Builder at all times. The Builder shall be solely responsible for and have control over the means, methods, techniques, sequences, and procedures for coordinating and constructing the Work, including Site safety and safety precautions and programs.

## **4.4 On Site Records**

- 4.4.1 The Builder shall maintain at the Site one copy of all drawings, specifications, addenda, approved shop drawings, daily logs, change orders, submittals, other modifications, and all other documents generated throughout the course of the project in good order. The daily logs shall contain detailed information regarding weather conditions, materials delivered, work performed, operating hours, subcontractors working on the Project, and staffing of each subcontractor.
- 4.4.2 The Builder shall continuously update all drawings and specifications to reflect changes as they occur throughout construction. Such “as-built” plans and specifications shall be available at all times to the Owner, the Professional(s), the Owner’s consultants, and quality control and testing agency personnel. The drawings shall be neatly and clearly marked in color during construction to record all variations made during construction, and the Builder shall include such supplementary notes and details necessary to clearly and accurately represent as-built construction.
- 4.4.3 Depending on the requirements of the project-specific BIM Execution Plan, the Builder shall also maintain copies of the BIM models that reflect the as-built or as-installed conditions, geometry, and product/equipment information.

## **4.5 Bribes and Kick-Backs**

The Builder shall not by any means:

- (i) induce any person or entity employed in the construction of the Project to give up any part of the compensation to which that person or entity is entitled;
- (ii) offer or accept any bribes or kick-backs in connection with the Project from or to any individual or entity, including any of its trade contractors, subcontractors, consultants, suppliers, or manufacturers of Project goods and materials; or



- (iii) without the express written permission of the Owner in accordance with Owner's policies, call for or by exclusion require or recommend the use of any subcontractor, consultant, product, material, equipment, system, process, or procedure in which the Builder has a direct or indirect proprietary or other pecuniary interest.

#### **4.6 Quality Control And Testing**

The Builder shall develop and implement a quality management program to ensure quality construction. Unless otherwise specified in the Contract for Construction, the Builder shall procure the quality control and testing agencies, subject to Owner's written approval. The Builder shall coordinate all tests and inspections required by the Construction Documents, and the Builder shall arrange for tests and inspections to be conducted as necessary to avoid any interference with the progress of Work. No claims for extension of time or extra costs will be allowed on account of any testing, retesting, inspection, re-inspection, or rejection of Work when defective or deficient Work is found. Cost of specified measures and tests required by the Construction Documents and performed by Owner-approved quality control and testing agencies shall be included in the Cost of the Work.

#### **4.7 Incident Reporting**

The Builder shall immediately notify the Owner and Professional(s), both orally and in writing, of the nature and details of all incidents which may adversely affect the quality or progress of the Work including, but not limited to, union jurisdictional disputes, accidents, delays, damages to Work, and other significant occurrences.

#### **4.8 Hazardous Substances**

The Builder shall immediately notify the Owner and the Professional(s), both orally and in writing, of the presence and location of any physical evidence of, or information regarding, environmental contamination on the Site (including but not limited to Hazardous Substances and petroleum releases) of which it becomes aware. If the Builder encounters environmental contamination (including but not limited to Hazardous Substances), the Builder shall (i) immediately stop performance of Work or that portion of the Work affected by or affecting such contamination; (ii) secure the contaminated area against intrusion; (iii) not disturb or remove the contamination; (iv) not proceed, or allow any subcontractor or supplier to proceed, with any Work or other activities in the area affected by such contamination until directed to do so by the Owner; and (v) take any other steps necessary to protect life and health.

#### **4.9 Owner's Use Of and Access To The Site**

The Builder shall perform the Work so as not to interrupt any operations of the Owner on, adjacent to, or near the Site.

4.9.1 The Builder understands and acknowledges that the Owner may need access to or use of certain areas of the Site or Work prior to the Builder's achievement of Substantial Completion, and that such occupancy, access, or use shall not constitute the Owner's acceptance of any Work.

4.9.2 The Builder shall not enter any Owner-occupied area of the Site or Project unless first approved and scheduled by the Owner. The Builder understands and acknowledges that the Owner may incur damages if the Owner's operations on the Site are interrupted or impaired as a result of the Work.



- 4.9.3 The Builder shall afford the Owner's own forces and other consultants, trade contractors, subcontractors, and suppliers, access to the Site for performance of their activities, and shall connect and coordinate its construction and operations with theirs as required by the Construction Documents.

**4.10 Utilities**

The Builder shall be responsible for all costs associated with connections to, and consumption of, utilities required for temporary service and construction.

**ARTICLE 5 – BUILDER'S PERSONNEL, SUBCONTRACTORS, SUPPLIERS, AND SITE FACILITIES**

**5.1 Project Staffing**

The Builder shall staff the Project with qualified and designated individuals and entities responsible for its obligations and performance.

- 5.1.1 An authorized representative of the Builder shall be present at all times when Work is being performed.
- 5.1.2 The Builder shall employ persons skilled in the tasks assigned to them and shall contract with subcontractors and suppliers skilled in the tasks assigned to them and capable of working harmoniously with all trades, crafts and other individuals on the Project. The Builder shall use its best efforts to minimize the likelihood of any strike, work stoppage, or other labor disturbance.
- 5.1.3 Students, faculty, and staff shall not be harassed, disturbed, or in any way disrupted in their lawful pursuits. The Builder shall immediately remove from the Site, for the duration of the Project, any person making an inappropriate religious, racial, sexual or ethnic comment, statement or gesture toward any other individual. Sexual harassment shall be reported to the University's Title IX Coordinator and Deputy Title IX Coordinator for Students as prescribed elsewhere in the Contract for Construction.
- 5.1.4 The Builder shall immediately remove from the Site, for the duration of the Project, any person who is incompetent, careless, or not working in harmony.
- 5.1.5 The Builder shall be responsible to the Owner for the acts and omissions of Builder's agents and employees, consultants, subcontractors, and suppliers.
- 5.1.6 Employees of the Builder and its subcontractors shall be screened for – and banned from working on the Owner's property if found to have committed – certain crimes as described elsewhere in the Contract for Construction. The cost of such screening shall be included in the Construction Price.

**5.2 Subcontractor / Supplier Contracts**

The Builder shall enter into written contracts with its subcontractors and suppliers, and those written contracts shall be consistent with the Contract for Construction. It is the intent of the Owner and the Builder that the obligations of the Builder's subcontractors and



suppliers inure to the benefit of the Owner and the Builder, and that the Owner be a third-party beneficiary of the Builder's agreements with its subcontractors and suppliers.

- 5.2.1 The Builder shall make available to each subcontractor and supplier, prior to the execution of written contracts with any of them, a copy of the pertinent portions of the Contract for Construction, including those portions of the Construction Documents to which the subcontractor or supplier will be bound, and shall require that each subcontractor and supplier shall similarly make copies of applicable parts of such documents available to its respective subcontractors and suppliers.
- 5.2.2 The Builder shall include in its written contracts with subcontractors and suppliers a provision that includes the acknowledgment and agreement of the subcontractor or supplier that it has received and reviewed the applicable terms, conditions, and requirements of the Contract for Construction included by reference in its written contract with the Builder, and that it will abide by those terms, conditions, and requirements.
- 5.2.3 The Builder's written contracts with its subcontractors and suppliers shall preserve and protect the rights of the Owner and include the acknowledgment and agreement of each subcontractor or supplier that the Owner is a third-party beneficiary of the contract. The Builder's agreements with its subcontractors and suppliers shall require that in the event of default under, or termination of, the Contract for Construction, and upon request of the Owner, the Builder's subcontractors and suppliers will perform services for the Owner.
- 5.2.4 Without limitation of the foregoing subsections, the Builder's written contracts with its subcontractors and suppliers shall include the following provision: *"When the Builder receives payment from the Owner for labor, services, or materials furnished by subcontractors and suppliers hired by the Builder for the Project, the Builder shall remit payment due to those subcontractors and suppliers, less the value of any item contested in accordance with the Contract for Construction, within ten (10) days after the Builder's receipt of payment from the Owner. When the payment due the subcontractor is for final payment, including retainage, the subcontractor must include with the invoice for final payment, a conditional release of lien and all required warranties and closeout documentation. When the subcontractor receives payment from the Builder for labor, services, or materials furnished by the subcontractors and suppliers hired by the subcontractor, the subcontractor shall remit payment due to those subcontractors and suppliers, less the value of any item contested in accordance with the Contract for Construction, within ten (10) days after the subcontractor's receipt of payment."*

### **5.3 Resolution of Trade Disputes**

The Builder shall promptly resolve claims, complaints, labor disputes, and disputes over assignment of work tasks by and among its subcontractors and suppliers.

## **ARTICLE 6 – GOODS, PRODUCTS, AND MATERIALS**

### **6.1 Quality Of Materials**

The Builder shall furnish goods, products, materials, equipment, and systems that:



- (i) comply with the Contract for Construction;
- (ii) conform to applicable specifications, descriptions, instructions, drawings, data, and samples;
- (iii) are new (unless otherwise specified or permitted) and without apparent damage;
- (iv) are of quality, strength, durability, capacity, or appearance equal to or higher than that required by the Construction Documents;
- (v) are merchantable;
- (vi) are free from defects; and
- (vii) exceed and/or are in addition to those required by manufacturers' or suppliers' specifications where such additional items are required by the Construction Documents.

## **6.2 Installation And Use Of Materials**

All goods, products, materials, equipment, and systems shall, unless specifically stated otherwise, be furnished, used, installed, employed, and protected in strict compliance with the specifications, recommendations, and instructions of the manufacturer or supplier, unless such specifications, recommendations, or instructions deviate from accepted construction practices or the Construction Documents, in which case the Builder shall so inform the Owner and Professional and shall proceed as directed by that Professional, unless otherwise directed by the Owner. The Builder shall coordinate and interrelate all trade contracts and subcontracts to ensure compatibility of goods, products, materials, equipment, and systems – and validity of all warranties and guarantees – required by the Construction Documents for the Work.

## **6.3 Unsuitable Materials**

The Builder shall inform the Owner of goods, products, materials, and equipment or systems the Builder knows are unsuitable or unavailable at the time of bid submission. Claims relating to or arising out of claims that goods, products, materials, equipment, or systems are unsuitable or unavailable shall not be entertained by the Owner unless the Builder, subcontractor, or supplier notified the Owner in writing at the time of bid submission, along with proposed alternatives. Approval by the Owner and the Professional does not mean or imply final acceptance by the Owner and Professional if such items should be defective or not as previously represented. Should the Builder furnish any approved goods, products, materials, equipment, or systems different from or in addition to those required by the Construction Documents which require supplemental materials or installation procedures different from or in addition to those required for specified items, the Builder shall provide such at no increased cost to the Owner.

## **6.4 Substitutions**

There shall be no substitution of products, materials, or equipment unless approved by the Professional in advance of procuring such goods, except as expressly permitted by the Contract for Construction.

## **6.5 Construction Manager Responsibility**



If Builder is acting as a construction manager, Builder shall also inform the Owner and Professional during the various stages of design development if proposed materials or equipment do not conform with the Owner's construction budget, Owner's program and/or project requirements, or Owner's design and construction standards.

#### **6.6 Security For The Project**

The Builder shall provide security for the Project, including but not limited to security for Work in progress and for the goods, products, materials, equipment, systems, construction machinery, tools, devices, and other items required, used, or to be used for performing the Work.

### **ARTICLE 7 – DOCUMENTS AND INFORMATION**

#### **7.1 Information from Owner**

The Owner shall provide the Builder with information reasonably necessary to assist the Builder in performing its services including, if applicable and available:

- (i) the Site legal description and any required survey;
- (ii) all written and tangible material of which it informs Builder concerning conditions below ground at the Site;
- (iii) if the Project involves an existing structure, all as-built drawings, record drawings, plans, specifications, and structural information; and
- (iv) the Owner's pertinent Project dates and key milestone dates.

#### **7.2 Resolution of Questions**

The Builder shall resolve all questions concerning the Construction Documents with the Professional(s) who prepared the documents.

#### **7.3 Processing of Documents**

When requested to do so by the Owner, the Builder shall process documents and provide other reasonably required drawings, services, and certifications necessary to enable the Owner to (i) obtain permits or other approvals not otherwise required to be obtained by Builder and (ii) represent that the Work complies with the requirements of Authorities Having Jurisdiction.

#### **7.4 Sufficiency of Owner Information**

The furnishing of information by the Owner to the Builder shall not relieve the Builder of responsibilities contained elsewhere in the Contract for Construction to evaluate information and documents provided by the Owner. The Builder shall timely notify the Owner in writing of any additional information needed or services required from the Owner in order for the Builder to perform the Work.



## **ARTICLE 8 – SUBMITTALS**

### **8.1 Submittal Schedule**

The Builder shall timely prepare and transmit to the Professional a schedule for provision of all anticipated submittals and shop drawings. The schedule shall (i) include submittals required by the specifications; (ii) be in a format acceptable to the Professional; (iii) be coordinated with the Construction Schedule; and (iv) set forth specific dates for submission of the listed submittals.

### **8.2 Processing of Submittals**

The Builder shall in timely fashion review, approve or reject as necessary, and forward approved submittals to the Professional for review and approval along with such detail and information as the Professional requires. No part of the Work dealt with by a submittal shall be fabricated or performed until such approval has been given.

8.2.1 Submittals and shop drawings shall be provided in electronic format – searchable PDF for product data and other submittals; DWG, RVT, or other Navisworks-compatible software for shop drawings.

8.2.2 The Professional is responsible to the Owner, but not to the Builder, to verify that the submittals conform to the design concept and functional requirements of the plans and specifications, that the detailed design portrayed in shop drawings and proposed equipment and materials shown in submittals are of the quality specified and will function properly, and that the submittals comply with the Contract for Construction.

8.2.3 All Work shall be performed in accordance with approved submittals. Approval of submittals by the Professional shall not relieve the Builder from complying with the Contract for Construction, including all plans and specifications, addenda thereto, and approved Change Orders.

8.2.4 Re-submittals required to correct errors, omissions, or invalid substitutions by the Builder or its subcontractors shall not constitute an excusable or compensable delay.

### **8.3 Record Documents**

The Builder shall provide to Owner final and complete electronic copies of all submittals and shop drawings, updated and annotated as needed to illustrate the products, equipment, and materials actually installed.

## **ARTICLE 9 – BUILDER’S INSPECTION AND CORRECTION OF DEFECTIVE OR INCOMPLETE WORK**

### **9.1 Rejection and Correction of Work In Progress**

During the course of Project, the Builder shall inspect and promptly reject any Work that (i) does not conform to the Construction Documents or (ii) does not comply with any applicable law, statute, building code, rule, or regulation of any governmental, public, and quasi-public authorities or Authorities Having Jurisdiction.



- 9.1.1 The Builder shall promptly correct or require the correction of all rejected Work, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. The Builder shall bear all costs of correcting such Work, including additional testing and inspections and compensation for all services and expenses necessitated by such correction.
- 9.1.2 The Builder shall bear the cost of correcting destroyed or damaged Work, whether completed or partially completed, of the Owner or other trade contractors or subcontractors caused by the Builder's correction or removal of rejected Work.

## **9.2 Covered or Concealed Work**

If a portion of the Work has been covered, the Builder shall, if notified to do so by the Owner or the Professional, uncover the designated portion for observation and then replace it.

- 9.2.1 If the designated portion of the Work was covered contrary to the request of the Owner or the Professional, or to requirements specifically expressed in the Construction Documents, the Builder shall receive no additional compensation for the costs of uncovering and replacement or modification of the Construction Schedule.
- 9.2.2 If the designated portion of the Work was covered prior to a specific request by the Owner or the Professional that it remain uncovered, the Builder shall receive additional compensation for the costs of uncovering and replacement or modification of the Construction Schedule(s) only if the designated portion of the Work was in conformance with the Construction Documents.

# **ARTICLE 10 – CHANGE ORDERS, CHANGES TO THE WORK, AND CHANGED CONDITIONS**

## **10.1 Change Order Proposals and Requests**

Builder may propose, and Owner or the Professional may request, changes to the Work, compensation, or applicable schedules.

- 10.1.1 With respect to Builder's proposals for changes, the Builder shall prepare and submit change order proposals to the Professional, together with appropriate back-up documentation.
- 10.1.2 With respect to Owner's and/or the Professional's requests for changes, the Builder shall promptly review and respond to such requests provided by the Owner or the Professional.
- 10.1.3 When requested to do so, the Builder shall prepare and submit to the Professional drawings, specifications, detailed cost estimates as prescribed below, or other data in support of a change order proposal or request.
- 10.1.4 Each Builder-submitted change order proposal shall include any and all time and monetary impacts of the change, whether the change order is considered alone or with all other changes during the course of the Project, together with substantiating back-up documentation.



## **10.2 Owner-Directed Changes**

The Owner may unilaterally direct the Builder to implement changes in the Work so long as the Work the Owner is requiring is not outside of the general scope of the Contract for Construction, and the Builder, upon written direction from the Owner, shall proceed with such change.

## **10.3 Professional-Directed Changes**

The Professional, without the Owner's prior approval, may authorize or direct the Builder to make minor changes in the Work that are consistent with the intent of the Construction Documents and which do not involve a change in Project cost, time for construction, scope, or approved design elements. Any such minor changes shall be implemented by written field order or supplemental instruction from the Professional and executed promptly by the Builder.

## **10.4 Administration of Changes**

The Professional will administer and manage all change orders and change order proposals or requests – including claims for additional compensation, time, or both – and will prepare required drawings, specifications, and other supporting data in connection therewith.

## **10.5 Compensation for Changes**

With respect to all change order proposals or requests involving credit to the Owner or additional compensation to the Builder, the Builder shall (i) obtain from subcontractors and suppliers the best possible price quotations; (ii) review such quotations to ascertain whether they are reasonable; (iii) prepare an itemized accounting together with appropriate supporting data, including reasonable expenditures by, and savings to, those performing the Work involved in the proposed change; and (iv) provide a reasonable and detailed price quotation to the Professional.

10.5.1 If Professional determines price quotations for change order proposals or requests are unreasonable, the Builder shall, in writing, justify said quotations or provide additional back-up documentation. If, after review of the additional information, the Professional determines the quotation is unreasonable, the Owner may require the subject Work be performed on a time and material basis.

10.5.2 The Builder and its subcontractors and suppliers shall be allowed no additional compensation for any costs, fees, or expenses incurred in performing services already required by the Contract for Construction, and shall not be entitled to additional reimbursement for home office, other non-jobsite or indirect overhead expenses, or tools necessary for construction.

10.5.3 It is the responsibility of the Builder to review and approve all pricing of additional work required of its subcontractors and suppliers.

## **10.6 Concealed and Unforeseen Conditions**

If (i) the Builder encounters concealed or unforeseen conditions of an unusual nature that affect performance of the Work; or (ii) the conditions vary from those indicated by the Construction Documents; and (iii) such conditions are not ordinarily found to exist or differ materially from those generally recognized as inherent in work of the character provided by the Builder, the Builder shall promptly, but in no event later than seven (7) calendar



days after first observance of the conditions, notify the Professional and the Owner before conditions are disturbed and give the Professional or the Owner opportunity to observe the condition in its undisturbed state.

10.6.1 Owner and Professional shall promptly investigate the conditions. If Owner and Professional determine, within their discretion, that the conditions (i) differ substantially from those indicated in the Construction Documents and (ii) cause a material increase or decrease in the Builder's cost of, or time required for, performance of the Work, then compensation and/or time for performance will be equitably adjusted.

10.6.2 All adjustments in compensation or extensions of time shall be by change order. Change order proposals or requests shall be submitted within fourteen (14) calendar days of the date of observation of the changed or unknown conditions.

10.6.3 The Builder's failure to notify the Professional and Owner as provided in this Article shall constitute a waiver of any claim arising out of or relating to such concealed or unknown condition.

## **10.7 Performance of Changes**

Upon Builder's receipt of an executed change order or approved change order proposal, changes in the Work shall be promptly performed. All changes in the Work shall be performed under applicable conditions of the Construction Documents.

## **10.8 Disputes Regarding Changes**

10.8.1 Regardless if there is a dispute (i) that a change has occurred; (ii) whether a change in the Work will result in adjustment of compensation or applicable schedules; or (iii) as to the amount of any adjustment of compensation or applicable schedules, the change shall be carried out if the Owner so directs. No claim shall be prejudiced by performance of the Work so long as the Owner is notified of the claim in writing prior to performance of the Work which is the subject of the dispute and the party disputing the decision of the Owner recites the reasons for its dispute in the written notice. Failure to notify the Owner in writing shall constitute a waiver of any claim resulting from the change.

10.8.2 In the event a change order proposal is approved by the Owner in the absence of an agreement as to cost, time, or both, the Professional will (i) receive and maintain all documentation pertaining thereto; (ii) examine such documentation on the Owner's behalf; (iii) take such other action as may be reasonably necessary or as the Owner may request; and (iv) make a written recommendation to the Owner concerning any appropriate adjustment in the Construction Price or time.

## **10.9 Necessity for Signature Approval**

No act, omission, or course of dealing shall alter the requirement that change orders shall be in writing and signed by the Owner, and that change orders are the exclusive method for effecting any adjustment to compensation or applicable schedules. The Builder understands and agrees, on behalf of itself and its subcontractors and suppliers, that neither compensation nor applicable schedules can be changed by implication, oral agreement, or unwritten change order.



## **ARTICLE 11 – OWNER’S CONSULTANT(S) AND CONSTRUCTION ADMINISTRATION**

### **11.1 Owner’s Designated Professional Representative**

Unless otherwise directed by the Owner, the Professional shall act as the Owner’s agent for design-related issues, interpretation of the Construction Documents, and other matters described in these General Terms & Conditions.

11.1.1 The Professional will be the Owner's design representative during performance of the Work and will consult with and advise the Owner on all design and technical matters.

11.1.2 The Professional will act as initial interpreter of the requirements of the Contract for Construction and as the Owner’s advisor on claims.

### **11.2 Professional Site Visits**

The Professional will visit the Site with sufficient frequency for familiarization with the progress and quality of the Work and to inspect the Work to determine compliance of the Work with (i) the Contract for Construction; (ii) approved shop drawings and other submittals; (iii) the Construction Schedule; and (iv) applicable laws, statutes, building codes, rules, or regulations of all governmental, public, and quasi-public authorities or Authorities Having Jurisdiction.

### **11.3 Professional Rejection of Work**

The Professional may disapprove or reject Work which does not comply with (i) the Contract for Construction; (ii) approved shop drawings and other submittals; or (iii) applicable laws, statutes, building codes, rules, or regulations of any governmental, public, and quasi-public authorities and Authorities Having Jurisdiction.

### **11.4 Professional Evaluations**

11.4.1 The Professional will review and evaluate the results of all inspections, tests, and written reports required by the Contract for Construction and by any governmental entity having or asserting jurisdiction over the Project. The Professional will take appropriate action, if necessary, arising from such evaluations, including acceptance, rejection, requiring additional testing or corrective work, or such other action deemed appropriate by the Professional. The Professional will promptly reject Work which does not conform to and comply with testing requirements.

11.4.2 The Professional may require inspection or testing of any Work in addition to that required by the Contract for Construction or governmental entities having or asserting jurisdiction over the Project when such additional inspections and testing is necessary or advisable, whether or not such Work is then fabricated, installed, or completed. The Professional will take appropriate action on all such special testing and inspection reports, including acceptance, rejection, requiring additional testing or corrective work, or such other action deemed appropriate by the Professional.

### **11.5 Professional Submittal Activities**

The Professional will review and approve, reject, or take other appropriate action on submittals such as shop drawings, product data, samples, proposed equal materials or



equipment, and requested substitutions not more than fourteen (14) calendar days after receipt, and will not approve any submittals unless such submittals conform to the Construction Documents. The Professional's review of submittals shall not constitute final acceptance of materials or equipment furnished or installed if such materials or equipment prove to be defective or not as represented by approved submittals or as otherwise required by the Construction Documents. The Builder remains responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of assembly, and for performance of the Work.

#### **11.6 Professional Interpretations**

The Professional will, when requested to do so in writing by the Builder, promptly and so as to cause no unnecessary delay, render written or graphic interpretations and decisions necessary for the proper execution of the Work. The Professional's interpretations and decisions relating to aesthetic or artistic effect shall be final if not inconsistent with the Contract for Construction.

#### **11.7 Professional Pay Application Activities**

The Professional will review applications for payment, including such accompanying data, information, and schedules as the Professional requires, to verify the amounts due to the Builder and shall authorize payment by the Owner to the Builder in writing. After the Work is determined to be Finally Complete by the Professional, the Professional will certify to the Owner in writing that the Builder is entitled to final payment and submit the pay application to the Owner for final approval.

#### **11.8 Professional Relationship to Builder**

The duties, obligations, and responsibilities of the Builder under the Contract for Construction shall not be changed, abridged, altered, discharged, released, or satisfied by any duty, obligation, or responsibility of any Professional. The Builder shall not be a third-party beneficiary of any agreement by and between the Owner and any Professional. The duties of the Builder to the Owner shall be independent of, and shall not be diminished by, any duties or obligations of any Professional to the Owner.

#### **11.9 Commissioning Consultant**

The Owner may also employ an independent Commissioning consultant to verify performance and/or quality of certain building systems or components. The Builder shall coordinate the Work and its schedule and activities with the Commissioning consultant and shall act upon the observations and recommendations of same, provided such action does not conflict with the Contract for Construction or specific direction by the Owner or the Professional.

The Builder shall perform functional performance testing of items being commissioned under the supervision of the Owner's Commissioning consultant.

### **ARTICLE 12 – SUBSTANTIAL AND FINAL COMPLETION**

#### **12.1 Substantial Completion**

12.1.1 When the Builder believes that the Work is Substantially Complete, it shall notify the Owner and the Professional that the Work is ready for a Substantial Completion inspection. The Builder shall endeavor to give the Owner and the



Professional notice two (2) weeks prior to the predicted Substantial Completion inspection date(s).

- 12.1.2 Upon receipt of notification from the Builder, the Professional will coordinate with the Owner and the Builder date(s) for inspection(s) of the Work to determine whether the Work is Substantially Complete.
- 12.1.3 Prior to such inspections, the Builder shall develop a comprehensive list of known discrepancies, deficiencies, or incomplete Work (i.e., the “punchlist”).
- 12.1.4 At inspection(s) to determine whether the Work is Substantially Complete, the Professional, the Commissioning consultant(s), the Owner, and other governing or concerned entities will:
  - (i) inspect the Work;
  - (ii) create or append punchlists;
  - (iii) review the overall status of the Work and any outstanding or deficient issues; and
  - (iv) determine whether Substantial Completion of the Work has occurred.
- 12.1.5 If the Work is determined not to be Substantially Complete, the Work shall be prosecuted until the Work is Substantially Complete and the inspection process shall be repeated at no additional cost to the Owner until the Work is determined to be Substantially Complete. Builder will be responsible for costs of the Owner’s consultants associated with premature or failed inspections.
- 12.1.6 On or prior to the required date of Substantial Completion, the Builder shall deliver to Owner reports, extra materials, and other necessary documents and items for the Owner’s occupancy and use of the Work for its intended purpose. These documents and items are enumerated on the Owner’s website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)). The Professional will review such documentation and items, and will inform the Owner and the Builder of any deficiencies.
- 12.1.7 When the Owner, the Builder, and the Professional agree that the Work has passed Substantial Completion inspection(s) and the Builder has produced the required Substantial Completion documentation and items, they shall each sign the Owner’s standard Certificate of Substantial Completion form, declaring the Work Substantially Complete and establishing the actual date of Substantial Completion. The Certificate of Substantial Completion shall also be accompanied by a final, consolidated punchlist.
- 12.1.8 If the Work is commissioned through the services of a Commissioning consultant, such Commissioning – including functional performance tests – shall be completed as a pre-requisite to the Work being declared Substantially Complete, provided Builder shall not be responsible for delays in Commissioning not the fault of Builder.



- 12.1.9 The Builder shall provide the Owner with operation and maintenance documents not less than forty-five (45) calendar days prior to the required date of Substantial Completion to allow adequate time for review, correction, and training of the Owner's personnel prior to Commissioning and the Owner's occupancy of the Project.
- 12.1.10 The Builder shall meet with the Owner's personnel prior to the required date of Substantial Completion to familiarize and train them with respect to maintenance and use of the Project. All training sessions shall be recorded (audio and visual), with copies provided to the Owner.
- 12.1.11 The date of Substantial Completion shall fix the commencement date of warranties and guaranties and allocate between the Owner and the Builder responsibility for security, utilities, damage to the Work, and insurance.

## **12.2 Final Completion**

- 12.2.1 When the Builder believes the Work has achieved Final Completion (including correction of all punchlist items), the Builder shall notify the Owner and the Professional that the Work is ready for Final Completion inspection.
- 12.2.2 Upon receipt of such notification from the Builder, the Professional will coordinate with the Owner and the Builder a date for inspection of the Work to determine whether the Work has achieved Final Completion.
- 12.2.3 At the Final Completion inspection, the Owner and the Professional will:
- (i) inspect the Work;
  - (ii) determine whether all punchlist items have been satisfactorily completed and corrected;
  - (iii) determine whether the Work complies with (a) the Contract for Construction; (b) applicable laws, statutes, building codes, rules, or regulations of all governmental, public, and quasi-public authorities or Authorities Having Jurisdiction; and (c) applicable installation and workmanship standards;
  - (iv) determine whether required inspections and approvals by the official(s) having or asserting jurisdiction over the Project (including, but not limited to, the AHJ) have been satisfactorily completed; and
  - (v) confirm receipt of the deliverables listed below.
- 12.2.4 If Final Completion has not been achieved, the Builder shall continue to prosecute the Work, and the inspection process shall be repeated at no additional cost to the Owner, until Final Completion is achieved.
- 12.2.5 On or prior to the date of Final Completion, the Builder shall deliver to the Owner the following documentation and items:



- (i) Certificate of Final Completion – executed on Owner’s standard form;
- (ii) all operation and maintenance manuals not previously produced;
- (iii) one (1) set of as-built plans and specifications;
- (iv) record copies of BIM files as required by the project-specific BIM Execution Plan, if applicable;
- (v) certification and affidavit that all insurance required of the Builder beyond final payment, if any, is in effect and will not be canceled or allowed to expire without notice to the Owner;
- (vi) written consent of the surety(ies), if any, to final payment;
- (vii) full, final, and unconditional waivers of mechanics or construction liens, from each contractor, subcontractor, supplier, or other person or entity who has or might have a claim;
- (viii) full, final, and unconditional certification and affidavit that all of the Builder’s obligations to contractors, subcontractors, suppliers, and other third parties for payment for labor, materials or equipment related to the Project have been paid or otherwise satisfied;
- (ix) all written warranties and guarantees relating to the labor, goods, products, materials, equipment, and systems incorporated into the Work, endorsed, countersigned, and assigned as necessary;
- (x) affidavits, releases, bonds, waivers, permits, and other documents necessary for final close-out of Work;
- (xi) a list of any item(s) due but unable to be delivered and the reason for non-delivery; and
- (xii) any other documents reasonably and customarily required or expressly required herein for full and final close-out of the Work, including those items enumerated on the Owner’s website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)).

12.2.6 The Professional will review and determine the sufficiency of all such documentation and items and will immediately inform Owner and the Builder of any deficiencies and omissions.

## **ARTICLE 13 – BUILDER’S WARRANTIES AND GUARANTEES**

### **13.1 One-Year Warranty**

In addition to the warranties and guarantees set forth elsewhere in the Contract for Construction, the Builder, upon request by the Owner or the Professional, shall promptly correct all failures or defects in the Work for a period of one year after the actual date of Substantial Completion, or the date of acceptance by the Owner, whichever is later.



13.1.1 The Builder shall schedule, coordinate, and participate in a walk-through inspection of the Work one month prior to the expiration of the one-year correction period, and shall notify the Owner, the Professional, and any necessary subcontractors and suppliers of the date of, and request their participation in, the walk-through inspection. The purpose of the walk-through inspection is to determine if there are defects or failures requiring correction.

13.1.2 Should the Builder fail to promptly correct any failure or defect, the Owner may take whatever actions it deems necessary to remedy the failure or defect and the Builder shall promptly reimburse the Owner for any expenses or damages it incurs as a result of the Builder's failure to correct the failure or defect.

### **13.2 Post-Completion Commissioning Activities**

The Builder and its subcontractors shall participate in Commissioning activities following Substantial Completion as prescribed in the Construction Documents, the purpose of which is to confirm and optimize performance of the commissioned systems. Such participation may include the need for the Builder to perform corrective work if deficiencies in the Work are revealed.

### **13.3 Express Warranties and Guarantees – Builder**

In addition to the warranties and guarantees set forth elsewhere herein, the Builder expressly warrants and guarantees to the Owner:

- (i) that the Work will comply with the Construction Documents and all applicable laws, statutes, building codes, rules, and regulations of all governmental, public, and quasi-public authorities or Authorities Having Jurisdiction;
- (ii) that all goods, products, materials, equipment, and systems incorporated into the Work will conform to applicable specifications, descriptions, instructions, drawings, data, and samples;
- (iii) that all goods, products, materials, equipment, and systems incorporated into the Work will be new (unless otherwise specified or permitted) and without apparent damage or defect; of quality equal to or higher than that required by the Construction Documents; and merchantable; and
- (iii) that all management, supervision, labor, and services required for the Work will comply with the Contract for Construction and will be performed in a workmanlike manner.

### **13.4 Express Warranties and Guarantees – Subcontractors and Suppliers**

The Builder shall require that all of its subcontractors and suppliers provide written warranties, guarantees, and other undertakings to the Owner and the Builder in a form identical to the warranties, guarantees, and other undertakings set forth in the Contract for Construction, including the warranties, guarantees, and undertakings set forth in this Article, which warranties, guarantees, and undertakings shall run to the benefit of the Owner as well as the Builder.

### **13.5 Non-Exclusivity and Survival**

The warranties and guarantees set forth in this Article shall be in addition to all other warranties – express, implied, or statutory – and shall survive the Owner's payment,



acceptance, inspection of or failure to inspect the Work, and review of the Construction Documents.

### **13.6 Non-Limitation**

Nothing contained in Paragraph 13.1 shall be construed to establish a period of limitation with respect to the Builder's obligations under the Contract for Construction. Paragraph 13.1 relates only to the Builder's specific obligations with respect to the Work, and has no relationship to the time within which the Builder's contractual obligations under the Contract for Construction may be enforced, nor to the time within which proceedings may be commenced to establish the Builder's liability with respect to any contractual obligations pursuant to Paragraph 13.1 or contained elsewhere herein.

### **13.7 Commencement of Obligations**

Unless otherwise specified, all of the Builder's warranty and guaranty obligations, including the time period(s) for all written warranties and guarantees of specifically designated equipment required by the Construction Documents, shall begin on the actual date of Substantial Completion or the date of acceptance by the Owner, whichever is later.

## **ARTICLE 14 – OWNER'S DUTIES, OBLIGATIONS, AND RESPONSIBILITIES**

### **14.1 Timely Compensation of Builder**

The Owner shall, in a timely manner, compensate the Builder in accordance with the Contract for Construction.

### **14.2 Owner Review of Documents**

The Owner shall review documents prepared by the Builder in a timely manner and in accordance with schedule requirements. Review by the Owner shall be solely for the purpose of determining whether such documents are generally consistent with the Owner's intent. No review of such documents shall relieve the Builder of any of its responsibilities. In addition, the Owner's review of documents for purposes of issuing a building permit shall not relieve the Builder of any of its responsibilities.

### **14.3 Status of Owner**

The Owner shall not have control of, or responsibility for, construction means, methods, techniques, sequences, procedures, or safety precautions and programs in connection with the Work, nor shall the Builder, for any of the foregoing purposes, be deemed the agent of the Owner.

## **ARTICLE 15 – BUILDER'S COMPENSATION**

### **15.1 Schedule of Values**

15.1.1 Prior to submitting its first application for payment for the Work, the Builder shall prepare and present to the Owner and Professional for approval a schedule of values (SOV) using the Owner's form.

15.1.2 For construction management projects, this SOV shall be based on the draft schedule of values submitted with the GMP proposal, adjusted to account for the final subcontract award amounts.



15.1.3 Allowances for un-awarded trade subcontracts may be included in the SOV.

15.1.4 The Builder shall not imbalance or artificially inflate any element in the SOV.

15.1.5 Upon the Owner's acceptance, the SOV shall be used to process and pay the Builder's payment requests.

15.1.6 The Builder shall comply with the Trench Safety Act (Chapter 553, Part VI, Florida Statutes), which requires that builders delineate in their Schedules of Values the cost of compliance with applicable trench safety standards.

## **15.2 Unit Prices**

If any portion of the Construction Price is determined by the application of unit prices, the number of units contained in the Schedule of Values is an estimate only, and compensation to the Builder shall be determined by the actual number of units incorporated in, or required by, the Work.

## **15.3 Invoicing Procedures**

In accordance with the procedures and requirements set forth in the Owner's policies, the Builder shall invoice the Owner and the Owner shall pay the Builder the amount due subject to the following and the Contract for Construction.

15.3.1 The Builder shall submit invoices to the Professional requesting payment for labor and services rendered during the preceding thirty calendar days. Each invoice shall contain such detail and be backed up with whatever supporting information the Owner or the Professional requests and shall at a minimum state:

- (i) the total original Construction Price and total current Construction Price;
- (ii) the amount due for properly provided labor, materials, and equipment properly incorporated into the Project; and with respect to amounts invoiced for materials or equipment necessary for the Project and properly stored at the Site (or elsewhere if offsite storage is approved in writing by the Owner), be accompanied by written proof that the Owner has title to such materials or equipment and that such material and equipment is fully insured against loss or damage;
- (iii) a breakdown of the various phases, bid packages, or parts of the Work as related to the Construction Price in accordance with standard Construction Specifications Institute (CSI) format;
- (iv) the value of the various phases, bid packages, or parts of the Work actually performed;
- (v) previously invoiced amounts and credit payments made;
- (vi) the total amount due, less any agreed retainage; and
- (vii) a summary of change orders to date.



Applications for payment shall also include such lien waivers and other documentation verifying the Builder's payment to subcontractors and suppliers as the Owner or Professional may request.

15.3.2 Goods and materials procured through the Owner Direct Purchase process shall be invoiced separately in accordance with Owner's policies.

## **15.4 Payment Procedures**

15.4.1 Within seven (7) days of receipt, the Professional will review the Builder's applications for payment, including such accompanying data, information, and schedules as the Professional requires, to determine the amounts due to the Builder and, based upon such review, together with its inspections of the Work, shall authorize payment by the Owner to the Builder in writing. Such authorization will constitute the Professional's certification to the Owner that:

- (i) the Work described in the Builder's invoice has progressed to the level indicated and has been performed in accordance with the Contract for Construction;
- (ii) all necessary and appropriate lien waivers have been submitted;
- (iii) the "as-built" record documents are current and up-to-date; and
- (iii) the amount requested is currently due and owing to the Builder.

15.4.2 In the case of unit price work, the Professional's recommendations for payment will constitute a final determination of quantities and classifications of such work.

## **15.5 Owner's Right to Refuse Payment**

The Professional's approval of the Builder's invoice shall not preclude the Owner from exercising any of its remedies under the Contract for Construction. In the event of a dispute, payment shall be made within the timeframe(s) prescribed herein for amounts not in dispute, subject to any exceptions claimed by the Owner. The Owner shall have the right to refuse to make payment and, if necessary, may demand the return of all or a portion of the amount previously paid to the Builder due to:

- (i) the Builder's failure to perform the Work in compliance with the requirements of the Contract for Construction or any other agreement between the parties;
- (ii) the Builder's failure to correctly and accurately represent the Work performed in a payment request, or otherwise;
- (iii) the Builder's performance of the Work at a rate or in a manner that, in the Owner's opinion, is likely to result in the Project or any portion of the Project being inexcusably delayed;
- (iv) the Builder's failure to use funds previously paid the Builder by the Owner to pay the Builder's Project-related obligations including, but not limited to, the Builder's subcontractors, materialmen, and suppliers;



- (v) claims made, or likely to be made, against the Owner;
- (vi) loss caused by the Builder or the Builder's subcontractors or suppliers; or
- (vii) the Builder's failure or refusal to perform any of its obligations to the Owner.

#### **15.6 Builder's Right to Refuse Performance for Non-Payment**

If – within twenty (20) calendar days of Owner's receipt of the Builder's application for payment properly prepared in accordance with Owner's policies and approved and executed by the Professional – the Owner, without cause or basis hereunder, fails to pay the Builder any amounts then due and payable to the Builder, the Builder shall have the right, in addition to all other rights and remedies contained herein, to cease performance of the Work until receipt of proper payment after first providing fourteen (14) calendar days written notice to the Owner of its intent to cease work.

#### **15.7 Correction of Past Payments**

All prior payments, whether based on estimates or otherwise, may be corrected and adjusted in any subsequent payment and shall be corrected and adjusted in the final payment. In the event that any invoice contains a defect or impropriety which would prevent payment by the date due, the Owner shall notify the Builder in writing of such defect or impropriety. Any disputed amounts determined by the Owner to be payable to the Builder shall be due thirty (30) calendar days from the date the dispute is resolved.

#### **15.8 Invoice Warranties and Guarantees**

The Builder expressly warrants and guarantees to the Owner that:

- (i) title to all goods, products, materials, equipment, and systems covered by an invoice will pass to the Owner either by incorporation into the Work, or upon receipt of payment by the Builder, whichever occurs first;
- (ii) all goods, products, materials, equipment, and systems covered by an invoice are free and clear of liens, claims, security interests, or encumbrances; and
- (iii) no goods, products, materials, equipment, or systems covered by an invoice have been acquired by the Builder or its subcontractors or suppliers, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Builder or its subcontractors or suppliers.

#### **15.9 Builder's Signature**

The signature of the Builder on any invoice constitutes the Builder's certification to the Owner that (i) the Builder's services listed in the invoice have progressed to the level indicated and have been performed as required by the Contract for Construction; (ii) the Builder has paid its subcontractors and suppliers their proportional share of all previous payments received from the Owner; (iii) the amount requested is currently due and owing; and (iv) all subcontractors performing the Work for which payment is made hold all necessary State of Florida licenses.

#### **15.10 Taxes and Owner Direct Purchase Program**

15.10.1 The Builder shall incorporate into the Construction Price, and pay, all sales, consumer, use, and similar taxes for goods, products, materials, equipment, and



systems incorporated into the Work that were legally required at the time of execution of the Contract for Construction, whether or not yet effective or merely scheduled to go into effect.

15.10.2 For construction management projects, the Owner may elect to implement a direct purchase program, whereby eligible materials or equipment included in a subcontractor's bid are purchased by the Owner directly from the supplier in order to achieve sales tax savings.

15.10.3 Such direct purchases shall not relieve the Builder and/or its subcontractors of their responsibility to ensure the materials and equipment meet the specifications and requirements of the Contract for Construction.

15.10.4 When Builder's Risk insurance is furnished by the Builder (see Article 19), such insurance shall name the Owner as the insured or an additional insured and shall include coverage of such materials in transit or stored offsite. Builder shall in any case be responsible for safeguarding such materials on the project Site on the Owner's behalf.

15.10.5 The Owner's written policy on direct purchases shall govern. See [www.facilities.ufl.edu](http://www.facilities.ufl.edu).

#### **15.11 Compensation of Builder's Subcontractors and Suppliers**

15.11.1 Not less than forty-five (45) days after satisfactory completion of their portion of the Work, subcontractors may invoice Builder for remaining unpaid Work, including the full value of the retainage related to such Work less the value of any contested item(s), and provided each such subcontractor has provided Builder with all required close-out documentation. Builder shall include subcontractor pay requests in the Builder's application for payment. No later than ten days (10) after receipt of payment from the Owner, the Builder shall pay each of its subcontractors and suppliers out of the amount received by the Builder on account of such subcontractor's or supplier's portion of the Work, the amount to which each entity is entitled, reflecting percentages actually retained from payments to the Builder on account of such entity's portion of the Work, if any.

15.11.2 The Owner shall have no obligation to pay, and shall not be responsible for payments to, the Builder's subcontractors or suppliers. However, the Owner reserves the right, but has no duty, to make payment jointly to the Builder and to any of its subcontractors or suppliers in the event that the Owner becomes aware that the Builder fails to pay or unreasonably withholds payment from one or more of those entities. Such joint check procedure, if employed by the Owner, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit the Owner to repeat the procedure in the future.

#### **15.12 Retainage**

Subject to other provisions herein, and pursuant to Section 255.078, Florida Statutes, Owner will withhold and release retainage from each payment to Builder in accordance with the following:



- 15.12.1 Owner will withhold as retainage from each progress payment made to the Builder an amount equal to ten percent (10%) of the payment until the Work is fifty percent (50%) complete.
- 15.12.2 After the Work is fifty percent (50%) complete, Owner shall reduce the amount of retainage withheld from each subsequent progress payment made to the Builder to five percent (5%) of the amount of the payment.
- 15.12.3 After the Work is fifty percent (50%) complete, the Builder may present to the Owner a payment request for up to one-half of the retainage held by Owner, and Owner shall make payment to the Builder unless the Owner has grounds for withholding the payment of retainage (e.g., all or a portion of the retainage is the subject of a good faith dispute or a claim brought by Owner).
- 15.12.4 After the Work is fifty percent (50%) complete, the Builder may elect to withhold retainage from payments to its subcontractors at a rate higher than five percent (5%). The specific amount to be withheld must be determined on a case-by-case basis and must be based on the Builder's assessment of the subcontractor's past performance, the likelihood that such performance will continue, and the Builder's ability to rely on other safeguards. The Builder shall notify the subcontractor, in writing, of its determination to withhold more than five percent (5%) of the progress payment and the reasons for making that determination, and the Builder may not request the release of such retained funds from the Owner.

### **15.13 Final Payment**

Prior to being entitled to receive final payment, and as a condition precedent thereto, the Builder must achieve Final Completion. The Owner shall, subject to its rights set forth above in this Article, make final payment of all sums due the Builder within twenty (20) calendar days of Owner's receipt of the Builder's application properly prepared in accordance with Owner's policies and approved and executed by the Professional.

## **ARTICLE 16 – SCHEDULE REQUIREMENTS**

### **16.1 Construction Schedule**

The Construction Schedule shall include all pertinent dates and periods for timely completion of the Work.

- 16.1.1 Unless otherwise directed and approved by the Owner, the Builder shall – within fourteen (14) calendar days of the "Notice To Proceed" – prepare a critical path method schedule with separate divisions for each major portion of the Work or operations. The Construction Schedule shall include and properly coordinate dates for performance of all divisions of the Work, including completion of offsite requirements and tasks, so that the Work can be completed in a timely and orderly fashion consistent with the required dates of Substantial Completion and Final Completion. When preparing the schedule, Builder shall consider and account for Owner's operational needs on the Site and adjacent thereto, particularly with regard to utility interruptions and access restrictions.
- 16.1.2 The Construction Schedule shall depict all activities necessary for, or incidental to, performance of the Work, showing the logic (sequence, dependency), duration,



and “float” of each activity, with the critical path highlighted and shall include (i) the required dates of commencement, Substantial Completion, and Final Completion; (ii) any guideline and milestone dates required by the Owner; (iii) any applicable subcontractor and supplier sub-schedules; (iv) coordination with the submittal schedule which allows sufficient time for review of documents and submittals; (v) allowances for procurement, fabrication, and delivery of materials, especially “long lead” items; (vi) the complete sequence of construction by activity, with dates for beginning and completion of each element of construction; (vii) the time required for testing, inspections, and Commissioning, if applicable; (viii) time for schedule constraints, such as holidays and events on Owner’s property and adverse weather conditions which are normal and may be reasonably anticipated; and (ix) required decision dates.

16.1.3 By reviewing the Construction Schedule, the Owner and Professional do not assume any of the Builder’s responsibility (i) that the Construction Schedule be coordinated or complete; or (ii) for timely and orderly completion by the required dates of Substantial Completion, Final Completion, or any milestone dates required by the Owner.

16.1.4 The Builder shall periodically and in all instances when the Builder anticipates that performance of the Work will be delayed or in fact has been delayed, but not less frequently than monthly, prepare a revised Construction Schedule and show actual progress of the Work through the revision date, projected completion of each remaining activity, activities modified since previous submittal, major changes in scope, and other identifiable changes. The updated Construction Schedule shall be accompanied by a narrative report which (i) states and explains any modifications of the critical path schedule, including any changes in logic; (ii) defines problem areas and lists areas of anticipated delays; (iii) explains the anticipated impact the problems and delays will have on the schedule and scheduled activities; (iv) reports corrective action taken or proposed; and (v) states how problems anticipated by projections shown on the schedule will be resolved to avoid delay in delivering the Work by the required dates of Substantial Completion and Final Completion, and other milestone dates required by the Owner, if any.

## **16.2 Delay in Performance**

If at any time the Builder anticipates that performance of the Work will be delayed or in fact has been delayed, the Builder shall (i) immediately notify the Owner and Professional of the probable cause of and effect from the delay, and possible alternatives to minimize the delay; and (ii) take all corrective actions reasonably necessary to deliver the Work by the required dates of Substantial Completion and Final Completion, and other milestone dates required by the Owner, if any.

## **16.3 Early Completion**

The Builder may attempt to achieve Substantial Completion before the required date of Substantial Completion. However, such planned early completion shall be for the Builder’s sole convenience and shall not create any additional Builder rights or Owner obligations under the Contract for Construction, nor shall it change the required dates of Substantial Completion or Final Completion. The Owner shall not pay the Builder any additional compensation for achievement of Substantial Completion or Final Completion prior to the required dates nor will the Owner owe the Builder any compensation should the Owner



cause the Builder not to achieve Substantial Completion earlier than the required date of Substantial Completion or Final Completion earlier than the required date of Final Completion.

#### **16.4 Document Review**

The Builder shall provide documents to the Owner and Professional(s) for review in accordance with schedule requirements and with sufficient lead time to allow the Owner and Professional reasonable time for review.

### **ARTICLE 17 – TIME OF PERFORMANCE**

#### **17.1 Time of the Essence**

The parties hereto mutually understand and agree that time is of the essence in the performance of the Contract for Construction and that the Owner will incur damages if the Work is not completed on time. The Builder shall at all times carry out its duties and responsibilities as expeditiously as possible and shall begin, perform, and complete its services so that (i) the Work progresses in accordance with the Construction Schedule; (ii) the Work is Substantially Completed by the required date of Substantial Completion; and (iii) the Work is Finally Complete by the date of Final Completion.

#### **17.2 Modifications of Time for Performance**

The Builder may submit delay claims or otherwise propose modifications to the dates for Substantial Completion, Final Completion, or other milestones required by the Owner, if any. However, such claims shall be submitted in writing and supported by evidence that the delay was excusable, critical, and, if applicable, compensable. The Builder shall determine and promptly notify the Owner and the Professional in writing when it believes such adjustments are necessary, but no such adjustments shall be effective unless approved in writing by the Owner and Professional.

17.2.1 Extensions of time will be granted only to the extent that equitable time adjustments for the impacted activity or activities exceed the total float along the network paths involved. Such claims shall include an estimate of cost, if any, and substantiate the projected impact on the overall critical path schedule of the Project. In the case of a continuing delay, only one claim is necessary.

17.2.2 Modification(s) of the required dates of Substantial Completion or Final Completion shall be accomplished only by duly authorized and accepted change order stating the new date(s) with specificity and reciting that all references in the Contract for Construction to the required dates of Substantial Completion or Final Completion shall thereafter refer to the date(s) as modified, and all rights and obligations, including the Builder's liability for actual damages, delay damages and liquidated damages, shall be determined in relation to the date(s) as modified.

17.2.3 If adverse weather conditions are the basis for a delay claim, the claim shall be documented by data substantiating that: the weather conditions were abnormal for the given location and period of time; the weather conditions could not have been reasonably anticipated; and that the weather conditions had an adverse effect on the overall critical path of the schedule. Delays caused by adverse weather conditions are not compensable.



### **17.3 Compensable Delay**

If the Builder is delayed at any time in the progress or performance of the Work by (i) acts or omissions of the Owner or Professional; (ii) major changes ordered by the Owner in the scope of Work; or (iii) any other cause which the Owner determines may justify the compensation of the Builder for the delay, the Builder's compensation shall be equitably adjusted to cover the Builder's actual and direct increased costs attributable to such delay.

### **17.4 Excusable Delay**

If the Builder is delayed at any time in the progress or performance of the Work by (i) acts or omissions of the Owner or Professional; (ii) major changes ordered by the Owner in the scope of Work; (iii) fire; (iv) unusual delays in transportation; (v) adverse abnormal weather conditions that Builder could not have reasonably anticipated; (vi) unavoidable casualties; (vii) causes beyond the Builder's control which the Owner agrees in writing are justifiable; or (viii) any other cause that the Owner determines may justify the delay, Owner may extend the time for performance to allow for a demonstrated increase in overall construction duration, which may or may not be equal to the length of such delay, but only if (a) such delay is not concurrent with other, inexcusable delay(s); (b) such delay impacts the critical path; (c) such delay is not in any way caused by default or collusion on the part of the Builder or by any cause which the Builder could reasonably control or circumvent; (d) the Builder would have otherwise been able to timely perform all of its obligations under the Contract for Construction but for such delay; and (e) immediately but not later than fourteen (14) calendar days after the beginning of any such delay the Builder gives notice of its delay claim to the Owner. Such delay claims shall be submitted as a change order proposal. All such claims will be reviewed by the Professional within seven (7) days of submission. Delay caused by labor disputes, picketing, employee boycotts, or the like which directly or indirectly involves employees of the Builder or its subcontractors and suppliers is not the responsibility of the Owner and will result in time extensions only if agreed to in writing by the Owner at the time such events arise.

### **17.5 Critical Delay**

Additional work, unforeseen conditions, and other factors may result in one or more schedule activities being delayed. If, however, the critical path is not impacted and the overall construction duration and completion date(s) remain the same, the delay is not critical.

## **ARTICLE 18 – PROPRIETARY DOCUMENTS AND CONFIDENTIALITY**

### **18.1 Nature and Use of Information**

All information, documents, and electronic media furnished by the Owner to the Builder (i) belong to the Owner; (ii) are proprietary and confidential; (iii) are furnished solely for use on the Owner's Project; (iv), shall be kept confidential by the Builder; and (v) shall not be used by the Builder on any other project or in connection with any other person or entity, unless disclosure or use thereof in connection with any matter other than services rendered to the Owner hereunder is specifically authorized in writing by the Owner in advance or is required by law. The Owner hereby grants to the Builder a limited license to use and reproduce applicable portions of the Construction Documents necessary for execution of the Work. All copies made under this license shall bear the statutory copyright notice, if any, shown on the documents.

### **18.2 Ownership of Information**



All information, documents, and electronic media prepared by or on behalf of the Builder for the Project are the sole property of the Owner, free of any retention rights of the Builder. The Builder hereby grants to the Owner an unconditional right to use, for any purpose whatsoever, any information, documents or electronic media prepared by or on behalf of the Builder for the Project, free of any copyright claims, trade secrets, or other proprietary rights with respect to such documents.

### **18.3 Disclosure of Information**

The Builder shall not disclose any information it receives from the Owner to any other person or entity except to the extent necessary to allow it to perform its duties under the Contract for Construction or as required by law.

### **18.4 Instructions to Employees**

Because it is difficult to separate proprietary and confidential information from that which is not, the Builder shall instruct its employees and agents to regard all information not in the public domain as information that is proprietary and confidential.

### **18.5 Non-Publication**

Submission or distribution of documents to meet official regulatory requirements or for other required purposes in connection with the Project is not to be construed as publication in derogation of the Owner's common law copyrights or other reserved rights.

## **ARTICLE 19 – INSURANCE REQUIREMENTS**

### **19.1 Basic Insurance Requirements**

The Builder shall obtain and maintain the policies of insurance set forth in this Article with a company or companies lawfully authorized to do business in Florida, and with an A.M. Best Rating of no less than A, XV. All insurance policies shall be issued and countersigned by duly authorized representatives of such companies and shall be written on ISO standard forms or their equivalents. The insurance policies shall require that the insurer shall provide at least thirty (30) days written notice to Owner if a policy is to be canceled or the coverage thereunder reduced before the expiration date thereof and Builder shall provide Owner with a copy of an endorsement to the policy evidencing the same. The insurance required hereunder shall be carried by Builder at least until the Project has achieved Final Completion and has been accepted by Owner. At the Owner's sole discretion, the Owner may require the Builder and/or its subcontractors to carry additional types and amounts of insurance it deems appropriate given the nature and size of a particular Project. In such case, Owner shall notify Builder within a reasonable period of time prior to the commencement of the Work of such additional requirements.

#### **19.1.1 Liability Insurance**

##### **19.1.1.1 Commercial General Liability Insurance.**

The Builder shall obtain and maintain a commercial general liability insurance policy with limits of not less than the following:

- \$1,000,000 each occurrence and \$2,000,000 project aggregate for bodily injury, property damage, personal and advertising injury liability
- \$1,000,000 each occurrence and \$2,000,000 project aggregate for products and completed operations liability
- \$50,000 fire legal liability



Builder's commercial general liability policy must include coverage for contractual liability, independent contractors, and contain no exclusions for explosion, collapse, or underground damage. The University of Florida Board of Trustees and its officials, employees, and volunteers shall be covered as an additional insured with a form *CG-20-26-04-13 Additional Insured – Designated Person or Organization* or equivalent endorsement. The Builder's insurance coverage shall be primary insurance with respect to the Owner, its officials, employees, and volunteers. Any insurance or self-insurance maintained by the Owner, its officials, employees, or volunteers shall be in excess of Builder's insurance and shall be non-contributory. Builder's insurance policy shall protect Builder from claims which may arise whether such claims may arise out of the operations of the Builder or by anyone directly or indirectly employed by the Builder. If Builder is performing asbestos-related work, the policy shall also contain a pollution liability endorsement with limits of not less than \$1,000,000 per occurrence.

#### **19.1.1.2 Automobile Liability Insurance.**

Builder shall obtain and maintain automobile liability coverage, including coverage for all Owned vehicles, hired, and non-owned vehicles, for bodily injury and property damage with not less than a \$500,000 combined single limit for each accident. The University of Florida Board of Trustees shall be covered as an additional insured with a form *CA-20-48* or similar endorsement on such policy.

#### **19.1.1.3 Deductibles.**

Deductibles under these liability policies shall not exceed \$25,000. Owner shall not be liable for amounts that may represent a deductible in any insurance policy. The payment of such deductible shall be the sole responsibility of the Builder and/or subcontractor providing such insurance.

### **19.1.2 Worker's Compensation**

Builder shall obtain and maintain worker's compensation coverage applicable to all Builder's employees at statutory limits in compliance with applicable state and federal laws. If any operations are to be undertaken on or about navigable waters, coverage must be included in accordance with the US Longshoremen & Harbor Workers Act.

Such coverage shall include employer's liability limits of not less than \$100,000 each accident, \$500,000 disease policy limit, and \$100,000 disease each employee.

The Builder and its insurance carrier waive all subrogation rights against the Owner for all losses, damages, and/or events that occur while the Contract for Construction is in effect, regardless of whether suit is actually brought during such period or at a later date. The Owner requires all worker's compensation policies to be endorsed with form *WC00-03-13 Waiver of Right to Recover from Others* or equivalent.

### **19.1.3 Builder's Risk Insurance**

The Builder shall obtain and maintain builder's risk insurance, at replacement cost, covering the full value of the construction being performed, including where applicable, the existing structure. Such policy shall be written on an all-risk



coverage form including flood and windstorm coverage, and shall include coverage for reasonable compensation for the Professional's services and expenses required as a result of such insured loss. This insurance shall insure the interests of the Builder, subcontractors, and sub-subcontractors in the Work. Property covered by the insurance shall include temporary building(s) or structure(s) at the Project Site, other than any of Builder's office trailer(s). In addition, such insurance shall cover portions of the Work stored offsite (if Owner approves such storage) and materials and equipment in transit. The University of Florida Board of Trustees shall be named as an additional insured on such policy. The policy shall include a waiver of subrogation endorsement and a severability of interests endorsement, and shall also include a waiver of occupancy clause allowing the Owner to occupy the subject facility during construction, if necessary.

The deductible under the policy shall not exceed \$25,000. Owner shall not be liable for amounts that may represent a deductible in any insurance policy. The payment of such deductible shall be the sole responsibility of the Builder.

When the Work includes the repair, removal, installation, and/or testing of live steam boilers, valves, pipes, or lines, or mechanized, pressurized, or electrical equipment, then such insurance shall include boiler and machine/equipment breakdown coverage, written on an ISO form or its equivalent.

A loss or losses insured under this insurance policy shall be adjusted by the Builder and its insurance company. The Builder shall repair or replace the damaged property with the proceeds from the builder's risk policy. The Builder shall be responsible for all damages and necessary repairs whether or not the loss is covered by the builder's risk policy.

Alternatively, the Owner may elect to obtain and directly pay for Builder's Risk insurance through Owner's statewide program.

## **19.2 Certificates of Insurance**

19.2.1 Certificates of insurance and/or evidence of insurance for all insurance policies required under this Article, together with certified copies of the insurance policies (including required endorsements), shall be filed with and approved by the Owner prior to commencement of the Work.

19.2.2 Such certificates of insurance shall be dated and show the name of the insurer, the number of the policy, its effective date, and its termination date.

19.2.3 Certificates of insurance evidencing the renewal of all insurance required to be carried under this Article shall be provided to Owner at least thirty (30) days prior to the date each applicable insurance policy is scheduled to expire.

19.2.4 Certificates must provide for thirty (30) days' prior written notice to Owner of any policy cancellation or material change in coverage.

19.2.5 Owner's review, inspection, or approval of Builder's insurance shall not relieve Builder of its responsibility for providing the insurance required hereby nor constitute a waiver of any such requirements.



19.2.6 Owner will not issue a "Notice To Proceed" for the Work until Builder has complied with this Article and Builder shall not be entitled to an extension of time or to compensation which may result from delays in the issuance of a "Notice to Proceed" caused by its failure to provide the foregoing certificates and policies in a timely manner.

**19.3 Effect of Insurance**

Compliance with insurance requirements shall not relieve the Builder of any responsibility to indemnify the Owner for any liability to the Owner as specified in any other provision of the Contract for Construction, and the Owner shall be entitled to pursue any remedy in law or equity if the Builder fails to comply with the contractual provisions of the Contract for Construction. Indemnity obligations specified elsewhere in the Contract for Construction shall not be negated or reduced by virtue of any insurance carrier's (i) denial of insurance coverage for the occurrence or event which is the subject matter of the claim; or (ii) refusal to defend any named insured.

**19.4 Waiver of Subrogation**

The Builder's insurers shall agree to waive all rights of subrogation against the Owner and the Owner's Related Parties. The Builder hereby releases and discharges the Owner and the Owner's Related Parties of and from all liability to the Builder, and to anyone claiming by, through, or under the Builder, by subrogation or otherwise, on account of any damage or loss, whether to persons or property, however caused.

## **ARTICLE 20 – GENERAL BOND REQUIREMENTS**

**20.1 General Bond Requirements**

Recognizing the Project is a public project with a Construction Price which exceeds \$200,000, and as such is required to be bonded pursuant to 255.05, Florida Statutes, the Builder shall furnish payment and performance bonds on Owner's standard form covering the full and faithful performance of the Contract for Construction and the payment of obligations arising hereunder. Such bonds shall, in all respects, comply with Section 255.05, Florida Statutes.

**20.2 Delivery of Bonds**

The Builder shall deliver required bonds and powers of attorney to the Owner prior to commencement of the Work.

**20.3 Requests for Copies of Bonds**

Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract for Construction, the Builder shall promptly furnish a copy of the bonds or shall permit a copy to be made.

## **ARTICLE 21 – OWNER'S RIGHT TO STOP WORK**

**21.1 Cease and Desist Order**

If the Builder fails or refuses to perform or fails to correct defective Work as required, or persistently fails to carry out the Work in accordance with the Contract for Construction,



the Owner may, by written notice, order the Builder to cease and desist in performing the Work or any portion of the Work until the cause for the order has been eliminated to the satisfaction of the Owner. Upon receipt of such instruction, the Builder shall immediately cease and desist as instructed by the Owner and shall not proceed further until the cause for the Owner's order has been corrected, no longer exists, or the Owner instructs that the Work may resume.

21.1.1 The Builder shall not be entitled to an adjustment in the time for performance or the Construction Price under this clause since such stoppages are considered to be the fault of the Builder.

21.1.2 The right of the Owner to stop Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Builder or others.

21.1.3 In the event the Owner issues instructions to cease and desist, and in the further event that the Builder fails and refuses with seven calendar days to provide adequate assurance to the Owner that the cause of such instructions will be eliminated or corrected, then the Owner shall have the right, but not the obligation, to carry out the Work or any portion of the Work with its own forces, or with the forces of another builder, and the Builder shall be responsible for the cost of performing such Work by the Owner.

21.1.4 The rights set forth herein are in addition to, and without prejudice to, any other rights or remedies the Owner may have against the Builder.

## **ARTICLE 22 – TERMINATION OR SUSPENSION OF CONTRACT FOR CONSTRUCTION**

### **22.1 Termination for Cause by Owner**

22.1.1 The Owner may terminate the Contract for Construction for cause if the Builder materially breaches the Contract for Construction by:

- (i) refusing, failing, or being unable to properly manage or perform on any Project;
- (ii) refusing, failing, or being unable to supply the Project with sufficient numbers of workers, properly skilled workers, proper materials to maintain applicable schedules;
- (iii) refusing, failing, or being unable to make prompt payment to subcontractors or suppliers;
- (iv) disregarding laws, ordinances, rules, regulations, or orders of any public authority or quasi-public authorities or Authorities Having Jurisdiction;
- (v) refusing, failing, or being unable to substantially perform in accordance with the terms of the Contract for Construction as determined by the Owner, or as otherwise defined elsewhere herein; or



- (vi) refusing, failing, or being unable to substantially perform in accordance with the terms of any other agreement between the Owner and Builder.

22.1.2 Upon the occurrence of any of the events described in Paragraph 22.1.1, the Owner may give written notice to the Builder setting forth the nature of the default and requesting cure within seven calendar days from the date of notice. At any time after issuance of such notice, if the Builder fails to initiate the cure or if the Builder fails to expeditiously continue such cure until complete, the Owner may give written notice to the Builder of immediate termination, and the Owner, without prejudice to any other rights or remedies, may take any or all of the following actions:

- (i) complete all or any part of the Work, including supplying workers, material and equipment which the Owner deems expedient to complete the Work;
- (ii) contract with others to complete all or any part of the Work, including supplying workers, material, and equipment which the Owner deems expedient to complete the Work;
- (iii) take such other action as is necessary to correct such failure;
- (vi) take possession of all materials, tools, construction equipment, and machinery on the Site owned or leased by the Builder;
- (v) directly pay the Builder's subcontractors and suppliers compensation due to them from the Builder;
- (vi) finish the Work by whatever method the Owner may deem expedient; and
- (vii) require the Builder to assign the Builder's right, title and interest in any or all of Builder's subcontracts or orders to the Owner.

22.1.3 If the Owner terminates the Contract for Construction for cause, and the Owner takes possession of all materials, tools, construction equipment, and machinery on the Site owned or leased by the Builder, the Builder's compensation shall be increased by fair payment, either by purchase or rental at the election of the Owner, for any materials, tools, construction equipment, and machinery items retained, subject to the Owner's right to recover from the Builder the Owner's damages resulting from the termination.

22.1.4 If the Owner terminates the Contract for Construction for cause, and it is subsequently determined by a court of competent jurisdiction that such termination was without cause, then in such event, said termination shall be deemed a termination for convenience as set forth in Paragraph 22.3.

## **22.2 Termination for Cause by Builder**

22.2.1 The Builder may terminate the Contract for Construction for cause if the Owner materially breaches the Contract for Construction by:



- (i) refusing, failing, or being unable to make prompt payment to the Builder without just cause;
- (iv) disregarding laws, ordinances, rules, regulations or orders of any public authority of quasi-public authority or Authorities Having Jurisdiction; or
- (v) refusing, failing, or being unable to substantially perform in accordance with the terms of the Contract for Construction.

22.2.2 Upon the occurrence of any of the events described in Paragraph 22.2.1, the Builder may give written notice to the Owner setting forth the nature of the default and requesting cure within seven calendar days from the date of notice. If the Owner fails to cure the default within seven calendar days, the Builder, without prejudice to any rights or remedies, may give written notice to the Owner of immediate termination.

### **22.3 Termination or Suspension for Convenience**

The Owner may at any time give written notice to the Builder terminating the Contract for Construction or suspending the Project, in whole or in part, for the Owner's convenience and without cause. If the Owner suspends the Project for convenience, the Builder shall immediately reduce its staff, services and outstanding commitments in order to minimize the cost of suspension.

### **22.4 Builder's Compensation When Builder Terminates for Cause or Owner Terminates for Convenience**

If the Contract for Construction is (i) terminated by the Builder pursuant to Paragraph 22.2; (ii) terminated by the Owner pursuant to Paragraph 22.3; or (iii) suspended more than three months by the Owner pursuant to Paragraph 22.3, the Owner shall pay the Builder specified amounts due for Work actually performed prior to the effective termination date and reasonable costs associated with termination. The Owner may agree to additional compensation, if any, due to the Builder. Absent agreement on the additional amount due the Builder, the Owner shall pay the Builder:

- (i) reasonable costs incurred in preparing to perform the terminated portion of the Work, and in terminating the Builder's performance, plus a fair and reasonable allowance for overhead and profit thereon (such profit shall not include anticipated profit or consequential damages); provided, however, that if it appears that the Builder would not have profited or would have sustained a loss if the Work had been completed, no profit shall be allowed or included, and the amount of compensation shall be reduced to reflect the anticipated rates of loss, if any; and
- (ii) reasonable costs of settling and paying claims arising out of the termination of subcontracts or supplier orders. These costs shall not include amounts paid in accordance with other provisions hereof.

### **22.5 Builder's Compensation When Owner Terminates for Cause**

If the Contract for Construction is terminated by the Owner for cause pursuant to Paragraph 22.1, no further payment shall be made to the Builder until Final Completion of the Project. At such time, the Builder shall be paid the remainder of the Construction Price less all costs and damages incurred by the Owner as a result of the default of the Builder,



including liquidated damages applicable thereto. The Builder shall additionally reimburse the Owner for any additional costs or expenses incurred.

**22.6 Limitation on Termination Compensation**

Irrespective of the reason for termination or the party terminating, the total sum paid to the Builder shall not exceed the Construction Price, as properly adjusted, reduced by the amount of payments previously made and penalties or deductions incurred pursuant to any other provision of the Contract for Construction, and shall in no event include duplication of payment.

**22.7 Builder's Responsibility upon Termination**

Irrespective of the reason for termination or the party terminating, if the Contract for Construction is terminated, the Builder shall, unless notified otherwise by the Owner,

- (i) immediately stop work;
- (ii) terminate outstanding orders and subcontracts;
- (iii) settle the liabilities and claims arising out of the termination of subcontracts and orders; and
- (iv) transfer title and deliver to the Owner such completed or partially completed Work, and, if paid for by the Owner, materials, equipment, parts, fixtures, information and such contract rights as the Builder has.

**22.8 Lack of Duty to Terminate**

The right to terminate or suspend the Work shall not give rise to a duty on the part of either the Owner or the Builder to exercise that right for the benefit of the Owner, the Builder or any other persons or entities.

**22.9 Limitation on Termination Claim**

If the Builder fails to file a claim within one year from the effective date of termination, the Owner shall pay the Builder only for services actually performed and expenses actually incurred prior to the effective termination date.

## **ARTICLE 23 – DISPUTE RESOLUTION**

**23.1 Mutual Discussion**

In case of any dispute, claim, question or disagreement arising from or relating to the Project or arising out of the Contract for Construction or the breach thereof, the parties shall first attempt resolution through mutual discussion.

**23.2 Facilitative Mediation**

If the parties cannot resolve any dispute, claim, question, or disagreement arising from or relating to the Project or arising out of the Contract for Construction or the breach thereof through mutual discussion, the parties may in good faith participate in private, non-binding facilitative mediation seeking a just and equitable solution satisfactory to all parties.



- 23.2.1 All parties to a mediation shall promptly provide all other parties to the mediation with copies of essential documentation relevant to the support or defense of the matter being mediated.
- 23.2.2 The parties shall not be required to mediate for a period greater than ninety-one calendar days unless otherwise agreed to in writing by the parties. The parties shall share equally any administrative costs and fees of such proceedings, but shall each be responsible for their own expenses otherwise incurred.
- 23.2.3 In the event that the statute of limitations would run during the required mediation period, either party may institute litigation so as to avoid the running of such statute upon the condition that such party immediately seek a stay of such litigation pending the conclusion of the mediation period.
- 23.2.4 During the course of mediation, any party to the mediation may apply for injunctive relief from any court of competent jurisdiction until the mediation period expires or the dispute is otherwise resolved.
- 23.2.5 The Owner, the Professional, the Builder, and any other parties involved in any way in the design or construction of the Project are bound, each to each other, by this requirement to mediate prior to commencement of any litigation or administrative action, provided that they have signed the Contract for Construction or an agreement that incorporates the Contract for Construction by reference or signed any other agreement which binds them to mediate. Each such party agrees that it may be joined as an additional party to a mediation involving other parties under any such agreement. In the case where more than one mediation is begun under any such agreement and any party contends that the mediations are substantially related, the mediations may be conducted by the mediator selected in the first mediation which was commenced.
- 23.2.6 The mediation shall be conducted in Alachua County, Florida, unless agreed otherwise by the parties.

### **23.3 Conflicting Dispute Resolution Provisions**

Neither party to the Contract for Construction shall enter into any contract with regard to the Project which directly or indirectly gives the right to resolve any dispute with, involving, or affecting the other to any other person or legal entity which is in conflict with the dispute resolution procedures required by this Article.

### **23.4 Arbitration Preclusion**

In case of a dispute relating to the Project, or arising out of the Contract for Construction, no party to the Contract for Construction shall be required to participate in or be bound by, any arbitration proceedings.

### **23.5 Performance during Dispute Resolution**

The Owner and the Builder agree that pending the resolution of any dispute, controversy, or question, the Owner and the Builder shall each continue to perform their respective obligations without interruption or delay, and the Builder shall not stop or delay the performance of the Work.



### **23.6 Litigation/Administrative Action**

Disputes, claims, questions or disagreements involving monetary claims of \$200,000.00 or less may be conducted, at the Owner's option, pursuant to the Administrative Procedures Act, Chapter 120 Florida Statutes. All other claims, disputes and other matters shall be determined under the judiciary system of the State of Florida.

## **ARTICLE 24 – DAMAGES AND REMEDIES**

### **24.1 Builder's Repair**

The Builder shall, at its expense, promptly correct, repair, or replace all goods, products, materials, systems, labor and services which do not comply with the warranties and guarantees set forth in the Contract for Construction, or any other applicable warranty or guarantee.

### **24.2 Reimbursement**

The Builder shall promptly reimburse the Owner for any expenses or damages incurred by the Owner as a result of (i) the Builder's failure to substantially perform in accordance with the terms of the Contract for Construction; (ii) deficiencies or conflicts in the Construction Documents attributable to the Builder or of which the Builder was or should have been aware; (iii) breach of the warranties and guarantees set forth in the Contract for Construction or any other applicable warranty or guarantee; or (iv) other acts or omissions of the Builder. Reimbursements to the Owner made in accordance with this Article are separate and distinct from the assessment of liquidated damages, if any, as defined elsewhere in the Contract for Construction.

### **24.3 General Indemnity**

Pursuant to Section 725.06(2), Florida Statutes, the Builder shall indemnify and hold Owner (including its officers and employees) and Owner's Related Parties harmless from and against all liabilities, damages, losses, and costs, including but not limited to, reasonable attorney's fees, to the extent caused by the negligence, recklessness, or intentional wrongful conduct of the Builder and persons employed or utilized by the Builder in the performance of the Work or under the Contract for Construction.

### **24.4 Intellectual Property Indemnity**

To the fullest extent permitted by law, the Builder shall defend, protect, hold harmless, and indemnify the Owner and Owner's Related Parties from and against any and all liability, loss, claims, demands, suits, costs, fees and expenses (including actual fees and expenses of attorneys, expert witnesses, and other consultants), by whomsoever brought or alleged, for infringement of patent rights, copyrights, or other intellectual property rights, except with respect to designs, processes or products of a particular manufacturer expressly required by the Owner or Professional(s) in writing. However, if the Builder has reason to believe the use of a required design, process, or product is an infringement of a patent, copyright, or other intellectual property right, the Builder shall defend, protect, hold harmless, and indemnify the Owner and Owner's Related Parties as stated above, unless the Builder promptly notifies the Owner of that belief.

### **24.5 Non-Exclusivity of Owner's Remedies**

The Owner's selection of one or more remedies for breach of the Contract for Construction contained herein shall not limit the Owner's right to invoke any other remedy available to the Owner under the Contract for Construction or by law.



#### **24.6 Waiver of Damages**

The Builder shall not be entitled to, and hereby waives, any monetary claims for or damages arising from or related to, lost profits, lost business opportunities, unabsorbed overhead, or any indirect or consequential damages.

### **ARTICLE 25 – MISCELLANEOUS PROVISIONS**

#### **25.1 Integration**

The Contract for Construction represents the entire and integrated agreement between the Owner and the Builder, and supersedes all prior negotiations, representations or agreements, either written or oral, for the Project. The Contract for Construction may be amended only by written instruments signed by both the Owner and the Builder.

#### **25.2 Severability**

If any provision of the Contract for Construction, or the application thereof, is determined to be invalid or unenforceable, the remainder of that provision and all other provisions shall remain valid and enforceable.

#### **25.3 Waiver**

No provision of the Contract for Construction may be waived except by written agreement of the parties. A waiver of any provision on one occasion shall not be deemed a waiver of that provision on any subsequent occasion, unless specifically stated in writing. A waiver of any provision shall not affect or alter the remaining provisions of the Contract for Construction.

#### **25.4 Strict Compliance**

No failure of the Owner to insist upon strict compliance by the Builder with any provision of the Contract for Construction shall operate to release, discharge, modify, change or affect any of the Builder's obligations.

#### **25.5 Third-Party Beneficiaries**

The Contract for Construction shall inure solely to the benefit of the parties hereto and their successors and assigns, and, except as otherwise specifically provided in the Contract for Construction, nothing contained in the Contract for Construction is intended to or shall create a contractual relationship with, or any rights or cause of action in favor of, any third party against either the Owner or the Builder.

#### **25.6 Assignment of Anti-Trust Claims**

In consideration for the Contract for Construction, the Builder hereby conveys, sells, assigns and transfers to the Owner all of its right, title and interest in and to any and all causes of action it may now have or may hereafter acquire under the antitrust laws of the United States and the State of Florida for price fixing, relating to the goods or services purchased or acquired by the Owner under the Contract for Construction.

#### **25.7 Drug Free and Tobacco-Free Workplace**

Pursuant to 440.102(15), Florida Statutes, Builder shall implement, and cause its applicable subcontractors to implement, a drug-free workplace program. Additionally, the Builder shall enforce the Owner's tobacco-free policy.



**25.8 Survival**

All provisions of the Contract for Construction which contain continuing obligations shall survive its expiration or termination.

**25.9 Independent Contractor**

Builder is an independent contractor to Owner.

**25.10 Public Records**

Any books, documents, records, correspondence, or other information kept or obtained by the Owner or furnished by Builder to Owner in connection with the services contemplated herein are property of Owner.

25.10.1 Builder acknowledges and agrees that any and all such books, documents, records, correspondence or other information may be public records under Chapter 119, Florida Statutes

25.10.2 Builder agrees to promptly comply with any order of a Court having competent jurisdiction that determines that records maintained by Builder are "public records," which must be available to the public.

25.10.3 Builder acknowledges and agrees that any and all such books, documents, records, correspondence, or other information may also be subject to inspection and copying by members of the public pursuant to Chapter 119, Florida Statutes.

25.10.4 The Contract for Construction may be unilaterally canceled by the Owner for refusal by the Builder to allow public access to all documents, papers, letters, or other material subject to the provisions of Chapter 119, Florida Statutes, and made or received by the Builder in conjunction herewith.

**25.11 Governing Law and Venue**

The Contract for Construction shall be governed by, and construed under, the laws of the State of Florida, without regard to its choice of law provisions, and venue shall lie in the courts of Alachua County, Florida.

**25.12 Sovereign Immunity**

Builder acknowledges and agrees that nothing contained in the Contract for Construction shall be construed or interpreted as (i) denying to Owner any remedy or defense available to it under the laws of the State of Florida; (ii) consent of the Owner or the State of Florida or their agents and agencies to be sued; or (iii) a waiver of sovereign immunity of the Owner or of the State of Florida beyond the limited waiver provided in section 768.28, Florida Statutes.



## **Division 0 Non-Technical Requirements**

### **00810 Vendor Diversity**

- 1.1 The University of Florida is an equal opportunity institution and, as such, encourages the use of small businesses, woman-owned businesses, and minority-owned businesses in the provision of construction-related services. Such businesses should have a fair and equal opportunity to compete for dollars spent by the University of Florida to procure construction-related services. Competition ensures that prices are competitive and a broad vendor base is available.
- 1.2 The Builder shall use good faith efforts to ensure opportunities are available to small, woman-owned, and minority-owned businesses on the Project.
- 1.3 Contact the UF Division of Small Business and Vendor Diversity Relations for more information.

**END OF SECTION**



## **00842 Safety Requirements**

### **1.1 Health and Safety Requirements**

- A. Builders shall ensure that all activities carried out on behalf of the University or on University property are in compliance with all applicable Federal, state and local regulations (OSHA, EPA, FDEP) pertaining to worker and site safety.
- B. The Builder shall have a written health and safety program that outlines safe work practices and procedures expected to be followed by workers and shall have it available for review by the University's project manager or by representatives of the Environmental Health and Safety division upon request. Project managers and superintendents/supervisors shall have obtained an OSHA 30-hour Construction Safety Outreach Training card within 5 years of the date of the applicable project. The Builder is solely responsible for ensuring that all workers have received any required safety-related training. Training documentation shall be made available for review upon request.
- C. The Builder shall have a competent person or persons as defined by OSHA 29CFR1926.32(f) on the job site to monitor hazardous work activities such as, but not limited to, crane operations, electrical safety, excavations, fall protection, scaffolding, and confined space entry.
- D. The Builder shall have an updated Safety Data Sheet (SDS) for all chemical products used on the job site. The SDSs shall be readily accessible to all project workers and to University staff on request. If the use of any chemical product has the potential for harmful exposure to University of Florida staff, students or visitors, UF Environmental Health and Safety (EH&S) shall be notified and exposure controls will be discussed prior to the use of that chemical product.

### **1.2 Hazardous Substances**

Refer to the General Terms & Conditions.

### **1.3 Trench Safety Act**

It is the responsibility of the Builder to comply with F.S. 553.60.

**END OF SECTION**



## **00902 Public Entity Crimes**

- 1.1 Per F.S. 287.133, any person or affiliate who has been placed on the convicted vendor list by the Florida Department of Management Services may not submit a bid on a contract to provide any goods or services – including construction, repairs, or leases – and may not be awarded or perform work as a contractor (Builder), supplier, subcontractor, or consultant for the University of Florida for a period of 36 months from the date of being placed on the convicted vendor list. A "person" or "affiliate" includes any natural person or any entity, including predecessor or successor entities or an entity under the control of any natural person who is active in its management and who has been convicted of a public entity crime.

END OF SECTION



## **0903 Asbestos**

### **1.1 Background**

Asbestos is a confirmed human carcinogen that was previously used in many different types of building materials. It is important to note that asbestos in an undisturbed state is not considered hazardous. Due to the potential hazards associated with asbestos exposure if the material becomes airborne, Federal and State regulations are in place to control activities impacting asbestos containing materials. Various asbestos products can still be found in University of Florida buildings.

### **1.2 Surveys**

- A. An asbestos survey meeting the requirements of Federal and State regulations shall be completed prior to the commencement of any renovation, remodeling, or demolition project involving a University-owned building, a component of a University-owned building, or a building scheduled to be purchased by the University. A survey is required regardless of the age of the building. Asbestos surveys must be conducted by a Florida Licensed Asbestos Consultant (LAC) or their appointed representative.
- B. All surveys are required to be submitted to EH&S for review prior to the start of a construction project. EH&S reserves the authority to reject a survey based on incomplete content or failure to follow regulatory requirements.
- C. A limited survey, based on a review of the project scope of work, may be authorized by UF Environmental Health and Safety (EH&S).
- D. A copy of the completed asbestos survey must be kept on site for the duration of a construction project.

### **1.3 Asbestos Removal**

- A. Any removal or altering of asbestos containing material must be completed by a licensed asbestos abatement contractor.
- B. Asbestos-containing roofing may be removed by a State-certified or registered roofing contractor provided that all removal activities are performed under the direction of an onsite roofing supervisor. The supervisor must remain on site at all times while removal activities are taking place. The supervisor is required to have completed an approved asbestos roofing course prior to engaging in the removal of asbestos containing roofing materials, and copies of training documentation shall be provided to EH&S before job commencement.
- C. All activities involving the removal of asbestos containing materials require the submission of an Asbestos Project Notification Form (APNF) to Environmental Health and Safety at least ten days prior to the start of an asbestos project.



- D. The asbestos abatement contractor or demolition contractor actually performing the work is responsible for submitting an additional notification to the designated regulatory authority, typically either the Florida Department of Environmental Protection or the Florida Department of Business and Professional Regulation.

END OF SECTION



## **Division 1 General Requirements**

### **01014 Builder's Use of the Premises**

#### **PART 1 – GENERAL**

##### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.
- B. Refer to section 01016 for information regarding utility outages and dig permits.
- C. Refer to section 01310 for requirements regarding the coordination of work with the University of Florida Schedule.
- D. Refer to section 01500 for requirements related to Temporary Facilities & Controls.

##### **1.2 DESCRIPTION OF WORK INCLUDED**

This Section applies to situations in which the Builder or his representatives including, but not necessarily limited to, suppliers, subcontractors, employees, and field engineers, enter upon the Owner's property.

##### **1.3 QUALITY ASSURANCE**

- A. Promptly upon award of the Contract, notify all pertinent personnel regarding requirements of this Section.
- B. Require that all personnel who will enter upon the University's property certify their awareness of and familiarity with the requirements of this Section.
- C. Builder shall strictly enforce the University's **Tobacco Free** policy.

##### **1.4 TRANSPORTATION FACILITIES**

- A. See section 01500 for information on the maintenance of safe and accessible paths of travel in and around the job site.
- B. Builder's Vehicles:
  - 1. Builder's vehicles, vehicles belonging to employees or subcontractors of the Builder, and all other vehicles entering the Owner's property in performance of the Work shall only use agreed-upon access route(s).



2. All vehicles parked on campus (including construction sites) must have a valid parking permit issued through Transportation and Parking Services in accordance with University of Florida Police Department (UFPD) requirements. Permits – for remote/offsite worker parking, onsite staff parking, and remote/offsite storage containers – shall be requested through the University Project Manager.
  - (a) Remote/offsite worker parking and space for trailer/storage containers is provided at a paved lot near the Hilton on SW 34<sup>th</sup> Street. See map on the “Forms & Standards” page of the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)).
  - (b) Trailer/storage containers in the remote/offsite lot shall be clearly marked with the following information: Project Number, Project Name, Company Name, and Phone Number.
  - (c) Remote parking and trailer/storage container area must be kept clean and free of debris.
  - (d) See part 1.10 of this Specification regarding home football game weekends.
  - (e) Vehicles not following this policy may be ticketed or towed.
3. Within the University approved fenced-in construction site area, the Builder shall manage all site use, including parking by construction staff and employees (if approved). Do not permit vehicles to park on any street or other area of the Owner's property except in areas designated by the University.
4. Outside the designated construction site area, all University regulations regarding parking and accommodations for pedestrian use shall be strictly enforced.
5. Exceptions for temporary parking for construction delivery and construction access on curb side, walkways, vehicular parking, roadways and service drives that restricts or impedes normal traffic flow or use must be obtained from UF Transportation & Parking Services through the University Project Manager. This exception is granted only for construction vehicles, not for private passenger vehicles. Any temporary use of pedestrian pathways that exceeds 24 hours duration will require provision for equal alternate pathways around the impediments and UFPD review. In addition, any temporary use of the site (exceeding 24 hours duration) that impedes building occupant egress must be reviewed by UF Environmental Health & Safety (EH&S).
6. The University Project Managers shall not seek waivers of any sort for ticketed and towed vehicles in violation of the University parking regulations. Knowledge of the University Parking Regulations is the personal responsibility every individual who commutes to and works on campus.



7. Provide adequate protection for curbs and sidewalks over which trucks and equipment must pass to reach the job site.

## 1.5 INSPECTIONS and TESTS

- A. Physical Plant Division (PPD) inspections shall be requested 48 hours in advance through PPD Operations Engineering. The inspection request form and supporting checklists can be found on the “Forms & Standards” page of the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)). Inspection checklists shall be tailored by the Owner and Builder to the specific requirements of the project.
- B. Environmental Health & Safety (EH&S) inspections shall be requested 24 hours in advance. Also see section 01060.
- C. Office of Information Technology (OIT): Contact Telecommunications and Infrastructure (TNI) 24-48 hours in advance to request inspections for all telecom, cabling, and network infrastructure work. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)).
- D. HealthNet: For Health Science Center projects only, contact HealthNet 24-48 hours in advance to request inspections for all telecom, cabling, and network infrastructure work. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)).
- E. Office of Academic Technology (OAT): Where applicable, contact OAT 48 hours or more in advance to request inspections for all work related to classroom audio/visual systems. The inspection checklist – with notification timeframes and contact information – can be found on the “Forms & Standards” page of the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)).
- F. University of Florida Police Department (UFPD): UFPD must verify construction fencing, exterior lighting, landscaping, and other items during construction and closeout.
- G. Tests
  1. The Builder shall notify PPD and EH&S of all scheduled tests at least 48 hours in advance.
  2. Properly completed test reports shall be provided at the conclusion of each test. It is the responsibility of the Builder to maintain such reports through



Final Completion, at which point they shall be submitted with other closeout materials, such as Operation & Maintenance manuals.

## 1.6 SECURITY

- A. Construction sites located on the University of Florida campus fall under the jurisdiction of the UFPD. Any incident requiring police service should be immediately reported to the UFPD at (352) 392-1111.
- B. Builders and employees are to obey all laws and rules of the State of Florida and the University of Florida when on University property.
- C. Students, faculty, and staff shall not be harassed, disturbed, or in any way disrupted in their lawful pursuits. Sexual harassment shall be reported to the University's Title IX Coordinator and Deputy Title IX Coordinator for Students as per the following policy: [www.hr.ufl.edu/prevent](http://www.hr.ufl.edu/prevent)
- D. Restrict the access of all persons entering upon the Owner's property in connection with the Work to the access route and to the actual site of the Work. Employees are not permitted to enter University buildings unless such entry is directly related to their job duties.
- E. Restrict activities of employees to authorized areas. Employees shall not be allowed to mingle in student or public areas.
- F. Builders and employees shall secure all property to reduce theft or damage to equipment or property. Builders shall work with the UFPD as necessary and participate in crime prevention efforts.
- G. The Builder shall at all times guard against damage or loss to the property of the University or other vendors or contractors and shall be held responsible for replacing or repairing any such loss or damage. The University may withhold payment or make such deductions as deemed necessary to insure reimbursement or replacement for loss or damaged property through negligence of the successful bidder or his agents. Replace any trees, shrubs, lawns, or plantings damaged by Builder or its subcontractors or vendors during work of this project within two (2) weeks of occurrence. Grassed areas generally have irrigation systems below grade; verify location of these systems and all underground utilities in work or staging areas prior to start of construction. Repair utilities damaged by work of this project.
- H. The Builder shall provide identification badges for all personnel working on the site and shall require continuous use (wearing) of same at all times. Badge shall display photograph, name of employee, and company for which employee works.



- I. The Builder shall keep a daily log of all employees, visitors, and other personnel that enter the Project site. Said log shall be accessible to UFPD upon request.

## 1.7 PERSONNEL SCREENING

The following requirements are to be met by Builders and their subcontractors and vendors while engaged in construction projects at the University of Florida:

- A. A criminal history check shall be performed on all jobsite personnel, including subcontractors and temporary day laborers, at least once every two years. Prior to personnel entering the Project site, an initial criminal history background check shall be submitted to and performed by a private company trained to perform employment screening. The results of each criminal history check shall be reported to the Builder, which shall screen the results for the following disqualifying offenses to determine a person's eligibility to work on the University of Florida campus.
  1. Drug distribution activity or felony drug possession
  2. Sexual offenses, including, but not limited to, indecent exposure and voyeurism
  3. Crimes of violence involving physical injury to another person
  4. Murder
  5. Kidnapping
  6. Felony theft
- B. The following searches shall be performed to document types of convictions listed above that will render an individual ineligible to perform work on campus unless a waiver is granted:
  1. SSN Trace plus address history
  2. Sexual Offender database check
  3. National Criminal Database search
  4. 7-year County Court Check in the employee's County of residence
- C. Entities seeking to use an employee with one or more revealed convictions must apply for a written waiver from the UFPD Chief at (352) 392-1111 or [upinfo@admin.ufl.edu](mailto:upinfo@admin.ufl.edu).
- D. The UFPD Chief will consider the following factors when determining whether or not a waiver will be granted:
  1. The nature and gravity of any criminal offense(s);
  2. The individual's age at the time of the offense(s);
  3. The number and type of offense (felony, misdemeanor, traffic violations, etc.);
  4. The sentence or sanction for the offense and compliance with the sanction(s);
  5. The amount of time that has passed since the offense and/or completion of the sentence(s);



6. Whether there is a pattern of offenses;
  7. Whether the offense arose in connection with the individual's prior employment or volunteer activities;
  8. Information supplied by the individual about the offense(s);
  9. Work record and references after the offense(s);
  10. Subsequent criminal activity; and
  11. Truthfulness of the individual in disclosing the offense(s).
- E. Builders shall certify that all personnel have been subject to a criminal background check and shall continuously track, monitor, and re-certify throughout construction as new trades and personnel begin work.
- F. The cost of the criminal background check shall be borne by the Builder, but is compensable as a General Conditions expense for CMs and D/Bs.
- G. The Builder shall maintain copies of background checks at their home office, with background checks electronically accessible at the Project site. The names and pertinent information of all screened and approved employees shall be posted to the PD&C Sharepoint site at: <https://uflorida.sharepoint.com/sites/pdc/prj/Lists/Background%20Checks/AllItems.aspx>

#### 1.8 WORK HOURS

- A. Regular work hours shall be between 7:00 AM and 5:00 PM, Monday through Friday, excluding holidays.
- B. Work outside these hours must be requested in writing and approved by the Owner.
- C. Work will be required outside of regular work hours.

#### 1.9 UNMANNED AIRCRAFT

- A. The use of unmanned aircraft systems (e.g., drones or model aircraft) over University property is prohibited without the written approval of UF EH&S.
- B. For a complete explanation of the policy, procedures, and requirements, see [www.ehs.ufl.edu/programs/rm/uas\\_procedures](http://www.ehs.ufl.edu/programs/rm/uas_procedures).

#### 1.10 HOME FOOTBALL GAME WEEKENDS

- A. Approximately 100,000 people converge upon the campus on each of 6-7 Fall weekends for Gator football games. To safeguard both the public and the Work, jobsites on campus shall be secured, left clean, and free of safety hazards by 4:00 PM Friday on such weekends, with no work taking place on or around the site until Monday morning.



- B. Likewise, remove all vehicles parked at the paved remote lot near the 34<sup>th</sup> Street Hilton by 4:00 PM Friday on such weekends and do not permit parking there again until Monday morning. Approved trailer/storage containers may remain.
- C. See [www.gatorzone.com](http://www.gatorzone.com) for the football game schedule and incorporate these dates into the construction schedule.
- D. The Builder may request special exceptions to this policy with written justification at least one week in advance, but the Owner is under no obligation to approve such requests.

#### 1.11 PRE-CONSTRUCTION MEETING

- A. Prior to commencing Work at the site, the Builder shall attend a pre-construction conference with the University Project Manager, the Design Professional(s), other UF officials, and external agency representatives, if applicable (such the District Engineer on a Federally-funded project).
- B. Builder attendees shall include all field staff (project manager, superintendent(s), project engineer(s), and clerical assistants), plus major trade subcontractors as directed by the University Project Manager.
- C. The parties will discuss the administrative, logistic, fiscal, and procedural requirements for the Work, and for work in general at the University of Florida.
- D. The template agenda for the meeting shall be provided by the University Project Manager, who shall also arrange for attendance by other UF officials and outside agencies, if any. The Builder shall record and distribute minutes.

#### **END OF SECTION**



## **01016 Utility Outages and Dig Permits**

### **PART 1 – GENERAL**

#### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.
- B. Refer to Section 01310, Construction Schedule for related requirements regarding the coordination of utility outages with the University of Florida Schedule.

#### **1.2 UTILITIES OUTAGES**

- A. Planned utility outages are occasionally required for repairs, maintenance or construction. In order to avoid unexpected inconveniences, property damage, safety hazards, or loss of information or research, the Physical Plant Division (PPD) has instituted a utility outage notification system.
- B. When the Work requires an outage, the Builder shall submit – at least seven (7) work days in advance – a written request to PPD via the University Project Manager on an Owner-furnished form. Outages shall not proceed until authorized by PPD.
- C. Utility outages will be performed by PPD Systems personnel, at no cost to the Builder. The project will pay the applicable costs. However, the costs associated with an outage that becomes necessary to correct deficient work performed during a previous outage will be back-charged to the Builder. Contact PPD Operations Engineering (Telephone: 392-5050) as necessary to determine these costs.
- D. Unplanned utility outages occur on occasion as the unwelcome result of repair, maintenance, or construction activities. Report all unplanned utility outages immediately to the PPD Work Management Center (Telephone: 392-1121) and to the University Project Manager.
- E. Advance notification of between 14 and 30 calendar days must be provided to the Health Science Center, Department of Housing, and IFAS for significant outages effecting facilities operated by those entities.

#### **1.3 DIG PERMITS**

- A. All trenching, excavation, digging operations, or other penetration of the ground within the confines of the University campus or in any area for which the



University has responsibility, requires the Builder to obtain a Dig Permit, PPD Form 611, which can be retrieved from the PPD website at [www.ppd.ufl.edu](http://www.ppd.ufl.edu).

- B. The person, Builder, agency, or organization that will be performing the trenching, excavation, digging, or other ground-penetrating activity is responsible for requesting and obtaining permission to perform that activity.
- C. All Dig Permits shall be applied for 72 hours prior to the start of any work that penetrates the ground. Dig Permit applications shall be completed at PPD, Building 702.
- D. Sunshine State One-Call (800-432-4770) shall be utilized for utilities owned by others, including BellSouth, Cox Cable, and Gainesville Regional Utilities (GRU).

**END OF SECTION**



## 01060 Regulatory Requirements

### PART 1 – GENERAL

#### 1.1 RELATED SECTIONS

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

#### 1.2 BUILDING CODE ENFORCEMENT PROGRAM

- A. TITLE XLVIII (Florida K-20 Education Code) and Chapter 553.80(6) F.S. assign responsibility to the State University System for the enforcement of the Florida Building Code and the Florida Fire Prevention Code during building construction and renovation at State universities. At the University of Florida, the Environmental Health and Safety Division (EH&S) has been assigned the responsibility to implement and administer the Building Code Permit and Inspection Program. Program compliance requires that construction plans/specifications and permit application documents be submitted to the UF Building Code Administrator (EH&S) for review. Construction shall not begin on the project until a building permit has been issued by EH&S and the permit posted at the construction site.
- B. A more complete description of the University of Florida's Building Code Enforcement Program may be obtained from the University's Building Code Administrator.

##### EH&S Building Code Enforcement

Building 179, 916 Newell Drive, P.O. Box 112190, Gainesville, FL, 32611-2200

Phone: (352) 392-1591; Fax (352) 392-3647

Internet: [www.ehs.ufl.edu](http://www.ehs.ufl.edu)

#### C. RESPONSIBILITIES

1. The duly licensed State of Florida contractor shall apply to the UF Division of Environmental Health & Safety for a building permit. At the time of application for a permit, the Builder shall provide two sets of signed and sealed construction documents and specifications, a list of all subcontractors with appropriate license numbers and proof of Worker's Compensation insurance, and the "letter of code compliance" indicating the plans have been reviewed by EH&S and all outstanding code and safety-related items have been resolved. If a "letter of code compliance" has not been issued by EH&S, two copies of the final construction (bid) documents and specifications must



accompany the application. A building permit will be issued after the documents have been reviewed for code compliance by the Building Code Administrator/staff. One of the submitted sets of plans and specifications will be returned with the building permit placard and shall be stamped by EH&S stating "Reviewed for Code Compliance." This set of documents shall be protected and kept on site by the contractor for use by EH&S code enforcement.

2. When the contractor has completed the project per the permit documents and submitted all required tests and reports, their authorized representative shall request in writing a certificate of completion or certificate of occupancy from the UF/EH&S Building Code Administrator as required by the Florida Building Code.

### 1.3 LIFE SAFETY & FIRE SAFETY PLAN REVIEW

- A. In conjunction with review of plans for Building Code Compliance EH&S has been assigned the duty of life safety & fire safety plan review and inspection of UF construction projects.
- B. Plan review shall be conducted as each project is submitted for building code compliance review. A separate submission will not be required for this review phase as it will be conducted simultaneously with the building code compliance review.
- C. Inspections of life safety items shall be scheduled through EH&S's normal inspection process.
- D. Prior to issuance of the certificate of occupancy or completion EH&S's fire plans reviewer and inspector shall certify that the project meets or exceeds all life and fire safety minimum codes and standards.

### 1.4 FLORIDA PRODUCT APPROVAL

As required by Florida Statutes, the Builder shall provide information on certain structural and building envelope products and components. See "Florida Product Approval Info Sheet" on the "Forms" page of the EH&S Building Code Enforcement website ([www.ehs.ufl.edu/buildcode](http://www.ehs.ufl.edu/buildcode)).

**END OF SECTION**



## **01310 Construction Schedules**

### **PART 1 – GENERAL**

#### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.
- B. Refer to Section 01016, Utility Outages, for related requirements regarding the pre-planning of utility outages.
- C. Comply with pertinent provisions of Technical Specifications and drawings.

#### **1.2 QUALITY ASSURANCE**

- A. Employ, if necessary, a scheduler who is thoroughly trained and experienced in compiling construction schedules, and in preparing and issuing periodic reports as required.

### **PART 2 – PRODUCTS**

#### **2.1 CONSTRUCTION ANALYSIS**

- A. Graphically show by bar chart the order and interdependence of all activities necessary to complete the Work, and the sequence in which each activity is to be accomplished, as planned by the Builder in coordination with all subcontractors whose work is shown on the diagram.
- B. Highlight the “critical path” through the schedule to illustrate those inter-dependent activities that cannot be delayed without impacting the overall completion time.
- C. Builder shall coordinate the Work with the University of Florida schedule. The Work shall be scheduled and carried out such that the normal operations of the University are given first priority. This applies particularly to outages of utilities and restrictions of access. The University may require such construction operations to be executed outside of normal working hours and by overtime, weekend, and holiday working. It shall be the Builder's responsibility to provide for this in the Cost of Work.
- D. See Section 01014 for information on home football game restrictions, and account for same in the construction schedule.



- E. Incorporate commissioning requirements and milestones.
- F. Provide amplifying information as needed, such as reports on “float,” or as requested by the Owner or Professional.

**END OF SECTION**



## **01500 Temporary Facilities and Controls**

### **PART 1 – GENERAL**

#### **1.1 RELATED SECTIONS**

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.
- B. Utility outages and dig permits are covered in Section 01016. Permanent installation and hookup of the utility lines are described in other sections.

#### **1.2 DESCRIPTION**

##### **A. WORK INCLUDED**

Provide temporary facilities and controls needed for the Work, including, but not necessarily limited to:

- 1. Temporary utilities such as water, electricity, and telephone;
- 2. Field offices and sanitary facilities for the Builder's personnel;
- 3. Enclosures such as tarpaulins, barricades, and canopies; traffic control and pedestrian control devices;
- 4. Erosion control measures; and
- 5. Directional and informational signage.

##### **B. WORK NOT INCLUDED**

- 1. Except for the requirement that equipment furnished by subcontractors shall comply with pertinent safety regulations, such equipment as normally furnished by the individual trades in execution of their own portions of the Work, is not part of this Section.
- 2. The permanent installation and hookup of utility lines are described in other sections and are not part of this Section except as related to the metered cost of such utilities once established.

#### **1.3 PRODUCT HANDLING**



Maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

#### 1.4 SUBMITTALS

- A. The Builder shall present a jobsite management plan in the form of a scaled, marked-up site plan for the Owner's review at or prior to the Pre-Construction Conference. This drawing shall identify, at a minimum:
  - 1. Temporary fencing with gated point(s) of access
  - 2. Materials delivery & storage areas
  - 3. Field office or storage trailers
  - 4. Temporary accessibility features including paved or unpaved roads, sidewalks, bicycle paths, ramps, curb cuts, canopies, barricades, or other means of maintaining safe and ADA-accessible routes through or around the site
  - 5. Waste collection (dumpsters)
  - 6. Signage and striping
  - 7. Paths for emergency egress
  - 8. Onsite staff parking
  - 9. Tree protection
  - 10. Restricted access routes for vehicles and equipment belonging to the Builder and its subcontractors, vendors, and employees entering upon the UF Campus
- B. As construction progresses, the Builder shall identify any required disruptions or restrictions of roads, sidewalks, bicycle lanes, or other means of access. Approval for such disruptions shall be secured prior to scheduling related work by submitting a written request to the University project manager. This request shall be accompanied by a site sketch, start and end dates, an explanation of the reasons(s) for the request, and an illustration or description of the temporary controls to be used to maintain safe access. **THE FULL CLOSING OF VEHICULAR ROADS (i.e., all lanes) ON THE UF CAMPUS SHALL NOT BE PERMITTED.**
- C. A formal traffic control plan – including credentials of plan developer – shall be submitted for review when lane closures are anticipated. See paragraph 3.1 of this section.

#### PART 2 – PRODUCTS

##### 2.1 TEMPORARY UTILITIES

- A. USAGE, ESTABLISHMENT, and COST
  - 1. The Builder shall include in the Cost of Work both the installation of any temporary utilities and the (monthly) usage fees for same. This includes, but



is not limited to: potable water for drinking and/or construction trailers; water for cleaning, construction, flushing, commissioning, and testing of plumbing and mechanical systems; convenience power for tools, lighting, and/or construction trailers; temporary power for construction and testing; telecommunications lines for phone, fax, or Internet service. Current PPD utility rates can be viewed at <https://www.ppd.ufl.edu/information/rates.shtml>.

2. For use of University-owned utilities, the Builder shall establish an account with PPD by contacting PPD Billing at (352) 294-0628.
3. Prior to beginning work that involves connections to the University's utilities systems, the Builder shall submit – at least 48 hours in advance – a work request to PPD Work Management (392-1121) for installation of temporary meter(s) by PPD Utility Services.

#### B. WATER

1. The point(s) of connection shall be designated by PPD.
2. A temporary potable water meter will be furnished and installed by PPD Utility Services. Allow 14 days lead time for the Owner-furnished meter. The Builder shall furnish and install all necessary related accessories.
3. Builder shall furnish and install all necessary temporary piping and water supply and, upon completion of the Work, remove same.

#### C. ELECTRICITY

1. The point(s) of connection shall be designated by PPD.
2. A temporary electric meter will be furnished by PPD Utility Services, which shall also energize service, but installed by the Builder. Allow 14 days lead time for the Owner-furnished meter. The Builder shall furnish and install all necessary related accessories (CTs, compatible meter socket/can, etc.).
3. Builder shall furnish and install all necessary temporary wiring and, upon completion of the Work, remove same.
  - (a) All temporary wiring provided by the Builder must conform to the requirements of the National Electric Code (NEC), the Industrial Safety Commission, and local requirements. In addition, all wire used shall be fused to adequately protect that wire according to the NEC.
  - (b) The Builder shall have an adequate number of outlets and each outlet shall be properly and clearly labeled with the maximum voltage and fuse protection.



(c) Where temporary lighting is used, outlets shall consist of a weatherproof socket properly insulated and provided with a locking type wire guard.

(d) All devices shall be properly grounded.

4. Provide area distribution boxes located such that the individual trades may furnish and use extension cords 100 feet in length (maximum) to obtain power and lighting at points where needed for work, inspection, and safety.
5. Temporary electric facilities shall be inspected and approved by PPD and EH&S prior to energizing by PPD Utility Services.
6. In keeping with UF sustainability policies, and to minimize the cost of utility services, the Builder shall minimize the use of temporary or permanent lighting, particularly when the jobsite is inactive. The use of energy efficient lamps is encouraged if the energy savings justifies any additional expense.

D. TELEPHONE and INTERNET

1. The Builder shall make arrangements with UF Information Technology (UF IT) or HealthNet – as applicable – or the local utility for temporary phone, fax, and/or Internet service lines.

E. SANITARY FACILITIES

1. Furnish and install temporary sanitary facilities for use by all construction personnel.
2. The Builder shall provide and maintain in a neat and sanitary condition such accommodations for the use of employees and subcontractors as may be necessary to comply with the regulations of the State Board of Health.
3. Unless expressly allowed by the Owner, existing sanitary facilities may not be used by construction personnel, subcontractors, or vendors.

2.3 FIELD OFFICES AND SHEDS

A. TRAILERS – Office and Storage

2.4 ENCLOSURES

- A. GENERAL: Provide and maintain for the duration of construction all scaffolds, tarpaulins, canopies, steps, platforms, bridges, and other temporary construction



necessary for proper completion of the Work in compliance with pertinent safety and other regulations.

- B. **DUMPSTER ENCLOSURES:** For all projects requiring dumpsters, where the dumpster is located within the geographical area of campus bounded by SW 13th Street, West University Avenue, Gale Lemerand Drive, and Stadium Road, the dumpster shall be enclosed by a solid wooden fence installed around the entire perimeter. This fence shall be a minimum of 6' high and shall be constructed of vertical 1 x 6's on a 2 x 4 frame. Pre-fabricated sections are acceptable.
- C. **TREE PROTECTION:** See tree protection guidelines, Appendix I, University of Florida Construction Standards, Volume 1.

## 2.5 TEMPORARY FENCING

- A. Provide and maintain for the duration of construction a temporary fence to prevent entry of the public into the jobsite. Fencing shall be six-foot high sealed wood or chain link fencing with dark-colored inlaid fabric mounted on fixed posts of metal or wood for temporary parking and work area. Open trenches and other hazards shall be enclosed in a fixed wire fence or wooden barricades with flashing lights.
- B. Maintain the security and appearance of fencing throughout construction.

## 2.6 EROSION and SEDIMENTATION CONTROL

- A. The Builder shall develop a "Sedimentation and Erosion Control Plan" per the UF Design & Construction Standards (Appendix C).
- B. This plan shall be submitted for review and approval prior to beginning any onsite work or applying for dig permits.
- C. The Builder shall erect and maintain control measures as outlined in the plan throughout construction. Such measures may include gravel "wash-down stations" at jobsite entry and exit points, silt fencing, and temporary grass seeding.

## 2.7 SIGNAGE

- A. Install and maintain the appearance of the standard University of Florida Board of Trustees Project Sign in a location directed by the University Project Manager.
- B. Florida Statutes 812.014 and 810.09 require that construction fences be adorned with the following sign: **"WARNING (red on white) - This area is a designated construction site. Anyone trespassing on this property shall, upon**



**conviction, be guilty of a felony.”** (*black on white*) Signs shall be approximately 14" x 18".

- C. Post the following notice on each leg of construction fencing:  
**“Immediately report sexual harassment from anyone at this construction site. Please contact the University’s Title IX Coordinator at (352.273.1094).”**
- D. Provide way-finding, directional, and other informational signage as needed to safely accommodate the public’s need to pass around or through the Work. This shall include, as needed, directional assistance for ADA-compliant paths of travel throughout the duration of construction.
- E. No other signs or advertisements are permitted.

## 2.8 CLEANLINESS

The Builder shall keep the premises free from accumulation of waste material and rubbish, and shall remove from the premises all rubbish, implements, surplus materials, and temporary facilities provided during the course of the Work, leaving spaces broom clean.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. The Builder shall not mobilize and/or erect temporary facilities until the jobsite management plan has been reviewed and approved by the Owner.
- B. Prior to erection of fencing, the Builder shall review the proposed fencing plan onsite with the University Project Manager and representatives of EH&S, UFPD, and the Americans with Disabilities Act Office.
- C. Directional signage shall be installed simultaneously with fencing and/or temporary roads or paths.
- D. Traffic maintenance devices and procedures (signage, barricades and cones, flagmen, etc.) shall be per Florida Department of Transportation (FDOT) standards (2003 Edition, Manual on Uniform Traffic Control Devices (MUTCD), with Revision No. 1 Incorporated, dated November 2004). Work zone traffic control schemes and devices shall only be implemented or installed in the field by or under the direct supervision of a person who has satisfactorily completed the training requirements prescribed by FDOT Topic No: 625-010-010-f, “MAINTENANCE OF TRAFFIC TRAINING,” Work Zone Traffic Control and Maintenance of Traffic Intermediate or Advanced Level as appropriate for the project. All flagmen shall have successfully completed the Work Zone Traffic Control and Maintenance of Traffic - Basic Level.



### 3.2 WEATHER PROTECTION

- A. Take necessary precautions to ensure that roof openings and other critical openings in the building are secured. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.
- B. When a warning of gale force (or higher) winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Owner property. Precautions shall include, but are not limited to, closing openings; removing loose materials, tools, and equipment from exposed locations; removing or securing scaffolding and other temporary work; and arranging for all dumpsters to be emptied.

### 3.3 MAINTENANCE AND REMOVAL

- A. Maintain temporary facilities and controls as long as needed for safe, compliant, and proper completion of the Work.
- B. Remove temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Owner.

**END OF SECTION**



## **01505 Construction Waste Management**

### **PART 1 – GENERAL**

#### **1.1 RELATED SECTIONS:**

- A. Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.
- B. See the Physical Plant Division Solid Waste Management website at <https://www.ppd.ufl.edu/departments/refuse.shtml>.

#### **1.2 HAZARDOUS SUBSTANCES**

- A. The builder is responsible for proper management of hazardous substances used, stored, handled, generated, or disposed of by his own construction activities (e.g., excess or unwanted hazardous construction-related materials, including, but not limited to: equipment lubricants, used oil filters, aerosols, paints, activators, adhesives, caulks, and other hazardous wastes). In no case shall such construction hazardous waste be commingled with demolition hazardous waste. In no case shall such construction hazardous waste be commingled with non-hazardous construction or demolition waste.
- B. For renovation or demolition projects, hazardous wastes shall be segregated, collected, labeled, and disposed of via UF Environmental Health & Safety (EH&S). These include light fixture ballasts (PCB and non-PCB), mercury thermostats, and batteries. See [www.ehs.ufl.edu/programs/chemrad\\_waste](http://www.ehs.ufl.edu/programs/chemrad_waste).
- C. Evaluation, on-site storage, transportation, disposal and other aspects of Hazardous Waste Management shall comply with applicable Federal, State, and local laws.
- D. Refer to the General Terms & Conditions for requirements related to the discovery of environmental contamination, including, but not limited to, Hazardous Substances.

**END OF SECTION**



## **01700 Project Closeout**

### **PART 1 – GENERAL**

#### **1.1 RELATED SECTIONS:**

Documents affecting the work of this Section include other elements of the Contract for Construction, including the Owner/Builder Agreement or Owner/Design-Builder Agreement, the General Terms & Conditions, other sections of the Division 0 and Division 1 non-technical specifications, and the technical plans and specifications.

#### **1.2 CERTIFICATE OF OCCUPANCY**

Prior to occupancy of a new building, the Division of Environmental Health & Safety (EH&S) shall issue a Certificate of Occupancy (CO). The CO will state the building is complete, constructed in accordance with the plans and specifications, and meets the minimum code requirements at the time of issuance of the building permit. Project must achieve at least a temporary CO in order to achieve Substantial Completion.

#### **1.3 SUBSTANTIAL COMPLETION**

Separate and distinct from completion requirements related to life safety and building codes is the contractual obligation to achieve Substantial Completion on or before the specified date. Refer to the “Construction Inspection and Closeout” link under “Forms & Standards” on the Planning Design & Construction website ([www.facilities.ufl.edu](http://www.facilities.ufl.edu)). Checklists and forms related to closeout shall be tailored by the Owner and design professional (A/E) to the specific needs of the project.

#### **1.4 AS-BUILT DOCUMENTS**

See the General Terms & Conditions and certain technical specifications for more information regarding as-built / record documents.

#### **1.5 O&M MANUALS**

- A. Builder shall provide draft operation and maintenance (O&M) manuals and other documents for review by UF, the A/E, and the CxA prior to manufacturer startups, Cx Functional Performance Testing, and Owner training.
- B. Builder shall tailor the O&M documents to the project, excluding or striking through models/types not installed and otherwise including only information pertinent to the products, materials, equipment, or components actually installed. Builder shall clearly identify each item, with references to the construction documents as needed.



- C. Builder shall augment O&M documents with the final approved versions of any submittals, shop drawings, or other system/product data not already included.
- D. Builder shall finalize turnover/closeout documents (including O&Ms) by addressing review comments and incorporating missing or finalized documents, test reports, and other relevant information.
- E. See 1.9 below for content and format requirements.

## 1.6 UTILITY VIDEOS

When required by the technical specifications, television camera videos of underground utility lines shall be provided to the engineer of record and the Owner in MPEG or AVI format.

## 1.7 OWNER TRAINING

- A. Training on building systems, equipment, and materials, the specific requirements for which are outlined in the technical specifications, shall be completed prior to Substantial Completion, at which point the Owner assumes the responsibility for operation and maintenance of the facility.
- B. Builder shall coordinate the schedule for training with UF and provide a comprehensive schedule for all training sessions at least 30 calendar days prior to the first scheduled session.
- C. Builder shall provide – at least two weeks in advance of each scheduled session – a syllabus, outline, or agenda for each training session for review by UF, the A/E, and (for commissioned systems) the CxA.
- D. Training shall be conducted with the (draft) O&M manuals in hand – preferably in conjunction with commissioning activities – and shall be videotaped and turned over to the Owner in MPEG format.

## 1.8 ATTIC STOCK

Coordination of the physical storage location of “attic stock” items shall be made with the building O&M entity prior to Substantial Completion, and the items and quantities of same (as outlined in the technical specifications) shall be on hand as a requirement of Substantial Completion. The Builder shall develop a spreadsheet itemization of attic stock and other items to be turned over to the Owner, tracking the type and quantity of material, date(s) of turnover, and other relevant information.

## 1.9 ENERGY REBATE PROGRAM



Builder shall gather product data and other information as needed to assist Owner with its application for energy rebates based on the materials and products installed in the facility.

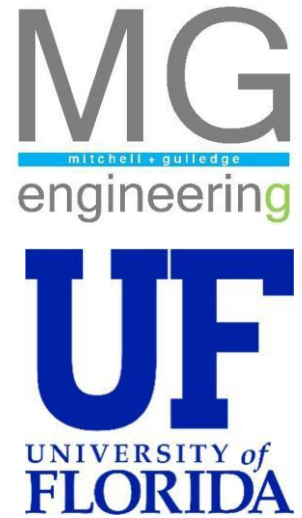
#### 1.10 CLOSEOUT DOCUMENTS and OTHER DELIVERABLES

- A. The final version of all O&M manuals and other turnover/closeout documents shall be provided in electronic (searchable PDF) form prior to Substantial Completion, including a Table of Contents for each discreet manual. Provide these to UF, the A/E on CD-ROM or through a file-sharing platform (e.g., Sharepoint), assembled and organized in electronic folders.
- B. Other than 010000, each e-folder listed above, where applicable, shall include the following sub-folders to consistently organize the documents and material:
  - 1. IOM Documents and Product Data
  - 2. Shop Drawings
  - 3. Training (*including training agendas, sign-in sheets, and videos*)
  - 4. Warranty Documents

**END OF SECTION**



Mitchell Gullledge Engineering, Inc.  
210 SW 4<sup>th</sup> Ave  
Gainesville, FL 32601  
352-745-3991



## University of Florida

JHMHC Communicore AHU-5, 7, & 8 Replacement

Address: 1249 Center Drive, Gainesville, FL 32610

Building Number: 0203

Project Number: MP05285

## Technical Specifications

100% Construction Documents

December 20, 2019

MG Project 19066



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PART 1 - GENERAL

- A. The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings.

1.2 Related Documents:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to work of this section.
- B. This is a Basic Mechanical Requirements Section. Provisions of this section apply to work of all Division 23 sections.
- C. Review all other contract documents to be aware of conditions affecting work herein.
- D. Definitions:
  - 1. Provide: Furnish and install, complete and ready for intended use.
  - 2. Furnish: Supply and deliver to project site, ready for subsequent requirements.
  - 3. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.

1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.

1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the said data.

1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.

1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.

1.7 Field Measurements and Coordination:

- A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications.
- B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
- C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with a minimum cutting and patching.
- D. Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on mechanical drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.



- E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. Cut no structural members without written approval.
- F. Carefully examine any existing conditions, piping, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- G. Because of the small scale of the drawings, it is not possible to indicate all offsets and fittings or to locate every accessory. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate piping, ductwork, equipment, and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or piping cannot be fitted, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee:

- A. The Contractor shall guarantee labor, materials, and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- B. Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

1.9 Approval Submittals:

- A. When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
  - 1. Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and the following.
    - a. Submittals shall be properly organized in accordance with the approved submittal control log.
    - b. Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
    - c. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
    - d. Submittals shall have been reviewed and approved by the Builder. Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.
    - e. Submittals that include a series of fixtures or devices (such as plumbing fixtures or valves) shall be organized by the fixture number or valvetype



- and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether or not those items are used on other fixtures.
- f. The electrical design shown on the drawings supports the mechanical equipment basis of design specifications at the time of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this change will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- B. If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
  - C. Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.
  - D. Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations, and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications, and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports, and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance (O&M) data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required and as described herein. Submit manuals at the Substantial Completion inspection.

## PART 2 - PRODUCTS

- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description,



characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

- A. Shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- B. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings, and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated, or painted.
- C. The label of the approving agency, such as UL, IBR, ASME, ARI, AMCA, by which a standard has been established for the particular item shall be in full view.
- D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.
- H. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

- A. Where a particular system, product, or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product, or material specified.
- B. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances:
  - 1. Required product cannot be supplied in time for compliance with Contract time requirements.
  - 2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted, or insured, or has other recognized disability as certified by Contractor.
  - 3. Substantial cost advantage is offered Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation, and other necessary services and similar considerations.



- C. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:
1. Principal of operation.
  2. Materials of construction or finishes.
  3. Thickness of gauge of materials.
  4. Weight of item.
  5. Deleted features or items.
  6. Added features or items.
  7. Changes in other work caused by the substitution.
  8. Performance curves.
  9. If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

### PART 3 - EXECUTION

- 3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any materials installed which do not present an orderly and reasonably neat and/or workmanlike appearance, or do not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.
- 3.2 Coordination:
- A. The Contractor shall be responsible for full coordination of the mechanical systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for piping, ductwork, or other equipment passing through slabs or walls.
  - B. Any additional steel supports required for the installation of any mechanical equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.
  - C. It shall be the Contractor's responsibility to see that all equipment such as valves, dampers, filters, and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.
  - D. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.
  - E. The contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
  - F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.
- 3.3 Start of work will be construed as acceptance of suitability of work of others.
- 3.4 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be



done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

- 3.5 Phasing: Provide all required temporary valves, piping, ductwork, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.
- 3.6 Cutting and Patching: Notify Builder to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.7 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts, and washers. Level equipment.
- 3.8 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 23. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.9 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials, and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.10 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.11 Climate Control: Operate heating and cooling systems as required after initial startup to maintain temperature and humidity conditions to avoid freeze damage and warping or sagging of ceilings and carpet.
- 3.12 Record Drawings:
- A. During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.
  - B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions and Supplementary Conditions.
- 3.13 Acceptance:
- A. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
  - B. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
  - C. Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
    - 1. Detailed operating instructions and instructions for making minor adjustments.
    - 2. Complete wiring and control diagrams.



3. Routine maintenance operations.
  4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
  5. Copies of approved submittals.
  6. Copies of all manufacturer's warranties.
  7. Copies of test reports and verification submittals.
- D. Record Drawings: Submit record drawings.
- E. Test and Balance Report: Submit four electronic certified copies. The Report shall be submitted for review prior to the Substantial Completion Inspection.
- F. Acceptance will be made on the basis of tests and inspections of job. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.
- G. Control Diagrams: Frame under glass and mount on equipment room wall.



PROJECT NAME  
PROJECT NUMBER

ARCHITECT: Company Name

ENGINEER: Mitchell Gulledge Engineering

CONTRACTOR: Contractor Name

SUBCONTRACTOR: Sub Name

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: mm/dd/yyyy

SECTION: 23 XX XX/Section Name

# SAMPLE

**Any standard heading is acceptable.**

1. Product 1: Manufacturer, Model

2. Product 2: Manufacturer, Model

3. Product 3: Manufacturer, Model

4. Product 4: Manufacturer, Model

5. Product 5: Manufacturer, Model

**List each product individually. Include manufacturer name and model.**

**Include GC or CM  
Approval stamp indicating  
review and acceptance by  
responsible contractor.**

END OF SECTION



## PART 1 - GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the mechanical work as herein called for and shown on the drawings.
- 1.2 This is a Basic Mechanical Requirements section. Provisions of this section apply to work of all Division 23 sections.

## PART 2 - CODES

- 2.1 All work under Division 23 shall be constructed in accordance with the codes listed herein. The design has been based on the requirements of these codes; and while it is not the responsibility of the Contractor to verify that all work called for complies with these codes, he shall be responsible for calling to the Architect/Engineer's attention any drawings or specifications that are not in conformance with these or other codes prior to ordering equipment or installing work.
- 2.2 Comply with regulations and codes of utility suppliers.
- 2.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 2.4 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.
- 2.5 Additional codes or standards applying to a specific part of the work may be included in that section.
- 2.6 The following codes and standards shall govern all work:
  - A. Florida Building Code – Sixth Edition (2017)
  - B. Florida Building Code – Sixth Edition (2017) – Existing Building
  - C. Florida Building Code – Sixth Edition (2017) – Energy Conservation
  - D. Florida Building Code – Sixth Edition (2017) – Mechanical
  - E. Florida Building Code – Sixth Edition (2017) – Plumbing
  - F. Florida Building Code – Sixth Edition (2017) – Fuel Gas
  - G. Florida Building Code – Sixth Edition (2017) – Accessibility
  - H. National Electric Code (NFPA 70 – 2014)
  - I. Fire Alarm and Signaling Code (NFPA 72 – 2013)
  - J. Standard for Air Conditioning and Ventilating Systems (NFPA 90A – 2012)
  - K. University of Florida construction standards
  - L. Florida Fire Prevention Code Sixth Edition
    - 1. Fire Code (NFPA 1 – 2017)
    - 2. Life Safety Code (NFPA 101 – 2017)

## PART 3 - STANDARDS

All mechanical materials, installation, and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

- 3.1 Underwriters' Laboratories (UL)
- 3.2 American National Standards Institution (ANSI)
- 3.3 American Society of Testing Materials (ASTM)
- 3.4 National Fire Protection Association (NFPA)
- 3.5 National Electrical Manufacturers Association (NEMA)
- 3.6 Air Conditioning and Refrigeration Institute (ARI)
- 3.7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)



- 3.8 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
- 3.9 Air Movement and Control Association (AMCA)
- 3.10 Standards of the Hydronic Institute (IBR)

END OF SECTION



## PART 1 - GENERAL REQUIREMENTS

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.2 This is a Basic Mechanical Requirements section. Provisions of this section apply to work of all Division 23 sections.
- 1.3 Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 23 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

## PART 2 - DIVISION 3 - CONCRETE

- 2.1 Refer to owner construction standards, for:
  - A. Rough grouting in and around mechanical work.
  - B. Patching concrete cut to accommodate mechanical work.
- 2.2 The following is part of Division 23 work, complying with the requirements of Division 3.
  - A. Curbs, foundations, and pads for mechanical equipment.
  - B. Basins, sumps, and vaults of mechanical work.

## PART 3 - DIVISION 4 - MASONRY

- 3.1 Refer to owner construction standards, for:
  - A. Installation of wall louvers.
  - B. Installation of access doors in walls.

## PART 4 - DIVISION 5 - METALS

- 4.1 Refer to owner construction standards, for:
  - A. Framing openings for mechanical equipment.
- 4.2 The following is part of Division 23 work:
  - A. Supports for mechanical work.

## PART 5 - DIVISION 6 - WOOD AND PLASTIC

- 5.1 Refer to owner construction standards, for:
  - A. Framing openings for mechanical equipment

## PART 6 - DIVISION 7 - THERMAL AND MOISTURE PROTECTION

- 6.1 Refer to owner construction standards, for:
  - A. Installation of all roof curbs and roof supports for mechanical work.
  - B. Caulking and waterproofing of all wall and roof mounted mechanical work.
  - C. Providing all roof curbs and all vent flashing for metal roofs.
- 6.2 The following is part of Division 23 work, complying with the requirements of owner construction standards, for:
  - A. Fire barrier penetration seals.

## PART 7 - DIVISION 8 - DOORS AND WINDOWS

- 7.1 Refer to owner construction standards, for:



- A. Providing all undercuts.

PART 8 - DIVISION 9 - FINISHES

8.1 Refer to owner construction standards, for:

- A. Painting exposed ductwork, piping, and equipment.
- B. Painting structural metal and concrete for mechanical work.
- C. Painting door grilles and access panels.
- D. Painting color-coded mechanical work indicated for continuous painting.
- E. Installation of access doors in gypsum drywall.

8.2 Colors shall be selected by the Architect for all painting of exposed mechanical work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

8.3 Perform the following as part of Division 23 work:

- A. Touch up painting of factory finishes.
- B. Painting of all hangers.

PART 9 - DIVISION 26 - ELECTRICAL

9.1 Mechanical contractor shall coordinate the exact electrical requirements of all mechanical equipment being provided with the electrical contractor. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the mechanical equipment basis of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this design will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

9.2 Mechanical contractor shall provide all HVAC control wiring including the Energy Management Control system sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26. The intent is for the mechanical contractor to be responsible for the entire HVAC control system, including point-to-point wiring.

9.3 Electrical contractor shall provide disconnect switches, starters, and contactors for mechanical equipment unless specifically noted as being furnished as part of mechanical equipment.

9.4 Electrical contractor shall provide all power wiring, raceway, and devices, and make final electrical connections to all mechanical equipment, switches, starters, contactors, controllers, and similar equipment.

9.5 All duct-mounted smoke detectors shall be furnished and wired by the electrical contractor and installed by the mechanical contractor.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

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

### 1.2 Summary:

- A. This Section includes basic requirements for motors. It includes motors that are factory-installed as part of equipment and appliances as well as field-installed motors.

### 1.3 Quality Assurance:

- A. Comply with NFPA 70, "National Electrical Code", and with NEMA MG1 31.40.4.2, "Motors and Generators".
- B. Provide NRTL listed motors. (The term "listed" shall be as defined in "National Electrical Code," Article 100, and "NRTL" (Nationally Recognized Testing Laboratory) shall be as defined in OSHA Regulation 1910.7.
- C. Acceptable manufacturers: Baldor Gold.

## PART 2 - PRODUCTS

### 2.1 Motors, General:

- A. Provide open drip proof motors with sufficient capacity to start and operate connected loads at designated speeds in indicated environment, and with indicated operating sequence, without exceeding nameplate ratings. Provide motors rated for continuous duty at 100 percent of rated capacity. Temperature rise shall be based on 40°C ambient except as otherwise indicated.
- B. Motors 1/2 HP and larger shall be polyphase. Motors smaller than 1/2 HP shall be single-phase. Motor frequency ratings shall be 60 Hz, with voltage ratings as determined by voltage of circuit to which motor is connected for the following motor voltage ratings (utilization voltages):
  - 1. 120 V Circuit: 115 V - motor rating.
  - 2. 208 V Circuit: 200 V - motor rating.
  - 3. 240 V Circuit: 230 V - motor rating.
  - 4. 480 V Circuit: 460 V - motor rating.

### 2.2 Polyphase Motors:

- A. Provide NEMA Design B squirrel-cage induction-type motors with double-shielded, pre-lubricated ball bearings suitable for radial and thrust loading of the application. All polyphase motors shall be of the high efficiency type, with nominal efficiency equal to or greater than that stated in NEMA MG 1, Table 12-6B for that type and rating of motor.
- B. Multi-speed motors shall have a separate winding for each speed.
- C. Variable speed motors for use with solid-state drives shall be energy efficient, squirrel-cage induction, Design B units with ratings, characteristics, and features coordinated with and approved by drive manufacturer.
- D. Internal thermal overload protection for motors, where indicated, shall automatically open control circuit arranged for external connection. Protection operates when winding temperature exceeds safe value calibrated to the temperature rating of the motor insulation.
- E. Rugged duty motors shall be totally enclosed with 1.25 minimum service factor. Provide motors with regreasable bearings and equipped with capped relief vents.



Insulate windings with nonhygroscopic material. External finish shall be chemical resistant paint over corrosion resistant primer. Provide integral condensate drains.

- F. Coordinate motors with reduced inrush starting with indicated reduced inrush controller type and with characteristics of driven equipment load. Provide required wiring leads in motor terminal box to suit control method.
- G. For all motors used for exterior applications, provide TEFC type motors.

2.3 Single-Phase Motors:

- A. Single-phase motors shall be of one of the following types as selected to suit the starting torque and other requirements of the specific motor application.
  - 1. Permanent Split Capacitor.
  - 2. Split-Phase Start, Capacitor-Run.
  - 3. Capacitor-Start, Capacitor-Run.
- B. Shaded-pole motors may be used only for motors smaller than 1/20 HP.
- C. Internal thermal overload protection for motors, where indicated, shall automatically open the power supply circuit to the motor, or a control circuit arranged for external connection. Protection operates when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Provide device that automatically resets when motor temperature returns to normal range except as otherwise indicated.
- D. Bearings for belt connected motors and other motors with high radial forces on motor shaft shall be ball bearing type. Sealed, prelubricated sleeve bearings may be used for other single-phase motors.

PART 3 - EXECUTION

3.1 Installation:

- A. For field installed motors, install motors in accordance with manufacturer's published instructions and the following:
- B. Direct Connected Motors: Mount securely in accurate alignment.
- C. Belt Drive Motors: Use adjustable motor mounting bases. Align pulleys and install belts. Use belts identified by the manufacturer and tension belts in accordance with manufacturer recommendations.
- D. Provide TEFC motors for outside installations.

3.2 Commissioning:

- A. Check operating motors, both factory and field-installed, for unusual conditions during normal operation. Coordinate with the commissioning of the equipment for which the motor is a part. Report unusual conditions, and correct deficiencies of field-installed units.

END OF SECTION



## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section, and is part of each Division-23 section making reference to or requiring identification devices specified herein.
- 1.3 Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Refer to Division-26 sections for identification requirements of electrical work; not work of this section. Refer to other Division-23 sections for identification requirements for controls; not work of this section.
- 1.5 Codes and Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

## PART 2 - PRODUCTS

- 2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.
- 2.2 Painted Identification Materials:
  - A. Stencils: Standard fiberboard stencils, prepared for required applications with letter sizes generally complying with recommendations of ANSI A13.1 for piping and similar applications, but not less than 1-1/4" high letters for ductwork and not less than 3/4" high letters for access door signs and similar operational instructions.
  - B. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
  - C. Identification Paint: Standard identification enamel.
  - D. Plastic Pipe Markers.
  - E. Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.
  - F. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.
  - G. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- 2.3 Valve Tags:
  - A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" diameter tags, except as otherwise indicated.
  - B. Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener. Provide 1-1/2" square black tags with white lettering, except as otherwise indicated.
- 2.4 Engraved Plastic-Laminate Signs:
  - A. General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style a minimum of



3/4" tall and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

- B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 3/32" for larger units.
- C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for motors, AHUs, pumps, etc.

### PART 3 - EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.2 Ductwork Identification:

- A. General: Identify air supply, return, exhaust, intake and relief ductwork with stenciled signs and arrows, showing ductwork service and direction of flow, in black or white.
- B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures, and at 50' spacings along exposed runs.
- C. Access Doors: Provide stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate and procedural information.

3.3 Piping System Identification:

- A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
  - 1. Plastic pipe markers.
  - 2. Stenciled markers, black or white for best contrast.
- B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations:
  - 1. Near each valve and control device.
  - 2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
  - 3. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
  - 4. At access doors, manholes, and similar access points which permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
  - 7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- C. The following piping shall be color-coded where exposed in mechanical and electrical rooms by completely painting the piping with the indicated color. Use standard colors where exposed in finished spaces. Use standard identification methods in concealed areas.



- 3.4 Valve Identification: Provide coded valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. Coordinate code with operating instructions.
- 3.5 Valve Charts: Provide framed, glass covered valve charts in each mechanical room. Identify coded valve number, valve function, and valve location for each valve.
- 3.6 Mechanical Equipment Identification: Install engraved plastic laminate sign on a vertical surface on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. Provide signs for the following general categories of equipment and operational devices:
- A. Main control and operating valves, including safety devices.
  - B. Meters, gauges, thermometers, and similar units.
  - C. Fuel-burning units including boilers, furnaces, and heaters.
  - D. Pumps, chillers, and similar equipment.
  - E. Heat exchangers
  - F. Fans, blowers, primary balancing dampers
  - G. HVAC air handlers and fan coil units.
  - H. Tanks and pressure vessels.
  - I. Air conditioning indoor and outdoor units.
- 3.7 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, AHUs, etc. Where motors are hidden from view (within equipment casing, or otherwise not easily accessible, etc.), the equipment supplier shall furnish a duplicate motor data nameplate to be affixed to the equipment casing in an easily visible location, unless data is already included on the equipment nameplate.
- A. Adjusting and Cleaning:
- 1. Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.
  - 2. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION



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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

### 1.2 Description of Work:

- A. Extent of meters and gauges required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of meters and gauges specified in this Section include the following:
  - 1. Glass Thermometers.
  - 2. Thermometer Wells.
  - 3. Pressure Gauges.
  - 4. Pressure Gauge Cocks.
  - 5. Calibrated Balancing Valves.
  - 6. Gauge Connector Plugs.
  - 7. Venturi - Type Flow Meters.

### 1.3 Quality Assurance:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Comply with ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

### 1.4 Submittals:

- A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

## PART 2 - PRODUCTS

### 2.1 Thermometers:

- A. Glass Thermometers: Provide a die cast aluminum case finished in baked epoxy enamel, with glass front, spring secured, and nine inches long. The adjustable joint shall also be die cast aluminum with 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device. Provide a mercury filled tube and capillary with magnifying lens and 1% scale range accuracy. Scale shall be satin faced, nonreflective aluminum, with permanently etched markings. Stem shall be copperplated steel or brass, for separable socket. Ranges shall be as follows:
  - 1. Hot Water: 30°F-240°F with 2°F scale divisions.
  - 2. Chilled Water: 0°F-120°F with 1°F scale divisions.

### 2.2 Thermometer Wells:

- A. Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide extension, length equal to insulation thickness, for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.



2.3 Temperature or Pressure Gauge Connector Plugs:

- A. General: Provide temperature gauge connector plugs rated for 500 psi and 200°F (93°C). Construct of brass and finish in nickel-plate, equip with 1/2" NPS fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting 1/8" O.D. probe assembly from dial type insertion thermometer. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping.
- B. Acceptable manufacturers include Peterson Equipment Co.

2.4 Pressure Gauges:

- A. Provide pressure gauges for general use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection. Cases shall be drawn steel or brass, with glass lens, 4-1/2" diameter. Provide a brass connector with 1/4" male NPT. Provide a protective siphon when used for stream service. Scales shall be white coated aluminum with permanently etched markings. Accuracy shall be 1%. Ranges shall be as follows:
  - 1. Case: Drawn steel or brass, glass lens, four and 4-1/2" diameter.
  - 2. Connector: Brass with 1/4" male NPT. Provide protective siphon when used for steam service.
  - 3. Scale: White coated aluminum, with permanently etched markings.
  - 4. Range: Conform to the following:
    - a. Hot or Chilled Water: 0 - 100 psi.
- B. Acceptable manufacturers include Trerice (H.O. Co.), Weiss Instruments, Inc., Weksler Instruments Corp.

2.5 Pressure Gauge Cocks:

- A. Provide pressure gauge cocks between pressure gauges and gauge tees on piping systems. Construct gauge cock of brass with 1/4" female NPT on each end, and "T" handle brass plug.

2.6 Calibrated Balancing Valves:

- A. Provide as indicated, calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Each readout valve shall have an integral EPT check valve designed to minimize system fluid loss during monitoring process. Provide calibrated nameplate to indicate degree of closure of precision machined orifice. Construct balancing valve with internal EPT o-ring seal to prevent leakage around rotating element. Provide balance valves with pre-formed polyurethane insulation suitable for use on both heating and cooling systems. Acceptable manufacturers include Bell & Gossett, Taco, and Trush products.

2.7 Flow Venturis:

- A. Flow Venturi: Brass or steel flow venturi equipped with quick connect valves to facilitate connecting of differential pressure meter to flow meter. Provide calibrated nameplate with flow meter detailing its flow range of differential head pressures. Equip each readout valve with integral EPT check valve designed to minimize system fluid loss during monitoring process. Provide one portable differential pressure meter and associated connecting hoses fully compatible with supplied venturis. Acceptable manufacturers include Rinco Engineering Co. (Berkley, California), Presco Industries, Barco, and Gerand Engineering Co.



### PART 3 - EXECUTION

#### 3.1 Inspection:

- A. Examine areas and conditions under which meters and gauges are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Installer.

#### 3.2 Installation:

- A. Install temperature gauges, pressure gauges, and flow meters in accessible location and positioned so as to be easily read by an observer standing on the floor.
- B. Install gauge connector plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.
- C. Install pressure gauge cocks in piping tees with snubber. Install siphon for steam pressure gauges.
- D. Install venturi with grooved piping connections to allow for simple disassembly, cleaning, and orientation of ports.

#### 3.3 Adjusting and Cleaning:

- A. Adjust faces of meters and gauges to proper angle for best visibility.
- B. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.
- C. Provide two full sets of capacity curves for all flow venturis provided on the job. Capacity curves should be bound in a letter-size three-ring binder.

END OF SECTION



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## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to the work of this section.
- 1.2 This section is a Division-23 Basic Materials and Methods section, and is part of each Division-23 section making reference to or requiring valves specified herein.
- 1.3 Extent of valves required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Quality Assurance:
  - A. Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.
  - B. Valve Types: Provide valves of same type by same manufacturer.
- 1.5 Approval Submittals: When required by other Division-23 sections, submit product data, catalog cuts, specifications, and dimensioned drawings for each type of valve. Include pressure drop curve or chart for each type and size of valve. Submit valves with Division-23 section using the valves, not as a separate submittal. For each valve, identify systems where the valve is intended for use.
  - A. Check Valves: Type CK.
  - B. Ball Valves: Type BA.
  - C. Butterfly Valves: Type BF.
- 1.6 O&M Data Submittals:
  - A. Submit maintenance data and a copy of approval submittals.

## PART 2 - PRODUCTS

- 2.1 General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections.
- 2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the producers listed for each valve type. The model numbers are listed for contractor's convenience only. In the case of a model number discrepancy, the written description shall govern.
- 2.3 Check Valves:
  - A. Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40° to 45°, unless a composition disc is specified. Provide stop plug as renewable stop for disc hanger, unless otherwise specified. Disc and hanger shall be separate parts with disc free to rotate. Support hanger pins on both ends by removable side plugs.
  - B. Comply with the following standards:
    - 1. Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.
    - 2. Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.
    - 3. Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.
  - C. Types of check (CK) valves:



1. Threaded Ends 2" and Smaller (CK1): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Stockham B-319. Nibco T-413-BY. Crane 1707. Milwaukee 509.
2. Soldered Ends 2" and Smaller (CK2): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Stockham B-309. Nibco S-413-B. Crane 1707S. Milwaukee 1509.
3. Flanged Ends 2-1/2" and Larger (CK3): Class 125, iron body, bronze-mounted, bolted cap, horizontal swing, cast-iron or composition disc. Stockham G-931 or G-932 as applicable. Nibco F918-B. Crane 373. Milwaukee F2974 as applicable.
4. Threaded Ends 2" and Smaller (CK4): 200 WWP, bronze body, screwed cap, horizontal swing, regrinding type bronze disc.
5. Flanged Ends 2-1/2" and Larger (CK5): 175 WWP, iron body, bolted cap, bronze mounted, composition disc, UL listed, with ball drip if required. Stockham G-940. Nibco F-908-W.
6. Threaded Ends 2" and Smaller (CK6): Class 200, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-345. Nibco T-453-B. Crane 36. Milwaukee 518/508.
7. Flanged Ends 2-1/2" and Larger (CK7): Class 250, iron body, bronze mounted, bolted cap, cast-iron disc. Stockham F-947. Nibco F-968-B. Crane 39E. Milwaukee F2970.
8. Threaded Ends 2" and Smaller (CK8): Class 300, bronze body, screwed cap, Y-pattern swing, regrinding bronze disc. Stockham B-375. Nibco T-473-B. Crane 76E. Milwaukee 517/507.
9. Flanged Ends 2-1/2" and Larger (CK9): Class 300, cast steel body, bolted cap, horizontal swing, seal welded seat rings, chromium stainless disc. Stockham 30-SF. Crane 159.

#### 2.4 Ball Valves:

- A. General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.
- B. Construction: Ball valves shall be rated for 150 psi saturated steam and 600 psi non-shock cold water. Pressure containing parts shall be constructed of ASTM B-584 alloy 844, or ASTM B-124 alloy 377. Valves shall be furnished with blow-out proof bottom loaded stem constructed of ASTM B-371 alloy 694 or other approved low zinc material. Provide TFE packing, TFE thrust washer, and reinforced teflon seats. Valves 1" and smaller shall be full port design. Valves 1-1/4" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds 1/2" thickness.
- C. Comply with the following standards:
  1. MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
  2. MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
- D. Types of ball (BA) valves:
  1. Threaded Ends 2" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70. Stockham S216-BR-R-T. Milwaukee BA125. Apollo 77-100.



2. Soldered Ends 2" and Smaller (BA2): Bronze three-piece full port body with adjustable stem packing and stainless steel ball and trim. Nibco S-595-Y-66. Milwaukee BA350. Apollo 82-200.
3. Threaded Ends 1" and Smaller (BA3): Bronze two-piece full port body, UL listed (UL 842) for use with flammable liquids and LP gas. Nibco T-585-70-UL.
4. Threaded Ends 2" and Smaller (BA4): 175 WWP, bronze two-piece body. Nibco KT-585-70-UL and KT-580-70-UL.
5. Threaded Ends 2" and Smaller (BA5): 400 WWP, bronze two-piece body. Nibco KT-580.
6. Threaded Ends 2-1/2" and Smaller (BA6): 300 WWP, bronze three-piece body, gear operator with handwheel, indicator flag, accepts tamper switch. Nibco T-505-4 and G-505-4.
7. Flanged Ends 2-1/2" and Larger (BA7): Class 150, carbon steel full bore two-piece body with adjustable stem packing. Nibco F515-CS series. Apollo 88-240.

## 2.5 Butterfly Valves:

- A. General: Comply with MSS SP-67, Butterfly Valves. Provide butterfly valves designed for tight shut-off. Where used for terminal or equipment removal or repair, select lug type valves. Select wafer type valves for other applications. Provide gear operators on all butterfly valves 6" and larger.
- B. Types of butterfly (BF) valves:
  1. Wafer Type 3" and Larger (BF1): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-512. Nibco WD 2110-3. Crane 42-FXB-TL. Milwaukee MW222E-8416.
  2. Lug Type 3" and Larger (BF2): 200 CWP, cast-iron body, lever-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-712. Nibco LD 2110-3. Crane 44-FXB-TL. Milwaukee ML132B-8416.
  3. Wafer Type 3" and Larger (BF3): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-522 and LG-521. Nibco WD 2110-5. Crane 42-FXB-G. Milwaukee MW 122B-8115.
  4. Lug Type 3" and Larger (BF4): 150/200 CWP, cast-iron body, gear-operated, cadmium-plated ductile iron disc, Type 410 stainless steel stem, EPT seat. Stockham LG-722 and LG-721. Nibco LD 2110-5. Crane 44-FXB-G. Milwaukee ML 132B-8115.
  5. Wafer Type 4" and Larger (BF5): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-52U. Nibco WD 3510-8.
  6. Lug Type 4" and Larger (BF6): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-72U. Nibco LD 3510-8.
  7. Grooved Type 4" and Larger (BF7): 175 WWP, cast-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 410 stainless steel stem, EPT seat, UL listed. Stockham LG-82U. Nibco GD 1765-2.

## 2.6 Valve Features:



- A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ANSI B31.1.
- B. Valve features specified or required shall comply with the following:
  - 1. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving. Provide for gate valves 8" and larger.
  - 2. Drain: Comply with MSS SP-45, and provide threaded pipe plugs complying with applicable Division-23 pipe or tube section. Provide for gate valves 8" and larger.
  - 3. Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).
  - 4. Threaded: Provide valve ends complying with ANSI B2.1.
  - 5. Solder-Joint: Provide valve ends complying with ANSI B16.18.
  - 6. Trim: Fabricate pressure-containing components of valve, including stems (shafts) and seats from brass or bronze materials, of standard alloy recognized in valve manufacturing industry unless otherwise specified.
  - 7. Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.
  - 8. Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.
  - 9. Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.
  - 10. Mechanical Actuator: Provide factory-fabricated gears, gear enclosure, external chain attachment and chain designed to provide mechanical advantage in operating valve for all valves 4" and larger that are mounted more than 7'-0" above the floor, or are otherwise difficult to operate regardless of height.

### PART 3 - EXECUTION

#### 3.1 Installation:

- A. General: Install valves where required for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward below horizontal plane.
- B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.
- C. Applications Subject to Corrosion: Do not install bronze valves and valve components in direct contact with steel, unless bronze and steel are separated by dielectric insulator.
- D. Mechanical Actuators: Install mechanical actuators as recommended by valve manufacturer.

#### 3.2 Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:

- A. Tube Size 2" and Smaller: Threaded valves.
- B. Pipe Size 2" and Smaller: Threaded valves.
- C. Pipe Size 2-1/2" and Larger: Flanged valves.



- 3.3 Non-Metallic Disc: Limit selection and installation of valves with non-metallic disc to locations indicated and where foreign material in piping system can be expected to prevent tight shutoff of metal seated valves.
- 3.4 Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.
- 3.5 Installation of Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction flow.

END OF SECTION



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## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Materials and Methods section, and is a part of each Division-23 section making reference to or requiring supports, anchors, and seals specified herein.
- 1.3 Extent of supports, anchors, and seals required by this section is indicated on drawings and/or specified in other Division-23 sections.
- 1.4 Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports, anchors, and seals.
- 1.5 MSS Standard Compliance:
  - A. Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.
  - B. Select and apply pipe hangers and supports, complying with MSS SP-69.
  - C. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
  - D. Terminology used in this section is defined in MSS SP-90.
- 1.6 UL Compliance: Provide products which are Underwriters Laboratories listed.

## PART 2 - PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide supports and hangers by Grinnel, Michigan Hanger Company, B-Line Systems, or approved equal.
- 2.2 Horizontal-Piping Hangers and Supports: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
  - A. Adjustable Steel Clevises: MSS Type 1.
  - B. Steel Double Bolt Pipe Clamps: MSS Type 3.
  - C. Adjustable Steel Band Hangers: MSS Type 7.
  - D. Steel Pipe Clamps: MSS Type 4.
  - E. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
- 2.3 Vertical-Piping Clamps: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
  - A. Two-Bolt Riser Clamps: MSS Type 8.
  - B. Four-Bolt Riser Clamps: MSS Type 42.
- 2.4 Hanger-Rod Attachments: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building



attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

- A. Steel Turnbuckles: MSS Type 13.
- B. Malleable Iron Sockets: MSS Type 16.

2.5 Building Attachments: Except as otherwise indicated, provide factory-fabricated building attachments complying with ANSI/MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods.

- A. Center Beam Clamps: MSS Type 21.
- B. C-Clamps: MSS Type 23.
- C. Malleable Beam Clamps: MSS Type 30.
- D. Side Beam Brackets: MSS Type 34.
- E. Concrete Inserts: MSS Type 18.

2.6 Saddles and Shields: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

- A. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
- B. Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation matching adjoining insulation.

2.7 Miscellaneous Materials:

- A. Metal Framing: Provide products complying with NEMA STD ML 1.
- B. Steel Plates, Shapes, and Bars: Provide products complying with ANSI/ASTM A 36.
- C. Cement Grout: Portland cement (ANSI/ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ANSI/ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
- D. Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

### PART 3 - EXECUTION

3.1 Preparation:

- A. Proceed with installation of hangers, supports, and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors, and other building structural attachments.
- B. Prior to installation of hangers, supports, anchors, and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, and installers of other work requiring coordination with work of this section for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.2 Installation of Building Attachments:



- A. In areas of work requiring attachments to existing concrete, use self-drilling rod inserts, Phillips Drill Co., "Red-Head", or equal.

### 3.3 Installation of Hangers and Supports:

- A. General: Install hangers, supports, clamps, and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69 or as listed herein, whichever is most limiting. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

Horizontal steel pipe and copper tube 1-1/2" diameter and smaller: support on 6 foot centers.

- 1. Horizontal steel pipe and copper tube over 1-1/2" diameter: support on 10 foot centers.
- 2. Vertical steel pipe and copper tube: support at each floor.

- B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- C. Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.
- D. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.
- E. Provision for Movement:
  - 1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
  - 2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
  - 3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.
- F. Insulated Piping: Comply with the following installation requirements.
  - 1. Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.
  - 2. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

### 3.4 Installation of Anchors:

- A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.
- B. Fabricate and install anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.
- C. Anchor Spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and elbows. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.



- D. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions to limit movement of piping and forces to maximums recommended by manufacturer for each unit.
- E. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands. Prime and paint with black enamel.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

### 1.2 Description of Work:

- A. Extent of work required by this Section is indicated on drawings and/or specified in other Division 23 sections. Types of vibration isolation specified in this Section include equipment support isolators, equipment bases, resilient lateral guides, and flexible pipe connectors.

### 1.3 Quality Assurance:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of vibration isolation, of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Comply with ASME B31 Series - Code for pressure piping.
- C. All metallic components installed outdoors shall be hot dipped galvanized after fabrication.
- D. All equipment provided under this division shall operate under all conditions of load, free of objectionable sound and vibration. Sound and vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner.

### 1.4 Submittals:

- A. Product Data: Submit manufacturer's technical product data, including dimensions, supported loads, static deflections, isolator size, and type for each item of supported equipment for each of the following required types:
  - 1. Equipment support isolators. Type EM.
  - 2. Pipe flexible connectors, Type PF.

### 1.5 O&M Data Submittals:

- A. Submit maintenance data and a copy of approval submittals.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. All vibration isolation materials and systems shall be supplied by a single, approved manufacturer. Acceptable suppliers are VMC Amber/Booth Co., Vibro-Acoustics Inc., Kinetics Noise Control, Inc., Metraflex, Inc., Mason Industries, Inc. (MI), Wheatley.

### 2.2 Equipment Support Isolators:

- A. Spring Isolators, Free-Standing (EM1): Provide vibration isolation spring between top and bottom loading plates, and with pad-type isolator bonded to the bottom loading plate. Spring diameter shall not be less than eighty percent of the compressed height of the spring at the design load. Springs shall have a minimum additional travel to solid equal to fifty percent of the actual deflection. Springs shall have a horizontal to vertical stiffness ratio of approximately one. The spring element shall be set in the neoprene cup to ensure centering of spring on plate and have a steel washer to distribute the load evenly over the neoprene. All mounts shall have leveling bolts. Include holes in bottom plate for bolting to substrate.



1. If isolators are to be travel limited, all mounts shall have vertical travel limit stops to control extension when weight is removed. The travel limit stops shall be capable of serving as blocking during erection of the equipment. A minimum clearance of 1/4 inch shall be maintained around restraining bolts and between the limit stops and the spring to avoid interference with the spring action.
- B. Floor Neoprene (EM3): Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.
- C. Double Neoprene Pad (EM4): Neoprene pad isolators shall be formed by two layers of 5/16 inch thick ribbed or waffled neoprene, separated by a stainless steel or aluminum plate. These layers shall be permanently adhered together. Neoprene shall be forty to fifty durometer. The pads shall be sized so that they will be loaded between forty and fifty psi.

2.3 Flexible Pipe Connectors:

- A. Pump Connections (PF1): Provide EPDM and dacron or neoprene and nylon flexible connectors rated at 200 psi and 250°F. Connectors shall have the number of spheres required and ductile iron floating flanges with baked enamel finish. Provide control rods or cables as required for each application. Basis of Design: Mason Industries SFDEJ with reinforcing rings.
- B. Chiller Connections (PF2): Provide EPDM and dacron or neoprene and nylon flexible connectors rated at 200 psi and 250°F. Connectors shall have the number of spheres required and ductile iron floating flanges with baked enamel finish. Provide control rods or cables as required for each application. Basis of Design: Mason Industries SFEJ.
- C. Coil Connections (PF3): Provide EPDM and dacron or neoprene and nylon flexible connectors rated at 200 psi at 250°F. Connectors shall have the number of spheres required and ductile iron floating flanged or threaded ends with baked enamel finish. Provide control rods or cables as required for each application. Basis of Design: Mason Industries SFU or SFEJ as required.
- D. Stainless Steel Flexible Hoses (PF4): Provide 300 psi working pressure flexible hoses with corrugated seamless hose body and braided cover. Basis of Design: Mason Industries BSS threaded or RF flanged, as required.
- E. Stainless Steel Flexible Hoses (PF5): Provide 300 psi working pressure flexible hoses with corrugated hose body and braided cover. Basis of Design: Mason Industries CPSB-NSF with sweat ends.

PART 3 - EXECUTION

3.1 Application:

- A. Unless otherwise shown or specified, all floor-mounted major equipment items shall be set on four-inch high housekeeping type concrete pads. All equipment having moving parts shall be vibration isolated from the building structure. Electrical connections to vibration isolated equipment shall be flexible.
- B. Vibration isolation devices shall be installed for all piping, sheet metal ducts, and plenums as recommended by the manufacturer at the vibration products, and in accordance with recognized industry standards.

3.2 Installation:



- A. Location of all vibration isolation equipment shall be selected for ease of inspection and adjustment as well as for proper operation. Installation of vibration isolation equipment shall be in accordance with the manufacturer's written instructions.
- B. Sealed resilient penetration sleeves shall maintain an airtight seal around the penetrating element and shall prevent rigid contact of the penetrating element and the building structure.
- C. All vibration isolators shall be aligned squarely above or below mounting points of the supported equipment. Hanger rods for vibration isolated support shall be connected to structural beams or joists, not from the floor slab between beams and joist. Provide intermediate support members as necessary.
- D. Vibration isolation hanger elements shall be positioned so that the hanger housing may rotate a full 360 degrees about the rod axis without contacting the building structure or any object.
- E. No pipes or equipment shall be supported from other pipes or equipment. Resiliently isolated pipes shall not contact any rigid building structure or equipment.
- F. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
- G. Unless otherwise indicated, there is to be a minimum operating clearance of 1-1/2" between inertia bases or structural steel frames and the concrete housekeeping pad or floor beneath the equipment.
- H. Metal ductwork equipment connections: Ducts shall be connected to fan intakes and discharges by means of a flexible connection per Division 23 Ductwork Accessories specification section so that all equipment is fully isolated.

END OF SECTION



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PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials Sections apply to work of this section.
- 1.3 Description of Work:
  - A. Extent of testing, adjusting, and balancing work (TAB) is indicated by requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required.
  - B. Pretesting: Where required by the drawings or other Division 23 sections, pretest existing HVAC systems as directed and report findings prior to start of demolition work or any other modifications to the existing systems. Results of pretesting shall be reported to the Engineer in a timely manner. Comply with standards for final TAB reports described herein.
  - C. Coordination: Coordinate with the General Contractor and Mechanical Contractor responsible for the HVAC system installation as required to complete the TAB work.
- 1.4 The intent of this specification is to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise.
  - A. Airflow Tolerances:
    - 1. Air Handling: The supply air, return air, and outdoor air quantities shall be balanced within +/-5% of design values.
  - B. Temperature Tolerances:
    - 1. Air Handling Temperatures: The controlled temperatures at AHUs shall be verified to be under control within +/-1°F of design values.
    - 2. Hot Water Temperatures: The heating hot water controlled temperatures from boilers and heat exchangers and other similar devices shall be under control within +/-5°F.
    - 3. Chilled Water Temperatures: The chilled water controlled temperature from building systems shall be within +/-1°F of scheduled values.
    - 4. Room Temperatures: Balance systems and controls within +/-2°F of indicated settings.
  - C. Hydronic Flow: Balance hydronic flow rates to within 10% of design values.
- 1.5 Quality Assurance: The TAB Contractor shall be certified as follows:
  - A. Tester: A firm certified by National Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines required for this project, who is not the Installer of the systems to be tested and is otherwise independent of the project. Comply with NEBB's "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems" as applicable to this work.
  - B. Tester: A firm certified by Associated Air Balance Council (AABC) in those testing and balancing disciplines required for this project. AABC-certified firms are independent by definition. Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to this work.



- C. Industry Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.6 Job Conditions:

- A. Do not proceed with testing, adjusting, and balancing work until HVAC work (including Controls) has been completed and is operable. Ensure that there is no residual work still to be completed.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt, and discarded building materials.
- C. Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors) have been installed.
- D. Testing may proceed system by system, but each HVAC system must be complete as describe herein.
- E. The mechanical contractor shall make any changes in pulleys, belts, and dampers, and/or add dampers as required for correct balancing.

1.7 Approval Submittals:

- A. Submit the name of the proposed test and balance company for the Engineer's approval within thirty (30) days after awarding of contract.

1.8 Test Reports and Verification Submittals:

- A. Submit an electronic copy of the dated test and balance report upon completion of TAB work. The report shall include a list of instruments used for the work. The report shall be signed by the supervisor who performed the TAB work.

PART 2 - PRODUCTS

- 2.1 Patching Materials: Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork, and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
- 2.2 Test Instruments: Utilize test instruments and equipment of the type, precision, and capacity as recommended in the referenced standard. All instruments shall be in good condition and shall have been calibrated within the previous six (6) months (or more recently if required by standard).

PART 3 - EXECUTION

3.1 General:

- A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned, and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to Tester.
- B. Test, adjust, and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.
- C. Test, adjust, and balance systems during summer season for air conditioning systems and during winter season for heating systems, including at least a period of operation at outside conditions within 5°F wet bulb temperature of maximum summer design condition, and within 10°F dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit. The Contractor shall



return for a change of seasons test at no additional cost to the Owner and submit the revised TAB report.

- D. Punch List: Prepare a deficiency (punch)list for the Contractor with a copy of the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.
- E. Prepare TAB report of test results, including instrumentation calibration reports, in format recommended by applicable standards, modified as required to include all data listed herein.
- F. Patch holes in insulation, ductwork, and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.
- G. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.
- H. Include in the TAB report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.
- I. Include an extended warranty of ninety (90) days after completion of test and balance work, during which time the Engineer, at his discretion, may request a recheck, or resetting of any component as listed in test report. The TAB company shall provide technicians and instruments and make any tests required by the Engineer during this time period.

### 3.2 Controls:

- A. Check all HVAC controls for proper location, calibration, and sequence of operation.
- B. Check operation of all controllers and controlled devices to verify proper action and direction. Check the operation of all interlocks.
- C. Check all motorized damper motors for leakage when in closed position. If leakage is more than 5%, mechanical contractor shall reset damper linkages.
- D. Check all control valves for complete closure and correct action under all operating conditions.

### 3.3 Air Balancing:

- A. Leakage tests on ductwork must have been completed before air balancing.
- B. Set dampers, volume controls, and fan speeds to obtain specified air delivery with minimum noise level. Rebalance as required to accomplish this. Simulate fully loaded filters during test.
- C. Set grille deflections as noted on plans. Modify deflections if required to eliminate drafts or objectionable air movement.
- D. Record air terminal velocity after completion of balance work.
- E. Record final grille and register deflection settings if different from that specified on contract drawings.
- F. Record all fan speeds.

### 3.4 Water Balancing:

- A. Verify proper operation of all hydronic system devices to ensure the proper flowrate, flow direction, and pressure are maintained.
- B. Set balancing cocks and flow control devices to obtain specified water flow rates to all terminal units, coils, chillers, boilers, and heat exchangers.
- C. Impeller Trim: Record the initial suction and discharge pressure and flow rate of each pump with all cocks fully open. The Engineer will compare this data with the "balanced system" data and will determine if pump impellers should be trimmed for the piping



system as installed. Impeller trimming, if required, will be accomplished by change order. Additional TAB work to accomplish impeller trimming shall be performed at no additional cost to the Owner.

- D. Variable Speed Pumps: Verify proper operation of variable speed pumps and the associated distribution system at 50% and 100% flow.

3.5 Data Collection:

- A. In addition to the data required for any specified performance tests, measure and record the temperatures, pressures, flow rates, and nameplate data for all components listed herein.
- B. It is the intent of this section to record data on balanced systems, under normal operating or design conditions.
- C. Temperatures:
  - 1. Outside dry and wet bulb temperatures.
  - 2. Dry bulb temperature in each room and at least one wet bulb temperature in each zone.
  - 3. Refrigerant liquid and suction temperatures.
  - 4. Inlet and outlet temperature of each heat exchange device - both fluids.
- D. Pressures:
  - 1. Suction and discharge static pressure of each fan.
  - 2. Suction and discharge pressure of each pump.
  - 3. Each refrigerant suction and discharge pressure.
  - 4. Water pressure drop through each heat exchanger.
- E. Flow rates:
  - 1. Flow rate through each fan and pump.
  - 2. Flow rate through each coil or heat exchange device.
- F. Nameplate Data:
  - 1. Complete nameplate data for all equipment.
  - 2. Motor data to include horsepower, phase, voltage, RPM, full load nameplate current, fuse rating in disconnect switch, number or manufacturer's size designation, and ampere rating of overcurrent and low voltage protection devices in starters.

- 3.6 All test openings in ductwork shall be resealed in an approved manner.

END OF SECTION



## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Approval Submittals:
  - A. Product Data: Submit producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:
    - 1. Rigid duct insulation
    - 2. Flexible duct insulation
- 1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

## PART 2 - PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed.
- 2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, coverings, sealers, mastic, and adhesive) with a flame spread rating of 25 or less, and a smoke-developed rating of 50 or less as tested by ANSI/ASTM 84.
- 2.3 Rigid Fiberglass Insulation Board: ASTM C612, Class 1 (non-load bearing). Boards shall be 3 pcf density with UL rated aluminum foil vapor barrier (FSK).
- 2.4 Flexible Fiberglass Insulation: ASTM C553, Type I, Class B-3 (temperature less than 350°F). Duct wrap shall be 1 pcf density with UL rated aluminum foil vapor barrier (FSK).
- 2.5 General Purpose Mastic: Benjamin Foster 35-00 Series, Insulcoustic VIAC Mastic, Childers CP-10, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.
- 2.6 Vapor Barrier Sealant: Benjamin Foster 30-35, Insulcoustic IC-501, 3M EC-1378, Childers CP-30, or approved equal. Provide "Low Odor" type. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.
- 2.7 Adhesive: Benjamin Foster 85-20, Insulcoustic IC-205, 3M EC-35, Childers CP-82, Childers CP-89, or approved equal. The final selection of this product for the specific application indicated is the responsibility of the insulation supplier. The insulation system must meet the specified application.
- 2.8 Fiber-Glas Mesh: 10x10 Mesh. Foster Mastafab or equal.

## PART 3 - EXECUTION

- 3.1 Insulate all supply, return, and outdoor air ductwork exposed in mechanical rooms, mezzanines, fan lofts or in any finished spaces with 1-1/2" thick rigid fiberglass insulation with vapor barrier.
- 3.2 Installation of Rigid Insulation:
  - A. Clean and dry ductwork prior to insulating. Butt insulation firmly together to ensure complete and tight fit over surfaces to be covered. Install insulation materials with smooth and even surfaces. Maintain integrity of aluminum vapor barrier wherever



possible. Extend insulation without interruption through walls, floors, and similar ductwork penetrations except where otherwise indicated.

- B. Adhere insulation to duct with 50 percent coverage using approved insulation adhesive applied in 6" wide swaths with 6" spaces between swaths. Additionally, secure insulation with perforated pins and Tuff-Bond or by self-sticking pins with a 3/8" self-tapping screw. Space on 12" centers and 3" from all edges. Ducts up through 24" wide only require one row of pins. Ducts over 24" wide shall have pins spaced as described herein.
- C. Apply open mesh glass fabric embedded in vapor barrier mastic. Then apply a second coat of general purpose mastic with aluminum grey color. This finish shall be complete over all rigid insulation.

3.3 Insulate all supply, return and outdoor air ductwork concealed above ceilings, in chases, or elsewhere, and the backs of all ceiling supply outlets with 2" thick fiberglass blanket insulation with vapor barrier.

3.4 Installation of Flexible Insulation:

- A. Insulate round elbows and fittings with wrap such that thickness is equal to adjoining duct covering. Clean and dry ductwork prior to insulating.
- B. Adhere insulation to duct with 50 percent coverage using approved insulation adhesive applied in 6" wide swaths with 6" spaces between swaths. Additionally, secure insulation with perforated pins and Tuff-Bond or by self-sticking pins with a 3/8" self-tapping screw. Space on 12" centers and 3" from all edges. Ducts up through 24" wide only require one row of pins. Ducts over 24" wide shall have pins spaced as described herein.
- C. Lap all joints 2" and seal joints with 4" wide strips of open mesh glass fabric embedded in two coats of general purpose mastic.
- D. Seal all punctures and breaks in aluminum vapor barrier with open mesh glass fabric and vapor barrier sealant.

END OF SECTION



## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.3 Approval Submittals:
  - A. Product Data: Submit producer's data sheets and installation instructions on each insulation system including insulation, coverings, adhesives, sealers, protective finishes, and other material recommended by the manufacturer for applications indicated. Submit for:
    - 1. Fiberglass pipe insulation
    - 2. Cellular glass pipe above ground insulation
    - 3. Cellular glass equipment insulation
    - 4. Flexible unicellular piping insulation
    - 5. Fiberglass equipment insulation
- 1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

## PART 2 - PRODUCTS

- 2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armstrong, Johns Manville, Knauf, Owens Corning, Pittsburgh Corning, U.S. Rubber, or approved equal. All products shall be asbestos-free.
- 2.2 Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesive) with a flame-spread rating of 25 or less, and a smoke-developed rating of 50 or less, as tested by ANSI/ASTM E84.
- 2.3 Pipe Insulation Materials:
  - A. Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated. (Preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F)
  - B. Cellular Glass Pipe Insulation: ASTM C552, Type II, Class 1. (Uncovered.)
  - C. Flexible Unicellular Pipe Insulation: ASTM C534, Type I. (Tubular, suitable for use to 200°F.)
  - D. Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.
  - E. Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.
  - F. Bedding Compound for CHW Systems: Provide products to completely cover the piping or equipment being insulated. Products shall be low odor type. Foster 30-45 or Foster 95-50.
  - G. Jackets: ASTM C921, Type I (vapor barrier) for piping below ambient temperature, Type II (vapor permeable) for piping above ambient temperature. Type I may be used for all piping at Installer's option.
- 2.4 Equipment Insulation Materials:
  - A. Rigid Fiberglass Equipment Insulation: ASTM C612, Class 1. (Boards, non-loading bearing, suitable for use to 400°F.)
  - B. Flexible Fiberglass Equipment Insulation: ASTM C553, Type I, Class B-3. (Flexible blankets suitable for use to 350°F, 1 pcf).



- C. Cellular Glass Equipment Insulation: ASTM C552, Type I. (Flat, uncovered blocks.)
- D. Jacketing Material for Equipment Insulation: Provide 8-ounce canvas jacket, except as otherwise indicated.
- E. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics, and protective finishes as recommended by insulation manufacturer for applications indicated.
- F. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors, stud pins, and metal covers as recommended by insulation manufacturer for applications indicated.

### PART 3 - EXECUTION

#### 3.1 General:

- A. Install thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.
- B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.
- C. Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".
- D. Do not apply insulation to surfaces while they are hot or wet.
- E. Do not install insulation until systems have been checked and found free of leaks. Surfaces shall be clean and dry before attempting to apply insulation. A professional insulator with adequate experience and ability shall install insulation.
- F. Do not install insulation on pipe systems until acceptance tests have been completed except for flexible unicellular insulation. Do not install insulation until the building is "dried-in".

#### 3.2 Fiberglass Pipe Insulation:

- A. Insulate the following piping systems (indoor locations):
  - 1. Heating hot water below 140°F: up to 2" pipe – 1-1/2" thick,  
over 2" pipe – 2" thick.
- B. Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3" wide self-sealing butt strips to joints between insulation sections. Insulate all fittings, flanges, valves, and strainers with premolded insulation. Apply coat of insulating cement to fittings and wrap with glass cloth overlapping each wrap 1" and adjacent pipe 2". Finish with heavy coat of general purpose mastic. Premolded PVC covers may also be used, but no flexible inserts are allowed.
- C. Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over the insulation which extends halfway up the pipe insulation cover and at least 6" on each side of the hanger.
- D. Omit insulation on unions, flanges, strainer blowoffs, flexible connections, and expansion joints.

#### 3.3 Cellular Glass Pipe Insulation (Above Ground):

- A. Insulate the following piping systems:
  - 1. Chilled water: smaller than 6" pipe – 1-1/2" thick,
  - 2. Heating hot water: smaller than 6" pipe – 1-1/2" thick.



- B. Indoor Concealed Locations: Cut insulation in sections at fittings and carefully fit to the pipe and fittings. No stovepipe or single miter insulation is allowed. Apply cellular glass bedding compound to the pipe surface to achieve 100% coverage (chilled water piping only). Apply vapor barrier mastic to all edges of the cellular insulation and between joints in the insulation. Wire the cellular glass in place with stainless steel wire 9" on center. Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over or embedded in the insulation which extend halfway up the pipe insulation cover and at least 4" on each side of the hanger. Insulate anchors adequately to prevent moisture condensation problems. Finish cellular glass insulation in concealed locations by applying a white fire rated jacket with self-sealing lap. Finish elbows and fittings with weather barrier sealant reinforced with white glass fabric.
- C. Indoor Exposed, Mechanical Rooms, Manholes, and Outdoor Locations: Cut insulation in sections at fittings and carefully fit to the pipe and fittings. No stovepipe or single miter insulation is allowed. Apply cellular glass bedding compound to the pipe surface to achieve 100% coverage (chilled water piping only). Apply vapor barrier mastic to all edges of the cellular insulation and between joints in the insulation. Wire the cellular glass in place with stainless steel wire 9" on center. Provide hanger or pipe support shields of 16 gauge (minimum) galvanized steel over or embedded in the insulation which extend halfway up the pipe insulation cover and at least 4" on each side of the hanger. Insulate anchors adequately to prevent moisture condensation problems. Finish cellular glass by applying a heavy coat of weather barrier sealant reinforced with white glass fabric to the exterior of the cellular glass. Cover straight piping with 0.016" thickness smooth aluminum jacket fastened with aluminum bands on not over 12" centers. Use factory-made 0.014" aluminum covers for fittings and valves. Provide removable end caps for strainers. Metal jacketing shall be applied with the longitudinal seam positioned to shed water. Flexible rubberized asphalt products are not acceptable.

3.4 Cellular Glass Equipment Insulation:

- A. Insulate the following equipment:
  - 1. Chilled water pumps: 2" thick.
  - 2. Chilled water compression and buffer tank: 1-1/2" thick.
  - 3. Water chiller heat exchanger: 2" thick.
- B. Carefully cut and fit blocks to curvature of the surface of the equipment in staggered joint fashion. For pumps and other equipment requiring maintenance access, fabricate boxes with removable insulation sections. Chilled water equipment metal surfaces in contact with cellular glass shall be carefully covered with bedding mastic, except pumps and other equipment requiring maintenance access. Apply vapor barrier mastic to all edges and joints in the insulation. Fasten insulation in place with stainless steel wire 9" on centers. Provide heavy coat of vapor barrier sealant over the cellular glass. Embed a layer of open weave glassfab cloth in mastic, overlap joints at least 2" and smooth surfaces. Apply a finish coat of machinery grey general purpose mastic heavy enough to hide weave in cloth and finish to smooth surface.

3.5 Flexible Unicellular Pipe Insulation:

- A. Insulate the following piping systems:
  - 1. Condensate drains from air conditioning units: 1/2" thick.
  - 2. Refrigerant piping: 3/4" thick.



- B. Apply insulation in accordance with the manufacturer's recommendations and instructions. Mitre cut insulation to fit pipe fittings. Use approved cement to seal all joints and ends in the insulation.
- C. Insulation outside the building shall be protected by a smooth 0.016" thickness aluminum jacket secured with aluminum bands on 12" centers.

3.6 Fiberglass Equipment Insulation:

- A. Insulate the following equipment:
  - 1. Hot water expansion tank: 1" thick.
  - 2. Hot water heat exchanger: 2" thick.
- B. Coat insulated surfaces with a layer of insulating cement, troweled in a workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges, and depressions, and cover over joints with cement of sufficient thickness to remove surface irregularities. Cover insulated surface with glass cloth jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

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

### 1.2 Summary:

- A. Section includes commissioning process requirements all mechanical equipment shown on the drawings.

### 1.3 Definitions:

- A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- B. CxA: Commissioning Authority.
- C. HVAC&R: Heating, Ventilating, Air Conditioning, and Refrigeration.
- D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

### 1.4 Informational Submittals:

- A. Certificates of readiness.
- B. Certificates of completion of installation, prestart, and startup activities.

### 1.5 Contractor's Responsibilities:

- A. Perform commissioning tests at the direction of the CxA.
- B. Attend controls coordination meeting.
- C. Attend testing, adjusting, and balancing review and coordination meeting.
- D. Provide information requested by the CxA for final commissioning documentation.
- E. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

### 1.6 CxA's Responsibilities:

- A. Provide Project-specific checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.
- B. Direct commissioning testing.
- C. Verify testing, adjusting, and balancing of Work are complete.

### 1.7 Commissioning Documentation:

- A. Provide the following information to the CxA for inclusion in the commissioning plan:
  - 1. Corrective action documents.
  - 2. Verification of testing, adjusting, and balancing reports.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 Testing Preparation:

- A. Certify that HVAC&R systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the outlined in the scope of work documents.



- B. Certify that HVAC&R instrumentation and control systems have been calibrated and that they are operating according to the scope of work documents, and that pretest set points have been recorded.
- C. Certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.
- D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
- E. Inspect and verify the position of each device and interlock identified on checklists.
- F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.
- G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 General Testing Requirements:

- A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.
- B. Scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.
- C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of unit controllers and sensors.
- D. Tests will be performed using design conditions whenever possible.
- E. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- F. The CxA may direct that set points be altered when simulating conditions is not practical.
- G. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- H. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.3 HVAC&R Systems, Subsystems, and Equipment Testing Procedures:

- A. HVAC&R Instrumentation and Control System Testing: Field testing plans will be completed by CxA to test Sequence and Operations for HVAC Controls. Assist the CxA with preparation of testing plans.
- B. HVAC&R Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air distribution systems, including HVAC&R terminal equipment and equipment.

END OF SECTION



## PART 1 - GENERAL

- 1.1 A complete microprocessor controlled BACnet compatible building automation and control systems tested and ready for operation.
- 1.2 Contractor shall furnish and install a direct digital control and building automation system (BAS). The new BAS shall utilize electronic sensing, microprocessor-based digital control, and electronic actuation of dampers and valves to perform control sequences and functions specified. The BAS for this project will generally consist of monitoring and control of systems listed below. Reference also controls drawings, sequences of operation, and point lists.
- 1.3 Contractor shall furnish and install:
- A. Air Handlers
- 1.4 In addition to monitored and controlled equipment, this section also includes:
- A. Communication and Low voltage cable and pathway requirements.  
B. Power requirements.  
C. Instrumentation – Product specifications and Installation requirements.  
D. Other miscellaneous items required but not specified for a complete operational system.  
E. Products supplied but not typically installed under this section:
1. Control Valves
  2. Control Dampers
  3. Instrument Wells
  4. Flow Meters
  5. Energy Meters
- 1.5 Related Standards:
- |                                |   |
|--------------------------------|---|
| ANSI/ASHRAE Standard 135-2008  | BACnet  |
| FCC Part 15, Subpart J Class A | Computing Devices   |
| UL 864/UUKL                    | Smoke Control Listing (Ninth Edition)   |
| UL 873                         | Temperature-Indicating and Regulating Equipment   |
| UL 916                         | Energy Management Systems   |
| NEMA                           | Comply with NEMA Standards pertaining to components and devices for electrical controls |
| NFPA 70                        | National Electrical Code  |
- 1.6 Definitions: The following abbreviations, acronyms, and definitions apply to and are used within this Guide Specification:
- |           |   |
|-----------|---|
| Actuator  | Control device to provide motion of valve or damper in response to control signal   |
| AHU       | Air Handling Unit   |
| AI        | Analog Input  |
| AO        | Analog Output   |
| Analog    | A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values. |
| Auto-Tune | Software routine used to adjust tuning parameters based on historical or real-time data   |
| ASC       | Application Specific Controller   |
| BACnet    | The ASHRAE building automation and control protocol   |



BAS	Building Automation System
BLC	Building Level Controller – Supervisory control panel and the primary means of communication outside the building. May also act as a global controller, implementing building wide global strategies and energy management routines.
CxA	Commissioning Authority
Control Sequence	A BAS pre-programmed arrangement of software algorithms, logical computation, target values, and limits as required to attain the defined operational control objectives
DDC	Direct Digital Control
DDCP	Direct Digital Control Panel
Discrete	A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level each separated by a defined deadband. Digital Inputs and Digital Outputs are examples.
DI	Discrete Input
DO	Discrete Output
EEPROM	Electronically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interference
EMT	Electrical Metallic Tubing
E-P	Electric to Pneumatic
Fat Client	A network computer with a hard disk drive
FC	Fail Closed position of control device or actuator. Device moves to closed position on loss of control signal or energy source.
FO	Fail Open position of control device or actuator. Device moves to open position on loss of control signal or energy source.
Furnish	Supply but not install
GUI	Graphical User Interface
I/O	Input/Output (typically referring to points monitored by a system)
I/P	Current to pneumatic transducer
Instrument	Device used for sensing input parameters or used for actuation
IP	Internet Protocol
HOA	Hand Off Auto
Install	To mount, but not furnish
LAN	Local Area Network
IT	Information Technology
LOT	Local Operator Terminal
Modulating	Movement of a control device through an entire range of values proportional to an infinitely variable input value
Motorized	Control device with actuator
NC	Normally Closed position of switch contacts after control signal is removed
NO	Normally Open position of switch contacts after control signal is removed
Node	DDCP, user workstation, or other control device connected to communications network
Operator	Same as actuator
OWS	Operator’s Work Station (Personal Computer with Intranet / Internet capability)



PC	IBM-compatible Personal Computer from a recognized major manufacturer. PC "clones" assembled by a third-party subcontractor are not acceptable.
Peer-to-Peer	Mode of communication between controllers in which each device connected to network has equal status and each shares its database values with all other devices connected to network
P	Proportional control, control mode with continuous linear relationship between observed input signal and final controlled output element
PI	Proportional - Integral control, control mode with continuous proportional output plus additional change in output based on both amount and duration of change in controlled variable (Reset control)
PID	Proportional - Integral - Derivative control, control mode with continuous correction of final controlled output element versus input signal based on proportional error, its time history (reset), and rate at which it is changing (derivative)
PM	Project Manager capable of making project and personnel decisions
Point	Analog or discrete instrument with addressable database value
Protocol	A set of rules and standards governing the on-line exchange of data between control systems of the same or different manufacturers
Provide	To "furnish" and "install"
RF	Radio Frequency
RFI	Radio Frequency Interference
Router	Device for implementation of Network Layer Protocol (BACnet/IP)
Self-Tune	Same as Auto-Tune
Solenoid	Electric two position actuator
Software	Includes all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the control industry for real-time, on-line, integrated control system configurations
Thin Client	A network computer without a hard disk drive
Tier 1	LAN and/or WAN communication network. Building to building communication or high-speed Ethernet communication level running within a specific building.
Tier 2	Building level communication or low speed tier running under a building level supervisory controller
VAV	Variable Air Volume
VFD	Variable Frequency Drive
WAN	Wide Area Network

1.7 Systems Description:

- A. Acceptable control system manufacturer:
  - 1. Johnson Controls, Inc.
- B. Scope includes labor and materials including but not limited to:
  - 1. Tools and other equipment



2. Software, licenses, configurations, and database entries
  3. Interfaces, wiring, tubing, labeling
  4. Engineering and calculations
  5. Calibration, testing, verifications, training, and other services
  6. Documentation, samples, submittals
  7. Permits, professional licenses, etc.
  8. Other Administrative fees such as parking, shipping, handling, etc.
- C. Provide a complete system and be accessible via manufacturer's specific server system using a web browser interface implemented over the Owner's intranet as well as over the Internet.
- D. The BAS network includes but is not limited to the following:
1. Operator PCs – fixed or portable
  2. Connection to existing network servers
  3. Communications equipment needed to support the in-building communication BAS network
  4. Intelligent and addressable elements and end devices
  5. Third-party equipment interfaces
  6. Other components required for a complete and working BAS
  7. The BAS Network shall utilize an open architecture capable of all of the following:
    - a. Utilizing standard Ethernet communications operating at a minimum speed of 10/100 Mb/sec.
    - b. Connecting via BACnet/IP at the Tier 1 level in accordance with ANSI/ASHRAE Standard 135-2008. All points shall be made available for monitoring via BACnet/IP.
  8. The BAS network shall support both copper and optical fiber communication media at the Tier 1 level.
  9. The system shall be compatible with the owner network. Refer to owner standards for additional guidelines and information.
  10. The BAS shall be fully expandable with the addition of hardware and/or software. Expansion shall not require removal of existing DDCP, sensors, actuators, or communication networks.
  11. System must be of a modular design to ensure reliability and system performance.
  12. All electrical work required as an integral part of this section is work of this section.
  13. Provide final power connections including conduit, wire, and/or control panel disconnect switches to all control devices from appropriate electrical j-box.
  14. Include the following integrated features, functions, and services:
    - a. Operator information, alarm management, and control functions at any operator's console without the need to purchase special software from the contractor or BAS manufacturer for those consoles
    - b. Information management including monitoring, transmission, archiving, retrieval, and reporting functions
    - c. Diagnostic monitoring and reporting of BAS functions
    - d. Energy management
    - e. Wireless Device capability

1.8 Quality Assurance:



- A. Provide components not specifically indicated or specified, but necessary to make system function within the intent of contract documents and sequence of operation.
- B. All electrical products to be listed and labeled by UL and comply with NEMA Standards.
- C. Control wiring shall be in accordance with National Electric Code.
- D. The Contractor shall have support services within a 25-mile radius of Project Site and have the ability to comply with a two-hour on-site response time.
- E. Provide a competent and experienced Project Manager with a minimum of 5 years' experience with similar projects. Include resume in submittal package.
- F. Engineering services shall be performed by factory-trained engineers. Include relevant documentation in submittal package.
- G. System shall be installed by factory trained mechanical and electrical installers either in direct employ of this Contractor or by subcontractors who are under direct supervision of this Contractor.
- H. Use only manufacturer trained technicians who are skilled, experienced, trained, and familiar with the specific equipment, software, and configurations to be provided under this section. Include relevant documentation in submittal package.
- I. Coordinate with the Owner to ensure that the BAS will perform in the Owner's IT environment without disruption to any of the other activities taking place on that LAN or WAN. Coordinate device IDs with owner to prevent duplication within existing BACnet environment.
- J. Coordinate timely delivery of materials and supervise activities of other trade contractors to install inline devices such as immersion wells, pressure tappings, any associated shut-off valves, flow switches, level switches, flow meters, air flow stations, and other such items furnished under this section but installed by other trades.
- K. Select sensors and transducers to most closely match the expected sensing or control range.
- L. Mark and detail exact location of inline devices, wells, and taps to be installed by Mechanical Contractor on coordination drawings and confirm locations in the field.
- M. Instrumentation with factory J-boxes shall not be used as junction boxes.
- N. Install control equipment, wiring, and air piping in neat and workmanlike manner to satisfaction of A/E, and in accordance with manufacturer's recommendations. Maintain clearances, straight length distances, etc. required for proper operation of each device.
- O. Install control devices in accessible location. Coordinate all control device locations with other trade contractors. Contractor to report to A/E conditions that prevent reasonable accessibility.
- P. Wire VFDs so that all safeties and interlocks remain operational (inclusive of isolation dampers, isolation valves, end switches, interlocks, safeties, etc.) when drive is placed in Auto, Hand, or Bypass mode.
- Q. Provide weather protection cover or weatherproof control devices where required for control devices located outdoors.
- R. All control devices located outdoors shall be rated for the anticipated environment.
- S. Include provisions for supplemental ventilation when control devices must be located within outdoor control panels and when control devices are not rated the planned environment.
- T. All digital equipment furnished under this contract shall have been tested and made to comply with limits for Class A computing device pursuant to Subpart J of Part 15 of FCC Rules.
- U. Acceptance Criteria: The system shall report all values with an end-to-end accuracy equal to or better than those listed below: The intent of this guideline is to establish



criteria for the Control Contractor and Commissioning Agent with regard to calibration and acceptance. Reference specific instrumentation sections for required accuracies.

<u>Measured Variable</u>	<u>Criteria</u>
Space Temperature	+/- 1.0°F
Ducted Air (Single Probe)	+/- 0.5°F
Ducted Air (Averaging)	+/- 2.0°F
Outside Air	+/- 1.0°F
Dew Point	+/- 2.0°F
Water Temp	+/- 0.5°F
Relative Humidity (Duct and Space)	+/- 5% RH
Water Flow	+/- 5% (GPM) of reading
Air Flow (Terminal Unit)	+/- 5% (CFM) of reading
Air Flow (Measuring Station)	+/- 5% (CFM) of full scale
Air Pressure (Ducts)	+/- 0.10" WC
Air Pressure (Space)	+/- 0.01" WC
Water Pressure	+/- 2% (psig/psid) of reading
Electrical (A, V, W, PF)	5% of reading
Carbon Monoxide (CO)	+/- 5% of reading
Carbon Dioxide (CO2)	+/- 75 ppm

- V. Stability of Control: Control loops shall maintain measured variable at setpoint within the tolerances listed below and shall, upon any change to the feedback variable recover within 5 minutes of the initial event. The intent of this guideline is to establish criteria for the Control Contractor, A/E, and Commissioning Agent with regard to control loops and acceptance.

<u>Controlled Variable</u>	<u>Control Accuracy</u>	<u>Range of Medium</u>
Air Pressure (Ducts)	+/- 0.2" WC	-6 to +6" WC
Air Pressure (Room)	+/- 0.010" WC	-0.100 to +0.100" WC
Air Flow	+/- 100 CFM or 1% of setpoint (whichever is less)	
Temperature	+/- 0.5°F	
Room Temperature	+/- 1.0°F	
Humidity	+/- 3% RH	
Fluid Pressure	+/- 1.0 psi/psid	1 to 150 psi/psid
Carbon Dioxide (CO2)	+/- 50 ppm	100 to 2000 ppm

- 1.9 Provide all points required to implement control sequences specified, whether or not they are listed in schedules.
- 1.10 All outputs, whether sequenced or not, shall have separate programmable hardware outputs. For air handling units, minimum outside air, maximum (economizer) outside air, return, relief air, smoke dampers, heating valves, cooling valves, etc., shall each have a separate output.
- 1.11 Point and Alarming Expectations: The system shall include points and alarms as described in Contract Drawings.
- 1.12 Commissioning:
- A. Assist Testing Adjust Balance Contractor in verifying system operation for all modes of operation.
  - B. Demonstrate the sequence of operation for each system and/or sub-system to Commissioning Agent (CxA) and/or Engineer. Perform all other requirements and perform all services as required in Cx specification sections.



- C. Use vendor specific forms and Cx Agent documentation to document the operation and performance of all control systems.
- D. Demonstrate functional tests for each point, control sequence, and control loop.
- E. Provide trends, schedules, printouts, etc. to Cx Agent/Engineer as requested to document system performance.

1.13 Submittals:

- A. Organized submittals based on specification numbers with major tabs to separate major sections and a master index indicating all elements of submittal.
- B. Identify specific parts and accessories proposed for project. Order submittals based on the specification section and include the following:
  - 1. BAS network architecture diagrams including all Tier 1 nodes, Tier 2 interconnections, and 3rd party integration. Include repeater locations.
  - 2. Provide floor plans locating all control units, include all Tier 1 and Tier 2 communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, address, device instance, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. As-built wire routing conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.
  - 3. Schematic flow diagram of system showing all equipment and control devices. Diagram shall include designation of all inline devices, wells, taps, and other devices furnished under this Section but installed by other trades.
  - 4. Setting or adjustable range of control for each control device.
  - 5. Written description of detailed sequence of operations. Include all initial set-point values, time delay values, references to specific device names. The sequences shall be detailed and include all vendor specific pre-engineered logic. They should not be a duplication of the Engineer's sequences.
  - 6. Points schedule for each real point in the BAS, including: Tag, Point Type, System Name, and Display Units. Device Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number. Cable destination, terminal ID, slot number, etc. may also be identified in panel detail drawings.
  - 7. Samples of each typical system Graphic Display screen and associated menu penetrations to show hierarchy and functional interrelationships for systems specified. Sample floor plan graphic showing all proposed components and colors.
  - 8. Detailed Bill of Material list for each system, identifying quantity, part number, description, and optional features selected.
  - 9. Control Dampers
  - 10. Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Frame Type, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, Actuator Type, Actuator model number, Actuator torque rating and quantity of actuators required to ensure total closure of damper(s).
  - 11. Leakage and flow characteristics data for all control dampers. Leakage ratings to be based on AMCA Standard 500 and dampers to bear AMCA leakage certification seal.



12. Room Schedule including a separate line for each terminal unit indicating terminal identification, minimum/maximum cfm, box area, thermostat/sensor location, Htg/Clg Setpoints, and bias setting. The schedule shall include typical calibration factors to be filled in by TAB contractor during startup and verification.
  13. Air Flow Measuring System Schedule including a separate line for each flow device and column for device type, model number, size, location.
  14. Cabling indicate all required electrical wiring. Information including wire jacket colors for low voltage signal wiring, low voltage power wiring and communication cable. Indicate wire gauge for each type of cable.
  15. Electrical wiring diagrams: Shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring which is existing, factory-installed, and portions to be field-installed.
  16. FCC compliance
  17. Training Plan – The Contractor shall submit a written training plan to the Owner, A/E, CxA for review and approval prior to training. The plan shall include the following elements:
    - a. Equipment (included in training)
    - b. Intended audience
    - c. Location of training
    - d. Objectives
    - e. Subjects covered (description, duration of discussion, special methods, etc.)
    - f. Duration of training on each subject
    - g. Instructor name and qualifications for each subject
    - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.) Training to be recorded by contractor.
  18. Integration Plan
    - a. Coordination of vendor protocol and point list submission.
    - b. Workflow processes to integrate systems.
    - c. Include communication hardware, software, and protocols to implement full systems integration.
  19. Identify proposed enhancements or deviations from project documents. Include specific drawings or specifications impacted.
  20. Provide coordination information to accommodate complete integration of systems including:
    - a. Vendor protocol requirements.
    - b. Vendor point list, cross referenced to proposed BAS point list.
- 1.14 Operating and Maintenance Manuals:
- A. Include descriptions of maintenance for all components supplied under this section, including (but not limited to) sensors, actuators, and controllers.
  - B. Include inspection requirements, periodic preventative maintenance recommendations, fault diagnosis, instructions for repair or replacement of defective components,



calibration instructions, parts lists, name, address, and phone number of manufacturer's representative.

- C. Provide product operational and maintenance data in electronic PDF format (Acrobat latest version - 9.0 or greater) on vendor specific server, and provide means to access this data using intuitive operator interaction (quick links from main system graphics).
- D. Include name and 800 number of a 7 day a week 24 hour a day service line for needed service during the first year of operation.

1.15 Software Tab Section:

- A. As part of operating and maintenance manuals include a software tab. Divide this software tab section into separate parts with tabs for each part. A separate CD including all required information shall be included under this tab section which shall include the following:
  - 1. As-built sequence of operation provided in Microsoft Word format.
  - 2. All building level and system level programs. Application specific programs shall include all configuration files showing final menu selections and applicable default settings.
  - 3. Describe general operating procedures, starting with system overview and printed graphic displays of all systems and provide trend graphs of all control loops with a minimum 24-hour trend at five-minute intervals.
  - 4. Where applicable the Contractor shall provide the latest Factory standard technical manuals in CD and hard copy format. Confirm existing technical manuals are the latest versions for the systems provided under this project.
  - 5. Software Backup: Upon successful completion of acceptance testing, include in this section, one archive copies of all accepted versions of source code and compiled code for all application programs and data files on compact disc media. All control software must be readily accessible by Owner using BAS server hardware and software. Software file naming for ASC controllers shall match ID reference on mechanical drawing – ID reference will be unique.

1.16 Record Drawings:

- A. Submit as-built shop drawings indicating all changes made during project. The drawing files shall be in.pdf format and original control format software such as Visio or AutoCAD.
- B. Install all as-built control drawings (and associated sequence of operation) in electronic format on specific server, and provide means to access this data using intuitive interaction by end users.
- C. Each system web page shall allow for an automatic link to the associated control diagram product O&M data sheets and sequence of operation. Mark specific products and options used on project when posting product data sheets. Provide operator a way to access product and as-built control information from the associated system web page (e.g. AHU system, chilled water system, hot water system, VAV system, etc.).
- D. Mount (within control panel) laminated control flow drawing, sequence, point schedule, and control panel wiring diagrams indicating all field points connected.
- E. The control panel wiring diagrams shall utilize the same field device tag names used within the associated control diagram and graphic interface.
- F. Not required for room level controllers.

1.17 Warranty:



- A. At the end of final startup, testing, and commissioning phase, if equipment and systems are operating satisfactorily, the A/E and each of the owner's agents shall certify that the controls system's operation has been tested and accepted in accordance with the terms of this specification. The date of such certification shall be the start of the warranty period(s).
- B. Submit warranty documentation upon substantial completion of project or phase (if applicable) and acceptance by Engineer and Owner.
- C. Repair or replace systems or parts found defective at no cost to Owner during the warranty period.
- D. Include parts, labor, and necessary travel during warranty.
- E. Provide vendor specific and 3rd party warranty and registration information as applicable.
- F. Provide services incidental to proper performance.
- G. First year of warranty includes parts and labor for entire system (including 3rd party equipment). Adjust, repair, or replace, at no additional cost to the owner, control system failures during the 1st year (includes software issues).
- H. Second year of warranty includes parts only.
- I. Provide a minimum two-year warranty for all parts (including 3rd party equipment) provided under this section. Warranty includes all cost to cover defective hardware replacement of like or equal product.
- J. Warranty response time shall be as indicated. The designated owner's representatives representing the operations and service departments shall be the authorized callers and will determine the required response level.
  - 1. Emergency service – must respond within 2 hours of being notified.
  - 2. General warranty service – must respond within 4 hours of being notified.
  - 3. Scheduled service – must respond within 48 hours of being notified.

1.18 Owner Instruction:

- A. Training Requirements:
  - 1. The following summarizes the required training tasks and objectives for the systems provided under this section. The scope and duration shall be determined by the Contractor and shall be commensurate to the project scope and complexity. The Contractor shall include the following elements:
    - a. Review BAS deliverables with respect to general content and organization:
      - 1) Operations and Maintenance manuals
      - 2) As-Built Control Drawing Package
      - 3) Graphical User Interface
      - 4) Reporting packages and content
      - 5) As-Built Control Sequences
      - 6) Maintenance service agreements, state of warranty date, and similar continuing commitments
      - 7) Review location of all BAS equipment / panel locations
    - b. Operations:
      - 1) Startup procedures
      - 2) All equipment or system start-up procedures
      - 3) All equipment or system shut-down procedures
      - 4) Routine and normal operating sequence for all systems
      - 5) Special operating instructions and procedures not addressed above



- 6) Seasonal and weekend operating instructions
    - 7) Software backup procedures and file locations
  - c. Emergencies:
    - 1) Instructions on meaning of warnings, trouble indications, and error messages
    - 2) Instructions on stopping, manual overrides and BAS override procedures
    - 3) Safety device procedures and actions
    - 4) Operating procedures for system, subsystem, or equipment failure
    - 5) Shutdown instructions for each type of emergency
    - 6) Operating instructions for conditions outside of normal operating limits
    - 7) Special operating instructions and procedures
  - d. Adjustments:
    - 1) Proper adjustment procedures and points intended to be adjusted
    - 2) Economy and efficiency adjustments
    - 3) Adjustments for efficient energy use
  - e. Troubleshooting:
    - 1) Diagnostic instructions procedures for each typical system installed
    - 2) Test and inspection procedures for each typical system installed
  - f. Maintenance:
    - 1) Inspection procedures
    - 2) Types of cleaning agents to be used and methods of cleaning
    - 3) Procedures for calibration
    - 4) Procedures for preventive maintenance
    - 5) Procedures for routine maintenance
    - 6) Instruction on use of special tools
  - g. Repairs:
    - 1) Diagnosis and repair instructions
    - 2) Disassembly; component removal, repair, and replacement; and reassembly instructions
    - 3) Instructions for identifying parts and components
    - 4) Review of spare parts needed for operation and maintenance
2. In addition to the initial project training requirements above, the Contractor shall include an additional 16 hours of training to be delivered in accordance with owner's requirements.

## PART 2 - PRODUCTS

### 2.1 Software:

#### A. Data Storage and Archiving:

- 1. Trend data shall be stored at the stand alone BLC/AAC panels and uploaded automatically to server hard disk storage when archival is desired or when local trend storage capacity drops below 20%. All points shall be trended and stored on Vendor specific server. Storage capacity shall be based on an initial sample rate for all points at 15 minutes. Server capacity shall support a minimum five



years of trend data. The contractor is responsible for upgrading existing server as needed to support the additional project points and required memory. Ensure the server will maintain no less than 100% spare capacity.

B. Control Software Description for BLC/AAC include:

1. The ability to perform the following pre-tested stand-alone control algorithms:
  - a. Two-position control
  - b. Proportional control
  - c. Proportional plus integral control
  - d. Proportional, integral, plus derivative control
  - e. Automatic tuning of control loops with enable/disable capabilities
  - f. Equipment Cycling Protection: Include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
2. The ability to perform all of the following energy management routines:
  - a. Time-of-day scheduling
  - b. Calendar-based scheduling
  - c. Holiday scheduling
  - d. Temporary schedule overrides
  - e. Start-Stop Time Optimization
  - f. Automatic Daylight Savings Time Switch-over
  - g. Night setup and setback control
3. Read and display the value of any property, including all required properties, supported optional properties, and proprietary extensions of every object located within each networked device.
4. The ability to execute custom, job-specific processes to automatically perform calculations and special control routines.
5. Incorporate measured or calculated data from other DDC controllers on the network.
6. Issue commands to points in other DDC controllers on the network.
7. Support 30 characters, English language point names, structured for searching and logs.
8. Directly send a text message to a specified device or cause the execution of an alarm message at any connected thin client PC, dial-up connection to a remote device or cause the execution of a remote connection to a remote device such as a printer, pager, PDA, or cell phone.
9. Include a HELP function key.
10. Incorporate comment lines for program clarity.
11. Alarm management:
  - a. Monitor and direct alarm information to operator devices.
  - b. Generate custom written operator alarm message (to be developed by the Contractor and Owner in conjunction with the project) and advisories to operator I/O devices.
  - c. Perform distributed, independent alarm analysis, and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.
  - d. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.



- e. Users shall have the ability to manually inhibit alarm reporting for each point.
    - f. Alarm destinations shall be included so that alarms are indicated and printed at a pre-defined reporting device, or transaction log.
    - g. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hour's destinations) and/or based on priority.
    - h. Alarms shall directly send an alarm message to specified client PC destination or cause the execution of a connection to a remote device (owner to designate) and cause the execution of a communications connection to a remote wireless device (pager, hand held, email, or Pocket PC device).
    - i. Alarm messages and point graphic assignments alarms shall have accurate descriptions and response instructions, so that alarms may be quickly associated with appropriate graphic display.
  - C. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops as identified in the point I/O summary.
  - D. Failsafe hardware shall be provided such that BAS failures result in immediate return to local control. If the controller uses database values from other controllers, and the communication network fails or malfunctions, control loop outputs shall continue to function using last value received from BAS.
  - E. Controller size shall be sufficient to fully meet the requirements of this specification. Controllers at Tier 2 level shall not exceed 75% of available trunk capability.
  - F. Application Specific Controllers (ASCs) (VAV ##)
  - G. Performance and capacity of AAC/BLC units shall be extended through the use of stand-alone remote ASCs for VAV terminals, fan coil units, unit ventilators, heat pumps, small single zone air handlers, etc.
  - H. Controllers shall be capable of field configuration and program uploads and downloads.
  - I. Controllers shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network.
  - J. Controllers shall be a microprocessor-based, multi-tasking, real-time digital control processor.
  - K. Alarm Management: Each ASC shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
  - L. ASCs shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 4-20ma proportional signals, 0-5 Vdc or 0-10 Vdc proportional signals allowing for interface to a variety of modulating actuators.
- 2.2 VAV Terminal Controllers:
- A. The unit controller used for VAV applications shall support the air terminal unit used as the basis of design for this project, including the air terminal unit damper actuator and multi-point, center averaging velocity sensor. The controller shall be capable of controlling the air terminal unit in all control strategies as described in contract documents.
  - B. Setpoints, flow limits, and occupancy schedules shall be maintained indefinitely in each controller's non-volatile memory. No batteries shall be required.



- C. It shall be possible to monitor flow in CFM and to adjust flow limits, temperature setpoints, and schedules, without direct access to the terminal unit, by plugging in a standard laptop computer or PDA device at the room temperature sensor.
- D. Each controller shall control by modulating the terminal unit electrically actuated device(s) using a proportional/integral (PI) algorithm with programmable PI coefficients.
- E. If required by the sequence of operation, ASCs used as a VAV terminal unit controller shall be able to accept a relay input from an occupancy sensor. This input shall toggle the air terminal unit between occupied and unoccupied modes and override occupied/unoccupied scheduling information the air terminal unit receives from the BLC or AAC.
- F. Location of terminal unit to be indicated on ceiling grid. Use a permanent tag engraved with Box Number and Room Number of thermostat location. Use black lettering with white background.
- G. Provide a means of automatically disconnecting the differential pressure sensing lines to ensure a true no flow condition during automatic recalibration events.

2.3 Control Wiring and Pathways:

- A. All cables (< 50 VAC/VDC) used within control system shall contain an overall jacket (plenum) rate.
- B. Jacket Color-Coding:
  - 1. I/O Low Voltage Signal Wire: Gray
  - 2. Field Device Low Voltage (< 50 VAC/DC) Power Wiring: Orange
- C. Communication Cable: Manufacturers approved cable color will be acceptable if the jacket is factory stamped at no less than 10 ft. intervals indicating "BAS Communication" cable.
- D. Refer to other specification section for conductors, except as noted.
- E. Refer to other specification section for pathways, except as noted.
- F. Instrumentation I/O Conductors (<50 Volts and Under):
  - 1. No wire smaller than #18 AWG shall be used unless otherwise specified such as thermostat wiring.
- G. Provide isolated instrument grounding system per manufacturer's recommendations and project requirements.
- H. Conductors shall have UL listed plenum rated Teflon insulation.

2.4 Communication Cable:

- A. Manufacturer approved cable labeled "BAS Communication" no less than 10 ft. intervals. Provide additional shielding and grounding per applicable manufacturer's recommendations and/or job site conditions. Conductors shall have UL listed plenum rated Teflon insulation.

2.5 Local Control Panels:

- A. Local control panels shall be constructed of steel, high strength composite, or extruded aluminum with hinged door and keyed lock, with baked enamel finish of manufacturer's standard color. Construction shall comply with NEMA 1 standards for interior panels, NEMA 4 for exterior panels.
- B. Panel mounted controlling instruments, temperature indicators, relays, switches and gauges shall be factory installed and permanently labeled. Devices shall be located inside or flush mounted on face of panel.



C. Network Routers and Bridges:

1. BACnet Router: The BAS shall use the campus Wide Area Network (WAN) for communication to the campus vendor specific server.
2. The communication between the central server and the buildings DDC controllers shall be BACnet/IP.
3. This router or a separate broadcast manager shall limit BACnet data traffic to within the building level network until a remote request for information is requested or when a message must be transmitted outside the building level network.

D. Electrical Power Meter:

1. Manufacturer: Veris Industries or Approved Equal
2. Insulation Class 600 VAC†
3. Sample Rate 1,280 Hz
4. Internal Isolation 2,500 VAC
5. Operating Temp. Range 0 to 50°C (<95%RH, non-condensing)
6. Storage Temp. Range -40°C to 70°C
7. Systems Accuracy  $\pm 1\%$  of reading from 2% to 100% of the rated current of the CTs accomplished by matching the CTs with a meter and calibrating them as a system
8. Power Consumption 50 VA

2.6 Electrical Services:

- A. Any service where the phase A-N voltage is  $\leq 300\text{VAC}$  and the phase-to-phase voltage is  $\leq 480\text{VAC}$  nominal with neutral
- B. Frequency 50/60 Hz
- C. Protection Class NEMA 1
- D. BACnet MS/TP communication card or MODBUS

2.7 Servers:

- A. Servers are existing.

2.8 Discrete Electric Instrumentation:

- A. General:
  1. Electrical devices, switches, and relays shall be UL listed and of type meeting current and voltage characteristics of the project.

2.9 Temperature Switches (Electric Thermostats):

- A. Line voltage or low voltage type suitable for application with adjustable setpoint and setpoint indication.
- B. Low voltage type to have heat anticipation.
- C. Thermostats with remote sensing bulb shall have liquid filled sensing element and exposed setpoint adjustment.
- D. Wall mounted space thermostat enclosure shall have concealed sensing element and exposed setpoint adjustment.
- E. Unless otherwise stated, space thermostat covers shall be factory standard cover.

2.10 Relays:

- A. Equal to IDEC type or RIB series. Coil shall match control circuit characteristics. All relays shall include LED indication of status.



- B. Where HOA capability is required (i.e. AAC), relays must include an integral HOA function with override feedback.
- C. Provide DIN rail mountable (Snap type) mounting sockets.

2.11 Wall Mounted Space Sensors:

- A. Sensors shall be platinum or nickel RTD type, with the following minimum performance:  
Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C  
Accuracy: ± 0.1% at 32°F (Class B)  
Conformance: DIN-IEC 751  
Operating Range: -50 to 500°F 0 to 99% RH
- B. Thermistors will be acceptable in lieu of platinum or nickel RTD provided thermistor carries 5-year guarantee that device will maintain its accuracy within tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.
- C. Unless otherwise stated, space sensor covers shall be factory standard cover.

2.12 Room Thermostats:

- A. Setpoint range shall be resettable only from remote BAS or from any server/client PC. Temperature sensors shall be compatible with the associated controlled devices (e.g. DDC air terminal controller). Mounting box shall be recessed type unless otherwise indicated or required by the building construction materials.
- B. Room Temperature Sensors shall incorporate a thermistor/RTD element and an integral portable operator terminal plug-in port.
- C. Temporary override push-button/timers shall be installed at all locations.
- D. Provide warmer/cooler setpoint adjustment. Minimum and maximum adjustable range shall be set through the BAS only.
- E. Unless otherwise stated, room thermostat covers shall be factory standard cover.
- F. Unless otherwise stated, room thermostat shall not include a local LCD display.

2.13 Duct Mounted Probe Temperature Sensors:

- A. Nickel or platinum RTD type, with the following minimum performance:  
Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C  
Accuracy: +/- 0.1% at 32°F (Class B)  
Conformance: DIN-IEC 751  
Operating Range: 0 to 150°F 0 to 99% RH
- B. Thermistors or nickel RTD will be acceptable in lieu of platinum RTD provided thermistor carries 5-year guarantee that the device will maintain its accuracy within a tolerance of ± 0.36°F between 32°F and 150°F, and 0.5°F between -20°F and 212°F.
- C. Furnish sensors as shown on drawings or required for proper operation.
- D. Space humidity sensors shall be wall mount type with cover to match room thermostats and/or temperature sensors.
- E. Sensing element shall be resistive bulk polymer, or thin film capacitive type. Sensor/transmitter shall have the following minimum performance.  
Accuracy: ± 2% RH at 25°C over 20-95% RH including hysteresis, linearity, and repeatability.  
Temperature Effect: Less than 0.06% per °F.  
Sensitivity: 0.1% RH.  
Repeatability: 0.5% RH.  
Hysteresis: Less than 1%.



Long Term Stability: Less than 1% RH drift per year.  
Adjustment:  $\pm 20\%$  RH zero, non-interactive.  
 $\pm 10\%$  RH span, non-interactive.  
Operating Range: 0-99% RH, non-condensing, sensor.  
0-95% RH, non-condensing, electronics.  
Output: 4-20 mA, 0-10Vdc, 0-100% linear, proportional.  
Power: 12-36 VDC.

- F. Space humidity sensor covers shall be factory standard cover unless otherwise stated.

2.14 Carbon Dioxide Sensor: (Space or Duct Mounted)

- A. Manufacturer: Valtronics Model 2089, Veris CXD, or approved equal.  
B. Provide non-Dispersive Infra Red (NDIR) carbon dioxide sensor suitable for room mounting. 4-20 ma output signal corresponding to input CO2 concentration.

Input: 4-20 mA  
Range: 0-2000 PPM  
Accuracy:  $\pm 3\%$  of full scale  
Repeatability: 0.1% of full scale  
Calibration Frequency: No less than every 3 years

PART 3 - EXECUTION

3.1 Software:

- A. Coordinate graphics and points for consistency with existing campus system. Contractor shall be responsible for data base clean-up when a project is renovated. The graphic database, user view data base and software will be modified to reflect the final project.
- B. Continuously archive all data in standard database platform. Including but not limited to:
1. I/O points
  2. Software points such as:
    - a. Alarm limits
    - b. Setpoints
    - c. Parameters
    - d. Schedules
    - e. Alarm messages
    - f. Reports
    - g. Trends/History
  3. Provide BAS Reports including:
    - a. Alarm summary
    - b. Schedules
    - c. Control loop performance
    - d. Equipment specific energy performance calculations such as Energy Recovery Devices
    - e. Measurement and verification reports consistent with the requirements of the M+V plan developed by a separate 3rd party agent.
- C. The Contractor shall implement long term trending for all physical input and output points and all set-points. The initial trend interval settings shall be set to 15 minutes. In addition, the Contractor shall increase the resolution of all control loop trending to



every 5 minutes during the testing/acceptance phase (minimum of 2 weeks). Control loop trending shall include controlled variable, setpoint, and output from actuated device. Coordinate all trending requirements with Commissioning Agent/Engineer.

3.2 Alarming:

- A. The Contractor shall create enhanced alarm programs for all system points. These points shall be programmed for appropriate seasonal high or low alarm limits. Enhanced alarm programs shall prevent abnormal alarms from occurring when the associated system has been deactivated. For example: air handler mixed air, preheat, cooling, humidity, and static pressure control points, building chilled water, heating water system control points, etc. Alarm destinations, alarm messages, and point graphic assignments shall be included so that alarms are indicated and printed at a pre-defined Owner reporting device and recorded on a transaction log. Alarms shall have accurate descriptions and response instructions, so that alarms may be quickly associated with appropriate graphic display.
- B. The Contractor shall define the specific system reactions for each point. Alarms shall be enhanced and prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. The Contractor shall initially define all point priority levels for handling of all system alarms. Users shall have the ability to manually inhibit alarm reporting for each point.
- C. Alarm reports and messages shall be directed to a user-defined list of operator devices or PCs based on time (after hour destinations) and/or based on priority.
- D. In addition to the points descriptor and the time and date, the Contractor shall create, print, display and store an alarm message for each point to more fully describe the alarm condition or to direct operator response. Alarm events may be configured to send an alarm message to a specified client e-mail address, cellular phone number via SMS text messaging.

3.3 Graphic Displays:

- A. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list.
- B. Provide graphics for each floor plans of the building as a minimum. Coordinate with the Architect/Engineer (A/E). Size graphics to allow the operator to read room numbers and descriptions. Incorporate the capability to navigate section to section as required to view entire floor and to navigate floor to floor.
- C. Color shall be used to indicate normal and alarm conditions within all spaces. Color or common border lines shall be used to link HVAC equipment with zone(s) served.
- D. User shall be able to access the various system schematics and floor plans via a graphical penetration scheme and/or menu selection.
- E. User shall be able to penetrate from floor plan to associated HVAC system text-based display.
- F. Create enhanced alarm programs for all system points. These points shall be programmed for appropriate seasonal high or low alarm limits.
- G. Refer to the following graphics guideline section and Graphic Standards - Appendix B for additional examples and samples.
  - 1. All schedules.
  - 2. All points in an override condition.
  - 3. System specific summary screens.



4. Include an AHU terminal unit summary screen for each AHU that serves multiple terminal units. The summary screen shall include the following information and shall be continuously updated with real time data.

Air Terminal Summary									
Room #	CFM Actual	CFM Stpt	% Error	Min CFM Stpt	Max CFM Stpt	Reheat Valve Command	Htg Stpt	Temp Actual	Clg Stpt
TOTAL									

### 3.4 Control Wiring and Pathways:

- A. Provide all electrical wiring required for a complete and functional control system, including power circuit to control panels and field devices in accordance with all applicable local codes and the latest version of National Electric Code and NFPA when applicable.
- B. Sizing of cable, conduit, j-boxes and raceways to accommodate system with 25% spare capacity. Minimum conduit size shall be 3/4" at all locations. All wall mount devices shall be in conduit and routed to nearest accessible ceiling location stubouts shall be a minimum of 12" from wall line.
- C. Labeled wiring with unique tag to match I/O device identifier tag (e.g. sensor DA-T wire shall be labeled at panel and device as "DA-T"). Communication cable shall be labeled with Loop/Trunk #, previous and destination device (e.g. L1VAV101/VAV102 would be used to label the loop 1 communication bus between VAV101 and VAV102).
  1. Low voltage wiring concealed above accessible ceilings does not require raceway, however, cables run above accessible ceilings shall be run within a j-hook pathway system spaced no more than 4 ft apart. Cables run in concealed areas or within un-accessible spaces shall be installed in EMT. Run pathways and cables parallel and perpendicular to building structure.
- D. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit shall be UL listed.
- E. Run direct current instrument conductors separately from alternating current conductors. Where allowed by NEC wiring classification, AC-DC route crossings shall be at 90 degrees. Install special sensor to converter cables in accordance with drawings or in compliance with manufacturer's instructions. Extra precautions shall be taken when pulling and shortening these "vendor furnished" cables. Any extra length on these cables shall be neatly coiled into minimum 3" diameter coils and installed into junction box.

### 3.5 BAS Network Communication Cable:

- A. Run communication or low voltage power cable in separate pathways or in j-hooks with proper clearances.
- B. Install special cable connectors in accordance with manufacturer's recommendations.



- C. BAS network communication cable shall not be spliced unless a terminal strip enclosure is used.
  - D. BAS network communication shall be shielded with the shields taped back where applicable.
  - E. All control wiring located in mechanical or exposed spaces shall be run in EMT.
  - F. All Input / Output wiring shall be shielded in accordance with equipment requirements.
  - G. Refer to Division 26 for additional requirements, except as noted.
  - H. Power wiring to control compressors and dryers shall be as indicated on electrical power plans. Provide field mounted starters to Electrical Contractor for installation and supervise installation.
- 3.6 Raceway Identification: All the covers to junction and pull boxes of the BAS raceway system shall be painted white.
- 3.7 Local Control Panels:
- A. Provide local control panel for each system where more than one control device requires field mounting (air handling units, miscellaneous control system including pump controls, etc.). Single devices may be mounted exposed on piping or ductwork. Install local control panel where indicated on drawings or suitable location adjacent to system served. Do not mount panels on equipment.
  - B. Mount panel on wall with suitable brackets or on floor with self-supporting stand.
  - C. Mount top of panel no higher than 6 feet above floor.
  - D. Install panels so front cover door can swing full open without interference and maintain a minimum of 36" clearance.
  - E. Unless otherwise indicated, mount controllers, adjusting switches, pressure gages, temperature indicators, and other indicating or manually operated devices inside panel with permanent labels identifying device and controlled device or function.
  - F. In-line pneumatic gages shall be hard mounted to back panel and shall include permanent labels identifying end device. Other factory standard labeling methods are acceptable as long as the device name and function are clearly identified and is permanent. Labels shall correspond to control drawing tags and identifiers.
  - G. Labels shall correspond to control drawing tags and identifiers.
  - H. Panel will be labeled with location and breaker number of power feed.
- 3.8 Network Routers and Bridges:
- A. Provide router as required, to bridge BACnet/IP and the data link used between the controllers (BACnet ARCNET, BACnet MS/TP).
  - B. Proprietary networks (networking between buildings and central server) and proprietary protocols are not acceptable.
  - C. Coordinate final location with Owner and other trades.
- 3.9 Building Level Controller:
- A. Provide controllers as required.
  - B. Coordinate final location with Owner other trades.
- 3.10 Advanced Application Controllers – Hardware (AAC):
- A. Provide all processors, power supplies, and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.
  - B. Size controller to meet the requirements of this specification and the project point I/O schedule +15% additional capacity of each point type.



3.11 Application Specific Controllers (ASC):

- A. Provide the following types of application specific controllers (embedded or as a predefined software application) as a minimum:

Variable Air Volume (VAV) boxes

- B. Provide communication to the BAS.
- C. Coordinate location and power requirements with other trades.

3.12 Servers:

- A. Archive all historical data such as trends, alarm and event histories, and transaction logs on existing server.
- B. Furnish control valves as shown on drawings and/or as required to perform control sequence specified.
- C. Coordinate the installation of control valves.
- D. Control valves furnished by this contractor shall be installed by mechanical contractor under coordinating control and supervision of this Contractor.

3.13 Sizing:

- A. Select control valves to meet their intended service without cavitations. Provide cavitation calculations for modulating globe control valves over 250°F and all modulating butterfly valves over 60°F.
- B. Valve body ratings indicated in Part 2 are minimum required. Valve body, trim, and packing selected shall be designed to withstand maximum pressure and temperature encountered in the systems.
- C. Submit engineering calculations used for sizing modulating control valves. Control valves serving terminal devices may be sized based on flow ranges for each pump system.
- D. Calculations for sizing modulating valves shall be based on actual characteristics of equipment and system being installed.
- E. Valve calculations shall include information such as pump head or available pressure; branch piping circuit losses including all pipe, fittings, valves, and coils; flow rates; and pressure losses of other in-line devices.
- F. Obtaining adequate system information necessary for sizing valves.
- G. Design criteria for sizing modulating valves shall be based on two port, or 3 port, fail open or fail closed, as shown on plans, equal percentage valves unless otherwise specified.
- H. Heating control valves shall be full port ball valve and shall be selected for a minimum of 25% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.
- I. Size three-way mixing or diverting valves not directly associated with pump sub-circuit, for 3-5 psi pressure drop.
- J. Terminal reheat control valves shall be ball type and shall be selected for a minimum of 25% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.
- K. Cooling control valves may be full port ball, or butterfly type and shall be selected for minimum of 10% of equipment subcircuit pressure drop, but not more than maximum available pump head allowing minimum 2 psi drop for balance valve.
- L. Select control valves based on pressure drop calculations using Cv values at 100% stroke.



- M. Subcircuit is defined as all branch supply and return piping to terminal device, including all valve, coil, control valves, and balance valve.

3.14 Steam Valves:

- A. Modulating steam control valves shall be straight-through globe type with linear characteristics for 90% of closing stroke and equal-percentage for final 10%.
- B. For steam inlet pressure less than 15 psig, size valves for pressure drop equal to 75 to 80% of gauge inlet steam pressure.
- C. For steam inlet pressure of 15 psig or greater, size valves for pressure drop equal to 50% of absolute inlet pressure.

3.15 Control Dampers:

- A. Furnish control dampers as shown on drawings and/or as required to perform control sequence specified except those furnished with other equipment.
- B. Coordinate the installation of control dampers.
- C. Blank-off plates or transitions required to facilitate dampers will be provided by the mechanical contractor.

3.16 Actuators:

- A. Provide actuator for each automatic damper or valve with sufficient capacity to operate damper or valve under all conditions. Select actuators to provide tight shut off against maximum system temperatures and pressure encountered.
- B. Valve and damper operating speeds shall be selected or adjusted so operators will remain in step with controller without hunting regardless of load variations.
- C. Provide proper linkage and brackets for mounting and attaching actuators to devices. Design mounting and/or support to provide no more than 5% hysteresis in either direction (actual movement of valve stem/damper shaft/ideal movement) due to deflection of actuator mounting.
- D. Sizing:
  - 1. Calculations for sizing dampers shall be based on actual characteristics of ductwork system being installed.
- E. Opposed blade dampers shall be sized for minimum of 10% of duct section pressure drop. Parallel blade dampers shall be sized for minimum of 30% of duct section pressure drop. Duct section is defined as ductwork containing flow control damper starting with inlet or branch tee and ending with outlet or branch tee.
- F. Calculate actual duct pressure drops for each duct section containing modulating damper using latest version of ASHRAE Handbook of Fundamentals.
- G. If control system fixes pressure drop, use those pressure setpoints. Use duct blank-offs to provide additional pressure drop as required to obtain linear damper response.
- H. Contractor is responsible for obtaining adequate system information necessary for sizing.
- I. Contractor to provide dampers as shown on drawings or as scheduled.
- J. Two position dampers shall be sized as close as possible to duct size, but in no case is damper size to be less than duct area.

3.17 General Instrumentation:

- A. Pressure Gauges (Pressure Indicators):
  - 1. Install pressure gauges for indication of supply and control pressure in pneumatic systems at output of I/P transducers, electric air solenoid valves and pressure switches, actuators, and other points where visible indication of air pressure is



- required for operating and maintenance purposes (include a pressure gage with 12 inches of controlled device).
  - 2. Furnish pressure gauges with tapings for piping.
  - 3. Provide pressure gages in control panel and at end device (pneumatic actuators). End device pressure gage shall be mounted so that gage can be easily seen from eye level.
- B. Water Differential Pressure Sensors:
- 1. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device. Transmitter range shall be selected for mid-range values while operating under normal operating range.
  - 2. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines. Test ports shall be included for 3rd party verification.
  - 3. Differential pressure transmitter shall include a separate pressure gage scaled to indicate normal operating range of device. This pressure gage shall be installed in parallel with sensing lines.
  - 4. The transmitters shall be installed in an accessible location whenever possible.
- C. Discrete Electric Instrumentation:
- 1. General:
    - a. Terminate at terminal blocks inside enclosures unless otherwise specified.
    - b. Include auxiliary contact for remote status indication of safety devices.
  - 2. Temperature Switches (Electric Thermostats):
    - a. Provide temperature switches as shown or as required for sequence of operation.
  - 3. Low Limit Temperature Switches (Freeze Stats):
    - a. Install low limit controls where indicated on drawings or as specified. Unless otherwise indicated, install sensing element at downstream side of heating coils.
    - b. Distribute sensing element across entire area of medium being sensed. Install controls at accessible location with suitable mounting brackets and element duct collars where required.
    - c. Serpentine sensing element, starting at the lowest point (6" above coil bottom) of the coil being protected. Operation of low limit trip shall provide protection to associated coils.
    - d. Low limit trip activation shall cause all water coils to be overridden to full flow.
  - 4. Relays:
    - a. Provide control relays where indicated on drawings or as required to accomplish sequences.
    - b. Provide DIN mounted relays in control panels.
    - c. Provide RIB type relays for field control devices mounted on exterior of starter or VFD.
    - d. Mount relay for easy accessibility.
    - e. Mount relay for easy visual accessibility.
  - 5. Pressure Switches:



- a. Provide pressure switches where indicated on drawings or as required to accomplish sequences.
  - b. Coordinate installation of flow switches for proper location and installation.
6. Pressure Switches (Air Side):
  - a. Pressure Switches: Provide pressure switches where indicated on drawings or as required to accomplish sequences.
  - b. Coordinate installation of flow switches for proper location and installation.
7. Target Type (Paddle) Flow Switches:
  - a. Furnish paddle switches as required.
  - b. Coordinate installation of flow switches for proper location and installation.
8. Flow Switches:
  - a. Furnish flow switches as required.
  - b. Coordinate installation of flow switches for proper location and installation.
9. E-P Switches (Solenoid Valves):
  - a. Provide E-P switches where indicated on drawings or as required to accomplish sequences.
10. Position Switches (End Switch):
  - a. Provide position switches where indicated on drawings or as required to accomplish sequences.
11. Current Switches:
  - a. Provide current switches where indicated on drawings or as required to accomplish sequences.
  - b. Locate in starter or VFD or in an appropriate adjacent enclosure.
- D. Analog Electronic Instrumentation:
  1. Metering and Totalization:
    - a. Coordinate the delivery and installation of meter.
    - b. Installation where indicated on drawings.
    - c. Mount remote display unit at eye level in accessible location.
  2. Wall Mounted Space Sensors:
    - a. Install space thermostats/sensors where indicated, as required to perform specified controls, or directed to meet job site conditions.
    - b. Mount space sensors 4 ft above floor unless otherwise indicated.
    - c. Any room sensor mounted on exterior walls shall be mounted on thermally insulated sub-base.
    - d. Relocate room sensors if required due to draft, interferences with cabinets, writing board, etc., or improper sensing.
    - e. Provide a conduit from sensor box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.
  3. Room Thermostats
    - a. Install space thermostats where indicated, as required to perform specified controls, or directed to meet job site conditions.
    - b. Mount thermostats at 4 ft above floor unless otherwise indicated.



- c. Any room thermostat mounted on exterior walls shall be mounted on thermally insulated sub-base.
  - d. Relocate room thermostats if required due to draft, interferences with cabinets, writing board, etc., or improper sensing.
  - e. Provide a conduit from thermostat box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.
- 4. Duct Mounted Probe Sensors:
  - a. Provide sensors where shown or drawings or to accomplish sequences.
  - b. Install outside air sensors in weatherproof, non-corrosive solar shield.
- 5. Insertion Temperature Sensors:
  - a. Provide sensors where shown or drawings or to accomplish sequences.
  - b. Install wet sensors in stainless steel or brass wells with thermal grease.
- 6. Duct Mounted Averaging Temperature Sensors:
  - a. Use where temperatures are prone to stratification or where ducts are larger than 9 sq. ft. (1 sq. m); length as required. All sensors located within the AHU compartment shall be averaging.
  - b. Serpentine sensor in duct to maximize coverage of measured area.
  - c. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
  - d. Mounted to suitable supports using factory approved non-metal element holders.
- 7. Dew Point or Wet Bulb Temperature Transmitter:
  - a. Provide dew point transmitters where indicated or to accomplish sequences.
- 8. Space Humidity Sensors/Transmitters:
  - a. Install space humidity sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.
  - b. Mount sensors at same height as temperature sensors.
  - c. Any sensor mounted on exterior walls shall be mounted on thermally insulated sub-base.
  - d. Relocate room thermostats if required due to draft, interferences with cabinets, chalkboards, etc., or improper sensing.
  - e. Provide a conduit from sensor box to above the ceiling where it shall stub out into an accessible area parallel with the ceiling.
- 9. Duct Mounted Humidity Sensors/Transmitters:
  - a. Provide duct humidity sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.
- 10. Thermal Dispersion or Vortex Shedding Air Flow Sensors/Transmitters:
  - a. Provide air flow sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.
- 11. P-E Transducers (Pressure Transmitters):



- a. Provide transducers as required to perform specified controls, or directed to meet job site conditions.
  - b. Mount transducers in control panels.
  - c. Provide gauge for all transducers.
12. Dual Air System Static Pressure and Differential Pressure (Velocity) Transmitter:
- a. Provide transducers/transmitters to convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.
  - b. Mount transducers in control panels.
13. Building and Space Pressure Differential Transmitter:
- a. Provide directional mass flow transmitter installed in 2" thin-wall rigid conduit (EMT) or PVC between spaces to measure relative velocity created by the pressure difference.
  - b. Extend 2" EMT or PVC pipe between spaces for room pressure control, or between space and outside for building static pressure control.
  - c. Provide algorithm in software to convert air velocity to pressure differential ( $DP = C (V/4005)^2$ ). Field determine coefficient C by calibrated measurement.
  - d. Construct shroud of aluminum, painted to match building exterior.
14. Electric to Pressure Transducers:
- a. Provide pressure transducers integral to DDC panels or separate components to convert digital analog signal to variable pneumatic air pressure signal.
  - b. Provide output gauge for all transducers.
  - c. Mount in control panel.
15. Carbon Dioxide Sensor:
- a. Provide carbon dioxide sensor where indicated, as required to perform specified controls, or directed to meet job site conditions.
16. Terminal Unit Location Identification:
- a. Provide a label directly below terminal unit devices mounted above ceiling. Label the approximate location on ceiling grid.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this Section.

### 1.2 Summary:

- A. This Section includes piping systems for chilled water cooling and condenser water. Piping materials and equipment specified in this Section include pipes, fittings, and specialties, special duty valves, and hydronic specialties.

### 1.3 Definitions:

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

### 1.4 Submittals:

- A. Product Data: Submit manufacturer's technical product data for each hydronic specialty and special duty valve specified. Include rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties and accessories, and installation instructions. Furnish flow and pressure drop curves for diverting fittings and calibrated plug valves, based on manufacturer's testing.
- B. Shop Drawings: Submit manufacturer's drawings detailing dimensions, weight loadings, required clearances, methods of assembly of components, and location and size of each field connection.
- C. Maintenance Data: For hydronic specialties and special duty valves, for inclusion in operating and maintenance manuals.
- D. Quality Control Submittals:
  - 1. Welders' certificates certifying that welders comply with the quality requirements specified in Quality Assurance below.
  - 2. Certification of compliance with ASTM and ANSI manufacturing requirements for pipe, fittings, and specialties.
  - 3. Submit reports specified in Part 3 of this Section.

### 1.5 Quality Assurance:

- A. Qualifications for Welding Processes and Operators: ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification".
- B. ASME Compliance: Fabricate and stamp air separators and compression tanks to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

### 1.6 Maintenance:

- A. Maintenance Stock: Furnish a sufficient quantity of chemical for initial system start-up and for preventative maintenance for one year from Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 Pipe and Tubing Materials:

- A. Steel Pipe: ASTM A53, Schedule 40, with threaded joints and fittings for 2" and smaller, and with welded joints for 2-1/2" and larger. Use mechanical grooved end steel pipe and mechanical couplings and fittings only for chiller connections and at venturi flow measuring stations in water piping systems.

### 2.2 Fittings:



- A. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.
- B. Grooved Mechanical Fittings: ASTM A 53, steel fittings with grooves or shoulders designed to accept grooved end couplings, as manufactured by Victaulic Company of America or Grinnell.
- C. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings, as manufactured by Victaulic Company of America or Grinnell.
- D. Steel Flanges and Flanged Fittings: ANSI B16.5, including bolts, nuts, and gaskets of material group 1.1, butt welded end connections, and raised facings.
- E. Flexible Connectors: Pipe size 1-1/2" and smaller shall have flexible hose connectors consisting of a corrugated inner metal hose wrapped with a wire protective braid; hose and braid to be stainless steel. Pipe size 2" and larger shall have rubber expansion joints of the single or double arch type, constructed of an EPDM molded rubber cover. Joints shall have flanges integral with the body. Each joint shall be furnished with ANSI 125# drilling and flanges and solid 3/8" thick galvanized steel retaining rings. All units shall be suitable for working pressures up to 150 psig. Connector to be Style 1015 Maxi-Joint as manufactured by General Rubber Corporation or approved equal.

2.3 Special Duty Valves:

- A. Pump Discharge Valves: 175 psig working pressure, 300°F maximum operating temperature, cast-iron body, bronze disc and seat, stainless steel stem and spring, and "Teflon" packing. Valves shall have flanged connections and straight or angle pattern as indicated. Features shall include non-slam check valve with spring-loaded weighted disc, and calibrated adjustment feature to permit regulation of pump discharge flow and shutoff. Acceptable manufacturers include Amtrol, Inc., Armstrong Pumps, Inc., Bell & Gossett ITT (Fluid Handling Div.), and Taco, Inc.
- B. Pressure Reducing Valves: Diaphragm operated, cast-iron or brass body valve, with low inlet pressure check valve, inlet strainer removable without system shut-down, and noncorrosive valve seat and stem. Valve shall be factory-set at operating pressure and have the capability for field adjustment. Acceptable manufacturers include Amtrol, Inc., Armstrong Pumps, Inc., Bell & Gossett ITT (Fluid Handling Div.), Taco, Inc.
- C. Safety Relief Valves: 125 psig working pressure and 250°F maximum operating temperature; designed, manufactured, tested, and labeled in accordance with the requirements of Section IV of the ASME Boiler and Pressure Vessel Code. Valve body shall be cast-iron, with all wetted internal working parts made of brass and rubber. Acceptable manufacturers include Amtrol, Inc., Bell & Gossett ITT (Fluid Handling Div.), Spirax Sarco, and Watts Regulator Co.

2.4 Hydronic Specialties:

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150 psig working pressure, 225°F operating temperature; manually operated with screwdriver or thumbscrew; and having 1/8" discharge connection and 1/2" inlet connection. Acceptable manufacturers include Armstrong Machine Works, Bell & Gossett ITT (Fluid Handling Div.), Hoffman Specialty ITT (Fluid Handling Div.), Crane Co., Metraflex Co., and Spirax Sarco.
- B. Automatic Air Vent: Designed to vent automatically with float principle; bronze body and nonferrous internal parts; 150 psig working pressure, 240°F operating temperature; and having 1/4" discharge connection and 1/2" inlet connection. Acceptable manufacturers include Armstrong Machine Works, Bell & Gossett ITT (Fluid Handling Div.), Hoffman Specialty ITT (Fluid Handling Div.), and Spirax Sarco.



- C. Diaphragm-Type Compression Tanks: Size and number as indicated; construct of welded carbon steel for 125 psig working pressure, 375°F maximum operating temperature. Separate air charge from system water to maintain design expansion capacity, by means of a flexible diaphragm securely sealed into tank. Provide taps for pressure gauge and air charging fitting, and drain fitting. Support vertical tanks with steel legs or base; support horizontal tanks with steel saddles. Tank, with taps and supports, shall be constructed, tested, and labeled in accordance with ASME Pressure Vessel Code, Section VIII, Division 1. Acceptable manufacturers include Amtrol, Inc., Armstrong Pumps, Inc., and Taco Inc.

### PART 3 - EXECUTION

#### 3.1 Piping Installations:

- A. So far as practical, install piping as indicated. Install piping at a uniform grade of 1" in 40' upward in the direction of flow. Make reductions in pipe sizes using eccentric reducer fitting installed with the level side up. Install branch connections to mains using tee fittings in main with take-off out the bottom of the main, except for up-feed risers which shall have take-off out the top of the main line.
- B. Install unions in pipes 2" and smaller, adjacent to each control valve, at final connections each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices. Install flanges on valves, apparatus, and equipment having 2-1/2" and larger connections.
- C. Install flexible connectors at inlet and discharge connections to pumps (except inline pumps) and other vibration producing equipment.
- D. Anchor piping to ensure proper direction of expansion and contraction.

#### 3.2 Joints:

- A. Comply with recommended industry practice for preparation and assembly of soldered, threaded, and flanged joints.
- B. Comply with the procedures contained in the AWS "Brazing Manual" for brazed joints.

#### 3.3 Welding:

- A. Pipe welding shall comply with the provisions of the latest Revision of the Applicable Code, whether ASME Boiler Construction Code, ASA Code for Pressure Piping, or such state or local requirements as may supersede codes mentioned above.

#### 3.4 Valve Applications:

- A. General Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated the following requirements apply:
  - 1. Shut-off duty: Use ball and butterfly valves
  - 2. Throttling duty: Use ball and butterfly valves
- B. Install shut-off duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.
- C. Install throttling duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.
- D. Control: Use globe valves.
- E. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage.
- F. Install check valves on each pump discharge and elsewhere as required to control flow direction.



- G. Install pump discharge valves with stem in upward position; allow clearance above stem for check mechanism removal.
- H. Install safety relief valves on all hydronic systems, and elsewhere as required by ASME Boiler and Pressure Vessel Code. Pipe discharge to floor without valves. Comply with ASME Boiler and Pressure Vessel Code Section VIII, Division 1 for installation requirements.
- I. Install pressure reducing valves on inlet water line, and elsewhere as required to regulate system pressure.

3.5 Hydronic Specialties Installation:

- A. Install manual air vents at all high points in the system, at heat transfer coils, and elsewhere as required for system air venting.
- B. Install pump suction diffusers on end suction pump suction inlet; adjust foot support to carry weight of suction piping. Install diffusers to maintain minimum service clearance to service strainers. Install nipple and ball valve in blowdown connection.

3.6 Field Quality Control:

- A. Preparation for testing: Prepare hydronic piping in accordance with ASME B 31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during the test.
  - 2. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
  - 3. Flush system with clean water. Clean strainers.
  - 4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
  - 5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

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

### 1.2 Summary:

- A. This Section specifies piping materials and installation methods common to more than one section of Division 23 and includes joining materials, piping specialties, including drip pans, sleeves, and seals and basic piping installation instructions.

### 1.3 Quality Assurance:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.

### 1.4 Submittals:

- A. Product Data: Submit product data on escutcheons, dielectric unions and fittings, mechanical sleeve seals, roof drains, and strainers.
- B. Quality Control Submittals: Submit welders' certificates.

### 1.5 Delivery, Storage, and Handling:

- A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

## PART 2 - PRODUCTS

### 2.1 Joining Materials:

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code.
- B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code.
- C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
- D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21).

### 2.2 Piping Specialties:

- A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings. Acceptable manufacturers include Chicago Specialty Manufacturing Co., Sanitary-Dash Manufacturing Company, and Grinnell Co.
- B. Unions: Malleable-iron, Class 150 for low pressure service and Class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.



- C. Dielectric Waterway Fittings: Acceptable manufacturers include Epco Sales, Inc., and Victaulic Company of America.
- D. Dielectric Unions: Provide dielectric unions which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion. Acceptable manufacturers include Eclipse, Inc., Perfection Corp., and Watts Regulator Company.
- E. Y-Type Strainers: Provide strainers full line size of connecting piping. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch.
  - 1. Provide strainers with 125 psi working pressure rating for low pressure applications, and 250 psi pressure rating for high pressure application.
  - 2. Threaded or Flanged Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
  - 3. Threaded or Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 4. Butt Welded Ends, 2-1/2" and Larger for Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 5. Butt Welded Ends, 2-1/2" and Larger for High Pressure Application: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blowdown fitted with pipe plug.
  - 6. Grooved Ends, 2-1/2" larger: Tee pattern, ductile iron or malleable iron body and access end cap, access coupling with EPDM gasket.
  - 7. Acceptable manufacturers include Armstrong Machine Works, Hoffman Specialty ITT (Fluid handling Div.), Metraflex Corp., R-P & C Valve (Div. White Consolidated Industries Inc.), Spirax Sarco, Victaulic Co., of America, and Watts Regulator Co.
- F. Pipe Sleeves: Provide pipe sleeves of one of the following:
  - 1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snap-lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.
  - 2. Steel Sleeves: Schedule 40 galvanized welded steel pipe, ASTM A53, Grade A.
- G. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
  - 1. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation. Acceptable manufacturers include Thunder Line Corp.
- H. Fire Barrier Penetration Seals:
  - 1. Cracks, Voids, or Holes up to 4" Diameter: Use putty or caulking, one-piece intumescent elastomer, noncorrosive to metal, compatible with synthetic cable jackets, and capable of expanding ten times when exposed to flame or heat, UL listed.
  - 2. Openings 4" or Greater: Use sealing system capable of passing three-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F UL listed.



3. Acceptable manufacturers include Electro Products Div./3M, and Nelson (Unit of General Signal).
- I. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.
- J. Manual Air Vent: Bronze body and non-ferrous internal parts, 150 psig working pressure, 225°F operating temperature; manually operated with screw driver or thumb screw and having 1/8" discharge connection and a 1/2" inlet connection. Acceptable manufacturers include Armstrong, Bell & Gossett, Hoffman Specialty, and Spirax Sarco.
- K. Automatic Air Vent: Bronze body and non-ferrous internal parts with built in shutoff valve and vacuum breaker. All internal components shall be replaceable. 150 psig working pressure, 225°F operating temperature; manually operated with screw driver or thumb screw and having 1/2" discharge connection and a 3/4" inlet connection. Acceptable manufacturer: Honeywell Industrial air vent EA79A1004

### PART 3 - EXECUTION

#### 3.1 Preparation:

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe. Remove scale, slag, dirt, and debris both inside and outside of piping and fittings before assembly.

#### 3.2 Installations:

- A. So far as practical, install piping as indicated. Install piping free of sags or bends, tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with one-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing valves.
- B. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap. Hose bibbs will not be used. If low points are created and are not on plans or shop drawings, a drain shall be installed and noted on as-built drawings.
- C. Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6" and larger shall be sheet metal.
- D. Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.
- E. Fire Barrier Penetration Seals: Provide seals for any opening through fire rated walls, floors, or ceilings used as a passage for mechanical components such as piping or ductwork. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions.
- F. Escutcheons shall be used where piping enters or exits finished walls, cabinets and in the interior of cabinets, and elsewhere as noted in the specs and drawings.
- G. Install manual air vents at all high points of the piping systems and as indicated on the drawings.

#### 3.3 Fittings and Specialties:

- A. Remake leaking joints using new materials.



- B. Install unions adjacent to each valve, and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.
- C. Install flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.
- D. Install dielectric unions to connect piping materials of dissimilar metals in all piping systems.
- E. Pipe Sleeves: Install steel-pipe sleeves except as otherwise indicated where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Architect/Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish, and 3/4" above concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.
- F. Drip Pans: Locate drip pans under piping passing over or within three feet horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

### 3.4 Joints:

- A. Steel Pipe Joints:
  - 1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter.
  - 2. Pipe Larger than 2":
    - a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31. The use of backing rings is acceptable.
    - b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.
    - c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping.
- B. Nonferrous Pipe Joints:
  - 1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance with ANSI B31.1.0 - Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
- C. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.



3.5     Testing:

- A.     See individual specification sections in which piping specialties are installed for testing procedures for piping systems.

END OF SECTION



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## 23 24 00 TESTING, CLEANING, AND STERILIZATION OF PIPING SYSTEMS

## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 This section is a Division-23 Basic Mechanical Materials and Methods section and is part of each Division-23 section making reference to or requiring the testing and other procedures specified herein.
- 1.3 Notify the Architect/Engineer when system tests are ready to be witnessed at least 24 hours prior to the test.
- 1.4 All materials, test equipment, and devices required for cleaning, testing, sterilizing or purging shall be provided by the Contractor.

## PART 2 - PRODUCTS

- 2.1 None.

## PART 3 - EXECUTION

3.1 Pressure Tests:

- A. General: Provide temporary equipment for testing, including pump and gauges. Test piping systems before insulation is installed wherever feasible and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with indicated medium and pressurize for indicated pressure and time.
- B. Required test period is 2 hours.
- C. No piping, fixtures, or equipment shall be concealed or covered until they have been tested. The contractor shall apply each test and ensure that it is satisfactory for the period specified before calling the Architect/Engineer to observe the test. Test shall be repeated upon request to the satisfaction of those making the inspection.
- D. Observe each test section for leakage at the end of the test period. Test fails if leakage is observed or if pressure drop exceeds 5% of the test pressure.
- E. Check of systems during application of test pressures should include visual check for water leakage and soap bubble or similar check for air and nitrogen leakage.
- F. During heating and cooling cycles, linear expansion shall be checked at all elbows and expansion joints for proper clearance.
- G. Repair piping systems sections which fail required piping test. Disassemble and re-install using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.

3.2 Pressure Test Requirements:

- A. Chilled Water, Heating Hot Water: Perform hydrostatic test at 150% of the normal operating pressure, but not less than 150 psig.

3.3 Cleaning and Sterilization:

- A. General: Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water or blowdown with air before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- B. Flush and drain all water systems at least three times. Reverse flush systems from smallest piping to largest piping. Replace startup strainers with operating strainers.
- C. Cleaning: After completion of all work and operational check out of the HVAC installations and prior to acceptance of the project by the Owner, the following shall be



## 23 24 00 TESTING, CLEANING, AND STERILIZATION OF PIPING SYSTEMS

accomplished. The completed piping systems shall be thoroughly flushed (reversed flushing) and chemically cleaned as needed to remove all dirt, debris, and any foreign matter that may have been trapped in the piping systems during construction. After flushing of systems is complete, the Contractor shall clean all main strainers and all strainers at air handlers, fan coil units, VAV boxes, reheat coils.

- D. A second cleaning of all strainers will be required if requested by the Engineer. Contractor shall furnish and install all valves and piping stub outs in the piping systems as needed to accommodate this flushing operation. Install the valves and stub outs at a location and in a manner that will allow them to remain in place for future flushing operations. The flushing and strainer cleaning operations shall be witnessed and approved by the Engineer and Owner's representative.

END OF SECTION



## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods Sections apply to work of this section.
- 1.3 Extent of HVAC metal ductwork is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-23 sections for exterior insulation of metal ductwork.
- 1.5 Refer to other Division-23 sections for ductwork accessories.
- 1.6 Codes and Standards:
  - A. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" Latest Edition for fabrication and installation of metal ductwork, unless otherwise noted.
  - B. NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".
- 1.7 Approval Submittals:
  - A. Product Data: Submit manufacturer's technical product data and installation instructions for the following.
    - 1. Factory-fabricated ductwork
    - 2. Sealants
    - 3. Flexible duct
    - 4. Spin-in fittings
    - 5. Side take-off fittings
  - B. Shop Drawings: Submit scaled layout drawings of HVAC metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

## PART 2 - PRODUCTS

- 2.1 Ductwork Materials:
  - A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.
  - B. Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653, lockforming quality; with G 90 zinc coating in accordance with ASTM A653; and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.
- 2.2 Miscellaneous Ductwork Materials:
  - A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.



- B. Duct Sealant: Provide UL listed low VOC non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant shall be NFPA 90A and 90B compliant.
- C. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim, and angles for support of ductwork.
- D. Flexible Ducts: Provide flexible ductwork with an R-value of R-6 unless the ductwork is in a ceiling return plenum. The use of flexible ductwork for connection of supply air and return air devices is acceptable only where shown on the drawings.
  - 1. Construction: Provide reinforced metalized polyester jacket that is tear and puncture resistant, air tight inner core with no fiberglass erosion in the air stream and an encapsulated wire helix. Flexible ductwork shall have a recommended operating pressure of 6" w.g. for sizes 4" through 12" diameter and 4" w.g. for sizes 14" through 20" diameter. All diameters shall be suitable for a negative operating pressure of 0.75" w.g. Flexible ductwork shall meet the requirements of UL-181, the Florida Energy Code, SBCC, NFPA 90A, and NFPA 90B.
  - 2. Acceptable Manufacturers: Subject to compliance with requirements, provide R-6 flexible ductwork by: Atco 36, Flexmaster 9M-R6, or Thermaflex M-KE R6.
- E. Spin-in and Side Take-off Fittings: Provide round branch run-outs as follows.
  - 1. Supply air diffuser connections shall be conical with damper and one-inch high insulation stand-off equal to Crown 3210 DS or Flexmaster CBD-BO32000G.
  - 2. Return air grille connections shall be straight sided with damper and one-inch high insulation standoff equal to Crown 724-D5 or Flexmaster FLD-BO.
  - 3. Exhaust air grille connections shall be straight sided with damper equal to Crown 724 or Flexmaster FLD.
  - 4. Where duct height does not permit the use of conical spin-in fittings, use low profile side take-off fittings equal to Crown 3300-DS or Flexmaster STOD-BO3 2000G.
- F. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.

### 2.3 Fabrication:

- A. Shop fabricate ductwork in 4, 8, 10, or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricate ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards", except provide sealant at all joints. Supply duct between AHU discharge and terminal units shall be minimum 4" pressure class. Duct downstream of terminal units and supply duct from air conditioning units and all return and exhaust duct shall be minimum 2" pressure class unless otherwise noted.
- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to 1-1/2 times associated duct width; and fabricate to include turning



vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.

2.4 Factory-Fabricated Low Pressure Ductwork (Maximum 2" W.G.):

- A. Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.
- B. Gauge: 28-gauge minimum for round ducts and fittings, 4" through 8" diameter. 26-gauge minimum 9" through 14", 24-gauge minimum 15" through 26".
- C. Elbows: One-piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- D. Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- E. Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork by Semco Mfg., Inc. or United Sheet Metal Div., United McGill Corp, or approved equal.

2.5 Factory-Fabricated High Pressure Ductwork (3" W.G. and Higher):

- A. Round Ductwork: Construct of galvanized sheet steel complying with ASTM A 527 by the following methods and in minimum gauges listed.

<u>Diameter</u>	<u>Minimum Gauge</u>	<u>Method of Manufacture</u>
3" to 14"	26	Spiral Lockseam
15" to 26"	24	Spiral Lockseam
27" to 36"	22	Spiral Lockseam
37" to 50"	20	Spiral Lockseam
51" to 60"	18	Spiral Lockseam
Over 60"	16	Longitudinal Seam

1. Provide locked seams for spiral duct; fusion-welded butt seam for longitudinal seam duct.
2. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous welds along seams.

<u>Diameter</u>	<u>Minimum Gauge</u>
3" to 36"	20
38" to 50"	18
Over 50"	16

- B. Flat-Oval Ductwork: Construct of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, in minimum gauges listed.

<u>Maximum Width</u>	<u>Minimum Gauge</u>
Under 25"	24
25" to 48"	22
49" to 70"	20
Over 70"	18

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams.

<u>Maximum Width</u>	<u>Minimum Gauge</u>
----------------------	----------------------



Under 37"	20
37" to 50"	18
Over 50"	16

- C. Internally Insulated Duct and Fittings: Construct with outer pressure shell, 1" thick insulation layer, and perforated inner liner. Construct shell and liner of galvanized sheet steel complying with ASTM A 527, of spiral lockseam construction, use longitudinal seam for over 59", in minimum gauges listed.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner 3"</u>
to 12"	26 ga.	24 ga.
13" to 24"	24 ga.	24 ga.
25" to 34"	22 ga.	24 ga.
35" to 48"	20 ga.	24 ga.
49" to 58"	18 ga.	24 ga.
Over 59"	16 ga.	20 ga.

1. Fittings and Couplings: Construct of minimum gauges listed. Provide continuous weld along seams of outer shell.

<u>Nominal Duct Diameter</u>	<u>Outer Shell</u>	<u>Inner Liner</u>
3" to 34"	20 ga.	20 ga.
36" to 48"	18 ga.	20 ga.
Over 48"	16 ga.	20 ga.

2. Inner Liner for Straight 15: Perforate with 3/32" holes for 22% open area. Provide metal spacers welded in position to maintain spacing and concentricity. Provide a plastic film between the perforated liner and insulation to act as a vapor barrier.
3. Inner Liner for Fittings: Solid sheet metal. Provide metal spacers welded in position to maintain spacing and concentricity.
4. Mylar Film: Provide interior mylar film on interior liner.

- D. Optional Ducts and Fittings: At Installer's option, provided that certified tests by Manufacturer show that rigidity and performance is equivalent to SMACNA standard gauge ductwork, provide ducts and fittings as follows:

1. Ducts: Construct of Manufacturer's standard gauge, with spiral lock seam and intermediate standing rib.
2. Fittings: Construct by fabricating with spot welding and bonding with neoprene-base cement in lieu of continuous weld seams.
3. Acceptable Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork Semco Mfg., Inc. or United Sheet Metal Div., United McGill Corp., or approved equal.

### PART 3 - EXECUTION

- 3.1 General: Examine areas and conditions under which HVAC metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of Metal Ductwork:

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints.



Align ductwork accurately at connections, within c" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.

- B. Supports: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.
- C. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements. Seal joints in round or oval ductwork with hard cast or shrink bands, and sheet metal screws, or bywelding.
- D. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally. Avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. In finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction or above suspended ceilings, unless specifically noted as "Exposed". Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- E. Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.
- F. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.
- G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards. Fan discharge outlet ducts shall be installed correctly with regard to "system effect" per AMCA Publication 201.

### 3.3 Installation of Flexible Ducts:

- A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6'-0" extended length. Flexible duct shall only be allowed as detailed on the drawings.
- B. Installation: Install in accordance with Section III of SMACNA's "HVAC Duct Construction Standards, Metal and Flexible". Support flexible ducts to eliminate pinching and kinking which would restrict flow.
- C. Downstream of VAV Boxes: Peel back insulation and slide the inner core over the spin-in or diffuser neck, seal with duct sealant and install Panduit strap tightly. Slide insulation back over the inner core and install another Panduit strap over the insulation outer jacket. Tape is not acceptable.
- D. Upstream of VAV Boxes: Install same as downstream, except use stainless steel worm-gear clamps instead of Panduit straps.
- E. Seal all exposed edges of fiberglass insulation with glassfab and mastic.

### 3.4 Leakage Tests: After each duct system is completed, test for duct leakage in accordance with Sections 3 and 5 of the SMACNA HVAC Air Duct Leakage Test



- Manual. Test pressure shall be equal to pressure class of duct, less 0.5" static pressure. Repair leaks and repeat tests until total leakage is less than 5% of system design air flow for low pressure systems and less than 1% for systems rated over 3".
- 3.5 Equipment Connections: Connect metal ductwork to equipment as indicated, provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.
- 3.6 Clean ductwork internally free of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration. Keep ducts closed with poly during construction to prevent contamination by construction dust and debris.
- 3.7 Balancing: Refer to Division-23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.
- 3.8 System Adjustment: Adjust the system to provide functional operation to the extent possible, and leave ready for Testing and Balancing work. It is not the intent of this section to provide final testing and balancing, but to leave the system operational with a minimum of noise.

END OF SECTION



## PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.
- 1.4 Refer to other Division-23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.
- 1.5 Codes and Standards:
  - A. SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible" and "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems".
  - B. UL Compliance: Construct, test, and label fire dampers in accordance with the latest UL Standard 555 "Fire Dampers and Ceiling Dampers".
  - C. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.
- 1.6 Approval Submittals:
  - A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions as follows:
    - 1. Low pressure manual dampers
    - 2. Control dampers
    - 3. Counterbalanced relief dampers
    - 4. Fire dampers
    - 5. Duct access doors
    - 6. Flexible connections
  - B. O&M Data Submittals: Submit manufacturer's maintenance data including parts lists for fire dampers. Include this data, product data, and a copy of approval submittals in O&M manual.

## PART 2 - PRODUCTS

- 2.1 Dampers:
  - A. Low Pressure Manual Dampers: Provide 20 gauge dampers of single-blade type (12" maximum blade width) or provide 16 gauge dampers of multi-blade type. Damper blades to be gang-operated from a single shaft with acetal bearings on each end. Provide indexed locking quadrant. Parallel or opposed blade style is acceptable. Provide 2" standoff on locking quadrant for externally insulated duct.
  - B. Control Dampers: Provide AMCA Standard 500-D certified dampers with parallel blades for 2-position control or opposed blades for modulating control. Construct blades of 16 gauge steel. Provide heavy-duty molded self-lubricating nylon bearings and 1/2" diameter steel axles spaced on 9" centers. Provide TPE blade seals. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 gauge channel for face areas over 25 sq. ft. Provide galvanized steel finish with aluminum touch-up. Actuators (motors) are provided by control contractor.
  - C. Counterbalanced Relief Dampers: Provide AMCA Standard 500-D certified dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static



pressure. Construct blades of aluminum, provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Provide TPE blade seals. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 gauge channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

- D. Acceptable Manufacturers: Subject to compliance with requirements, provide dampers by Air Balance, American Warming & Ventilating, Arrow Louver and Damper, Greenheck, or Ruskin Mfg. Co.

## 2.2 Fire Dampers:

- A. Fire Dampers: Provide curtain type fire dampers, UL classified and labeled per UL 555, of types and sizes indicated. Construct casings and blades of galvanized steel. Damper shall not restrict duct free area when open. Dampers shall be rated for dynamic closure under flow and pressure. Provide sleeves and mounting angles. Provide fusible link rated at 160 to 165°F unless otherwise indicated. Provide damper with positive lock in closed position. All dampers shall be spring activated. Basis of design:
1. 1-1/2 HR: Greenheck DFD - Style B for rectangular, Style CR for round, Style CO for oval.
  2. 1-1/2 HR: Greenheck DFD-110 for transfer grilles in narrow partitions.
  3. 1-1/2 HR: Greenheck ODFD-150 Style B for out of wall or floor installation.
  4. 3 HR: Greenheck DFD350 - Style B for rectangular, Style CR for round, Style CO for oval.
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide fire dampers by Air Balance, Inc., American Warning & Ventilating, Arrow Louver and Damper, Greenheck or Ruskin Mfg. Co.

## 2.3 Turning Vanes: Provide manufactured or fabricated single wall turning vanes and vane runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards".

## 2.4 Duct Access Doors:

- A. General: Provide duct access doors of size indicated, or as required for duty indicated.
- B. Construction: Construct of same or greater gauge as ductwork served. Provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.
- C. Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Air Balance, Inc., Duro Dyne Corp., Ruskin Mfg. Co., or Ventfabrics, Inc.

## 2.5 Flexible Connections:

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.
- B. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.



### PART 3 - EXECUTION

- 3.1 Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
- 3.2 Installation of Ductwork Accessories:
- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
  - B. Install balancing dampers at all main ducts adjacent to units in return air, outside air and where indicated.
  - C. Install control dampers in the outside air duct and return air duct for each air handler. Damper Motor provided by control contractor.
  - D. Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
  - E. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
  - F. Install flexible connections in ductwork such that the clear length of the connector is approximately two inches. Provide thrust restraints as required. Flexible material shall not be so slack as to take a definite concave or convex shape during fan operation.
  - G. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
  - H. Install fire dampers within fire walls and floors at locations shown on the mechanical drawings. Install in strict accordance with the manufacturer's printed instructions, NFPA 90A, and UL 555. Basis of design installation is detailed on the drawings. Provide out of wall dampers where indicated on the drawings.
  - I. Install ceiling fire dampers to protect openings in rated ceilings at locations shown on the mechanical drawings. Install in strict accordance with the manufacturer's printed instructions, NFPA 90A, and UL 555. Provide diffuser radiation shields where required. Basis of design installation is detailed on the drawings.
- 3.3 Fire Dampers: Notify Engineer at least 24 hours in advance of ceiling installation or chase closure so that complete fire damper installation can be observed. A copy of the manufacturer's printed installation instructions shall be available at the site.
- 3.4 Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories as required to obtain proper operation and leakproof performance.
- 3.5 Adjusting and Cleaning:
- A. Adjusting: Adjust ductwork accessories for proper settings. Install fusible links in fire dampers and adjust for proper action.
  - B. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting, and Balancing". However, the system shall be left functional with all dampers open or throttled.
  - C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
  - D. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION







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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

### 1.2 Description of Work:

- A. Extent of air handler variable frequency drives work required by this Section is indicated on drawings and schedules, and by requirements of this Section.
- B. Refer to Division 26 sections for power supply wiring from power source to power connection on variable frequency drives; not work of this Section.

### 1.3 Quality Assurance:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of variable frequency drives for the HVAC industry with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five years.

### 1.4 UL Compliance: Provide variable frequency drives and components which are listed and labeled by Underwriters' Laboratories.

### 1.5 Submittals:

- A. Product Data: Submit manufacturer's drive specifications and installation and start-up instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
- C. Maintenance Data: Submit maintenance data and parts lists.

### 1.6 Product Delivery, Storage, and Handling:

- A. Handle variable frequency drives and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged drives or components; replace with new.
- B. Store drives and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
- C. Comply with manufacturer's installation instructions for unloading drives and moving them to final location.

### 1.7 Warranty:

- A. All units shall be warranted for a period of 18 months from date of shipment. Any warranty expense during that time shall be born entirely by the manufacturer, including any travel costs or living expenses necessary to repair in warranty equipment.

## PART 2 - PRODUCTS

### 2.1 Variable Frequency Drive:

- A. General:
  - 1. The variable torque AC drive shall consist of an adjustable frequency controller capable of driving a standard AC induction motor.
  - 2. The variable frequency controller shall convert 460 volts  $\pm 10\%$  three phase 60 HZ utility power to an adjustable frequency output for speed control from 10% to 200% of base speed. The adjustable frequency control shall be designed



exclusively for variable speed applications. The drive must be modifiable to accept all standard input voltages.

B. Basic Design:

1. The variable frequency drive (VFD) shall produce adjustable frequency and voltage output. To eliminate the need for isolation transformers and/or line suppression equipment, input line filters will be an integral part of the input section of the drive.
2. To minimize motor noise generation, the drive output will be six-step. Drives employing a pulse width modulation output wave form shall not be acceptable.
3. The variable frequency drive shall comply with the FCC rules and regulations part 15 subpart J regarding radio frequency interference.
4. Line noise created shall be no greater than three percent (3%) harmonic distortion and no more than a 16,400 volt-microsecond commutation notch area, in accordance with IEEE standard 519-1981 for special applications.
5. Ambient conditions - 0-40°F) to 95% non-condensing, elevation to 1000 meters (3300 feet) without derating.

C. Control Panel:

1. The operator's control panel shall include the following:
  - a. Manual Bypass
  - b. Hand/Off/Auto Switch
  - c. Local/Remote Switch
  - d. Manual Speed Control
  - e. Meter Function Selector
2. The control panel shall include a back lit LCD meter that will display % speed, % load, or output voltage. The desired display is selected by a push button.
3. The control logic for the drive shall contain the following customer adjustment potentiometers:
  - a. Minimum Speed Adjustment
  - b. Maximum Speed Adjustment
  - c. Gain and Offset Adjustments for Signal Follower
  - d. Current Limit
4. The VFD shall include the following drive status indicator lights on the control panel:
  - a. Power On
  - b. Ready
  - c. Overvoltage
  - d. Overcurrent
  - e. Running at commanded speed
  - f. Run
  - g. Fault
  - h. Reverse
  - i. Phase Loss
  - j. Over Temperature
  - k. Ground Fault
  - l. External Fault



5. In addition, the drive shall contain customer settable DIP switches to control the following functions:
  - a. Acceleration Time: Adjustable from approximately 3 to 280 seconds
  - b. Deceleration Time: Separately adjustable from approximately from 3 to 280 seconds
  - c. Fault Counter Reset: To limit fault reset attempts to seven, the fault counter reset is turned on
  - d. Variable Overload: To protect motor from excess current at low speeds
  - e. Individual Selectable Resettable Fault Control: Automatic functioning of the fault counter reset can be allowed or denied for ground fault, and phase loss fault.
  - f. High Starting Torque: 125% torque can be selected for starting
  - g. Follower Selection
  - h. Deceleration Control or Coast to Rest
  - i. Reverse Rotation
  - j. Output Frequency: 50 or 60 Hz
  - k. Output Voltages: 200/208, 230, 380, 415, 460, and 575 VAC
6. The following troubleshooting lights shall be supplied:
  - a. Bus Power
  - b. Commutation Drive
  - c. Conduction Drive
  - d. Commutation Power Supply
  - e. Run Command

D. Features:

1. In addition to the start/stop and variable speed features in the drive, the following features shall be supplied as standard:
  - a. 4-20mA or 0-10VDC follower capability
  - b. Floating input (accepts ground signal, 1K ohm impedance to drive ground)
  - c. Current limit protection
  - d. Independently adjustable acceleration and deceleration
  - e. Automatic restart
  - f. Over voltage protection
  - g. Over temperature protection
  - h. Ground fault protection
  - i. 96% efficiency

E. All steel enclosure, NEMA-3R.

F. Hinged, locking door.

2.2 Quality Assurance:

- A. To improve quality and eliminate premature failures, all VFDs shall be pretested at an elevated ambient temperature.

2.3 Manufacturers:

- A. Subject to compliance with requirements, manufacturers offering variable frequency drives which be incorporated in the work include the following:

1. ABB 550

PART 3 - EXECUTION



3.1 Inspection:

- A. Examine areas and conditions under which variable frequency drives are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of Drives:

- A. General: Install variable frequency drives where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that system complies with requirements and services intended purposes.
- B. Access: Provide access space around drives for service as indicated, but in no case less than recommended by manufacturer.

3.3 Start-Up and Cleaning:

- A. The manufacturer shall provide start-up assistance in the form of a factory trained service technician. When factory authorized start-up is performed, the warranty shall be extended to 36 months from date of shipment.
- B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

### 1.2 Description of Work:

- A. Extent of air cleaning work required by this Section is indicated on drawings and schedules, and by requirements of this Section. Types of air cleaning equipment specified in this Section include air filters (replaceable and automatic roll), filter holding systems (front, rear and side access), and filter gauges.
- B. Field installed control wiring shall be work of this Section. Refer to Division 26 for power wiring; not work of this Section.

### 1.3 Quality Assurance:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air cleaning equipment of types and sizes required, whose products have been in satisfactory use in similar service for not less than five years.
- B. NFPA Compliance: Comply with applicable portions of NFPA 90A and 90B, and NEC pertaining to installation of air filters and associated electric wiring and equipment.
- C. ASHRAE Compliance: Comply with provisions of ASHRAE Standard 52 for method of testing, and for recording and calculating air flow rates.

### 1.4 Submittals:

- A. Product Data: Submit manufacturer's technical product data including, dimensions, weights, required clearances and access, flow capacity including initial and final pressure drop at rated air flow, efficiency and test method, fire classification, and installation instructions.
- B. Wiring Diagrams: Submit wiring diagrams for power, interlock, and control wiring. Differentiate between factory-installed and field-installed wiring.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. Manufacturers offering air cleaning equipment which may be incorporated in the work include American Air Filter Co., (An Allis-Chalmers Co.), Cambridge Filter Corp., Continental Filter Corp., Farr Co., and Flanders Filters, Inc.

### 2.2 Air Filters:

- A. Ring Panel Filters (Moisture Resistant): Provide polyester antimicrobial self-sealing, ring and link 2-ply filter with unitized construction and fully sealed perimeter and at points on the face such that the inner wire frame supports the filter through the full range of rated velocity and filter loading. Initial filter resistance shall be less than 0.30" w.g. at 500 fpm and 70% efficient for particles greater than 5 um. Filters shall require no fasteners or clips.
- B. Replaceable (Throwaway) Panel Filters: Provide factory-fabricated, viscous-coated, flat panel type replaceable air filters with holding frames; with 2" thick UL Class 2 throwaway media material. Construct media of interlaced glass fibers, spray with nonflammable adhesive, frame in throwaway fiberboard casings, and sandwich between perforated metal grills. Construct ductwork-holding frames of 20-gauge galvanized steel, capable of holding media and media frame in place, and gasketed to prevent unfiltered air by-passing between media frames and holding members.



Provide filters with rated face velocity of 500 fpm, initial resistance of not greater than 0.30" w.g., final rated resistance of 0.50" w.g., and average arresstance of 80%. Basis of design: American Air Filter 5700.

- C. Extended Surface Filters: Provide high efficiency factory-fabricated, dry, supported, extended surface filters with holding frames; where shown, in sizes indicated. Equip with UL Class 1 water resistant fibrous media material formed into 12" deep V-shaped pleats and held by self-supporting wire frames. Construct ductwork-holding frames of 18-gauge galvanized steel, capable of holding media and media frame in place, and gasketed to prevent unfiltered air by-passing between media frames and holding members. Provide filters with rated face velocity of 500 fpm, initial resistance of not greater than 0.60" w.g., final rated resistance of 1.2" w.g. Basis of design: American Air Filter Varicel.
- D. Extended Surface Self Supporting Filters: Provide high efficiency factory-fabricated, dry, supported, extended surface filters with holding frames; where shown, in sizes indicated. Equip with UL Class 1 water resistant fibrous media material so that individual pleats are maintained in tapered form by flexible supports under rated flow conditions. Construct ductwork-holding frames of 18-gauge galvanized steel, capable of holding media and media frame in place, and gasketed to prevent unfiltered air by-passing between media frames and holding members. Provide filters with rated face velocity of 500 fpm, initial resistance of not greater than 0.60" w.g., final rated resistance of 1.0" w.g. Basis of design: American Air Filter DriPak.

### 2.3 Filter Holding Systems:

- A. Front and Rear Access Filter Frames: Provide filter bank framing system, constructed of aluminum framing members having minimum thickness of 0.09". Design system for either upstream (front) or downstream (rear) filter servicing. Cut to size and pre-punch members for easy assembly into modules of size and capacity as scheduled or noted on drawings. Provide permanently gasketed framing members to prevent bypass of unfiltered air. If vertical support members are required to prevent deflection of horizontal members, install so as not to interfere with either installation or operation of filters. Incorporate separate track for prefilters, removable from front, or removable from back after removal of after-filters. Provide factory-installed positive sealing device for each row of filters, to insure seal between gasketed filter elements. Provide hardware necessary for field assembly.
- B. Side Servicing Housings: Provide factory-assembled side servicing housings with flanges for insertion into ductwork system as indicated. Construct of 16-gauge galvanized steel. Provide integral pre-filter tracks to accommodate 2" throw-away or cleanable filters. Provide access doors with continuous gasketing on perimeter and positive locking devices. Incorporate positive-sealing gasket material on channels to seal top and bottom of filter cartridge frames to prevent bypass. Arrange so filter cartridges can be loaded from either access door.

### 2.4 Filter Gauges:

- A. Provide manometer-type filter gauge for each filter bank, with logarithmic curve tube gauge, and integral leveling gauge, graduated to read from 0-3" w.g.

## PART 3 - EXECUTION

### 3.1 Installation:

- A. Install air filters and holding devices in accordance with air filter manufacturer's written instructions and with recognized industry practices. Install filters in proper position to



prevent passage of unfiltered air. Locate each filter unit accurately in position indicated. Position unit with sufficient clearance for normal service and maintenance. Anchor filter holding frames securely to substrate. Coordinate as necessary to interface installation of filters properly with other work.

- B. Install and provide wiring for electrical devices furnished by manufacturer but not specified to be factory-mounted. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment Installer.
- C. Install air filter gauge pressure taps upstream and downstream of filters to indicate air pressure drop through air filter. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level inclined gauges if any, for proper readings

3.2 Field Quality Control:

- A. Operate installed air filters to demonstrate compliance with requirements. Test for air leakage of unfiltered air while system is operating. Correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.

3.3 Extra Stock:

- A. Provide one complete extra set of filters for each air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed, and the extra set has been received.

END OF SECTION



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PART 1 - GENERAL

- 1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- 1.2 Division-23 Basic Mechanical Materials and Methods sections apply to work of this section.
- 1.3 Refer to other Division-23 sections for other devices installed piping system, supports, Testing, Adjusting, and Balancing, Building Automation System.
- 1.4 Refer to Division-23 section "Vibration Isolation" for vibration isolation.
- 1.5 Extent of work required by this section as indicated on drawings and schedules, and by requirements of this section.
- 1.6 Refer to Division 26 sections for power supply wiring from power source to power connection; not work of this Section. All fan power cabling shall be installed in raceway.
- 1.7 Codes and Standards:
  - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of custom air handling units for the HVAC industry with characteristics, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five years.
  - B. Regulatory Requirements: Comply with the codes and standards specified.
  - C. must be manufactured in an ISO 9001 registered facility.
  - D. AMCA 99 - Standards Handbook.
  - E. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.
  - F. AMCA 300 - Test Code for Sound Rating Air Moving Devices.
  - G. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.
  - H. AMCA 500 - Test Methods for Louver, Dampers, and Shutters.
  - I. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment
  - J. AHRI 410 - Forced Circulation Air-Cooling and Air-Heating Coils.
  - K. AHRI 430 - Standard for Central Station Air Handling Units
  - L. NFPA 70 - National Electrical Code.
  - M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - N. NFPA 262 - Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
  - O. SMACNA - HVAC Duct Construction Standards Metal and Flexible.
  - P. UL 900 - Test Performance of Air Filter Units.
- 1.8 Quality Assurance:
  - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
  - C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning".
  - D. Comply with NFPA 70 for unit and all auxiliary components.
  - E. Performance Ratings: Conform to AHRI Standards; bear AHRI 430 certified rating seal. If unit is not AHRI 430 rated, unit shall be tested in accordance with the standards to establish acceptability.
  - F. Sound Ratings: Test air handling unit in accordance with AMCA 300 (ASHRAE 68) and AHRI 260 Guidelines.



- G. Air Coils: Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.
- H. Equipment shall fit into the space available with adequate clearances meeting manufacturer's requirements for service and as determined by the Engineer. The Contractor shall not assume that all of the manufacturers listed as acceptable manufacturers will provide a unit that will fit in the space allocated.

1.9 Approval Submittals:

- A. Product Data: Submit manufacturer's product data to include the following:
  - 1. Provide all technical information relevant to the product being provided, including but not limited to all the information shown on the drawing schedules and of this section. It is the responsibility of the supplier to highlight any variances in equipment characteristics.
  - 2. Dimensions, weights, capacities, certifications, shipping splits, component performance, electrical characteristics, casing construction details, wiring interconnections, gauges, and finishes of materials.
  - 3. Provide fan curves with specified operating points clearly plotted.
  - 4. Provide coil selection worksheets at scheduled operating points. Clearly indicate proper consideration for altitude and air density. Indicate coil tube fin and casing construction.
  - 5. Provide filter information, including initial APD, final APD, dust spot efficiency, final dust holding capacity, filter media description, filter frame details, and filter removal details.
  - 6. Submit sound power levels for both air handling unit inlet, outlet, and radiated at rated capacity. If the unit exceeds sound power levels at scheduled conditions, the manufacturer must provide sound attenuators and meet specified brake horsepower requirements without additional connected power requirements.
  - 7. Submit electrical requirements for power supply wiring including wiring diagrams interlocks and control wiring. Clearly indicate factory installed and field installed wiring. Submit load amperage draw, required, maximum overcurrent protection, and short circuit current ratings. Short circuit current rating shall be no less than 65kA.
- B. Coordination Drawings: Floor plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Mechanical-room or space layout and relationships between components and adjacent structural and mechanical elements.
  - 2. Support location, type, and weight.

1.10 Warranty:

- A. The complete unit shall be covered by a parts warranty issued by the manufacturer covering the first year of operation. This warranty period shall start upon receipt of start-up forms for the unit or eighteen months after the date of shipment, whichever occurs first.
- B. The installing contractor shall provide labor warranty during the unit's first year of operation.

PART 2 - PRODUCTS

- 2.1 Manufacturers: Subject to compliance with requirements, provide product indicated on



schedules by one of the following: Temtrol, York Solution, Haakon, or Ingenia.

2.2 Casing Construction and Performance:

- A. Exterior Panel: Provide minimum 16-gauge coated galvanized steel.
- B. Forming: Form walls, roofs, and floors as required for minimal deflection. Maximum deflection at any point on the unit casing shall be limited to 1/200th of the overall panel width or height. The unit casing leakage shall not exceed 0.5 CFM per square foot of cabinet area at the scheduled inches positive or negative static pressure.
- C. Casing Joints: Provide no-through metal construction to preclude fastener condensation and heat transfer. Field joints are only acceptable at shipping splits and shall be installed to match appearance and performance of factory joints.
- D. Sealing: Seal all joints with water-resistant sealant to comply with leakage requirement. Field applied sealant is only acceptable at shipping splits and shall be installed to match appearance and performance of factory applied sealant.
- E. Interior Liner: Provide minimum 20-gauge galvanized steel in all sections.
- F. Casing air leakage shall be field tested to less than 1% at 8" wg positive or negative pressure.

2.3 Casing Insulation and Fastening:

- A. Materials: Provide 2 inch thick, R-12 minimum foam insulation that complies with NFPA 90A and 90B and have a fire hazard classification of 25/50 (per ASTM-84 and ULF 723).
- B. Location and Application: Factory applied in all sections to extend fully inside each casing section to the internal surface of panels. Secure insulation tightly within casing to preclude movement and maximize thermal performance. Insulation shall be installed and sealed between outside and inside casing.

2.4 Base Construction:

- A. Provide heavy gauge structural steel tubing, C-channel, or I-beam welded perimeter construction with external lifting lugs and internal welded cross members to support internal unit components. Provide no-through metal construction to preclude fastener condensation and heat transfer. Field joints are only acceptable at shipping splits and shall be installed to match appearance and performance of factory joints.
- B. Provide 2" floor cavity closed cell spray foam insulation with embedded drain pans and piping. Insulation shall be UL 94HF1 rated and sealed between the bottom liner and floor liner.
- C. Floor Liner: Provide continuous 0.125 in aluminum checker plate flooring installed on the base framing with attachment and reinforced from below such that no mechanical fastening is required from above.
- D. Provide no-through metal construction to preclude fastener condensation and heat transfer. Field joints are only acceptable at shipping splits and shall be installed to match appearance and performance of factory joints.
- E. Sealing: Seal all joints with water-resistant sealant to comply with leakage requirement. Field applied sealant is only acceptable at shipping splits and shall be installed to match appearance and performance of factory applied sealant.
- F. Bottom Liner: Provide minimum 20-gauge galvanized steel in all sections.
- G. Air leakage rates shall be less than 1% at 8" wc.

2.5 Access Doors:

- A. Door Fabrication: Formed, reinforced, and welded, double-wall and insulated panels with thermal breaks of same materials, thicknesses, and performance as casing.



- B. Hinges: A minimum of two wedge-lever-type latches, operable from inside and outside. Provide Ventlock 310 high pressure latches. Arrange doors to be opened against air-pressure differential.
- C. Gasket: Neoprene, applied around entire perimeters of panel frames.
- D. Fabricate windows in all doors of double-glazed, safety glass with an air space between panes and sealed with interior and exterior rubber seals.
- E. Size: At least 18 inches wide by 5'-10" or full height of unit where the height of the unit does not allow a full height door. Fan access section door must be width of largest motor size.
  - 1. Minimum locations and size (refer to drawings for basis of design):
    - a. Access Section: 2'-0"
    - b. Cooling Coil Section: 2'-4"
    - c. Preheat Coil Section: 1'-0"
    - d. Filter Section: 8"
    - e. Motor: 1'-6"
- F. Service Light: 100-W equivalent LED fixture in each section with single switched junction box located outside fan section door.

2.6 Drains:

- A. Condensate Drain Pans:
  - 1. Fabricated double bottom style 16-gauge stainless steel drain pan with welded corners and two percent slope in three planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) to direct water toward drain connection. Extend drain pan 8" past face of coil to collect any carryover moisture.
  - 2. Drain Connection: Located at lowest point of pan and sized to prevent overflow or accumulation. Terminate with threaded nipple on one or both ends of pan.
  - 3. Provide stacked chilled water coils where height of the unit exceeds 36". Provide intermediate drain pan to collect condensate from top coil. Extend upper drain pan outlets to lower pan with stainless steel downspout.
- B. Access Section Drains:
  - 1. Provide floor type drain in all sections and terminate 1" outlet through base rail with cap.

2.7 Fan Array:

- A. Fan arrays shall consist of multiple direct-drive, modular plenum fans selected to provide the scheduled airflow at a minimum value of the sum of the scheduled external static pressure and the internal static pressure. Fans shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and motor horsepower. Fans shall have a sharply rising pressure characteristic extending through the operating range and continuing to rise beyond the peak efficiency to ensure quiet and stable operation. Fans shall have a non-overloading design with self-limiting horsepower characteristics and shall reach a peak in the normal selection area. All fans shall be capable of operating over the minimum pressure class limits as specified in AMCA's Standard 2408-69.
- B. Fans shall be tested in accordance with AMCA 210 and AMCA 300 test standards for air moving devices and shall be guaranteed by the manufacturer to deliver rated



published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for fan inlet sound, fan outlet sound, and air performance.

- C. Airfoil Fan Wheels: Wheels constructed entirely of aluminum to reduce weight and vibration. Airfoil blades shall be extruded aluminum, and continuously welded around all edges. The wheel and fan inlet are matched and have precise running tolerances for maximum performance and operating efficiency. In addition, fans shall be run tested at the specified operating speed prior to shipment. Each fan shall be dynamically balanced as a complete assembly to achieve Balance Quality Grade G6.3 for the rotating assembly. Maximum vibration shall be within the limits ANSI/AMCA 204 Fan Application Category BV-3. Balance readings shall be taken electronically in the axial, vertical, and horizontal directions. Records of each fan balance shall be made available upon request.
- D. Provide factory mounted flow ring at fan inlet and output signal to building automation system. Coordinate with building automation system signal requirements and provide all necessary hardware to output digital signal as required.
- E. Internal Vibration Isolation:
  - 1. An integral all welded steel vibration isolation base shall be provided for the fan and motor.
  - 2. Isolators shall be free standing with sound deadening pads and leveling bolts.
  - 3. Spring diameter to compressed operating height ratio shall be 1 to 1.
  - 4. The spring deflection shall be minimum of 2 in.
- F. Back-Draft Dampers:
  - 1. Each fan shall have an individual industrial grade low leak backdraft damper.
  - 2. Frame shall be minimum 9" deep x 2" (229 x 51) flanged 12 (2.8) gauge galvanized steel channel. The blades shall be maximum 7" (178) wide, minimum .080 (2) thick, 6063T5 extruded aluminum airfoil shaped with integral structural reinforcing tube running full length of each blade.
  - 3. Damper blades shall be equipped with silicone rubber seals mechanically locked into extruded blade slots. Adhesive type seals are not acceptable. Adhesive type seals are not acceptable. Dampers shall be equipped with vinyl jamb seals for low leakage application. Wind stop type seals are not acceptable.
  - 4. Axles shall be minimum 3/4" (19) diameter with machined edge to provide positive locking connection to blades. Full round axles are not acceptable.
  - 5. Bearings shall be ball style pressed into frame.
  - 6. Linkage shall be minimum 3/16" thick 3/4" (5 x 19) bar located on face of blade in airstream. Submittal must include leakage, pressure drop, and maximum pressure data based on AMCA Publication 500 testing.
- G. Motors:
  - 1. All fan motors shall comply with NEMA and IEEE for temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "HVAC Motors".
  - 2. Enclosure type shall be totally enclosed, fan cooled (TEFC) or open drip proof (ODP).
  - 3. All motors shall be NEMA Premium™ efficient motors as defined in NEMA MG 1.
  - 4. Motors shall be rated for continuous duty at full load at 40°C ambient temperature rise.
  - 5. Motor sizes shall be as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.15.



6. Motors shall be "inverter ready", complying with NEMA STD MG1 PART 31.4.4.2.
7. Motors shall have an insulation Class F.
8. Motors shall include a shaft grounding ring.

2.8 Filters:

- A. Prefilters: Filters shall be 30% efficient, MERV 7 pleated, disposable type. Each filter shall consist of a non-woven cotton and synthetic fabric media, media support grid, and enclosing frame. The filter shall be listed by Underwriters' Laboratories as Class 2.
- B. Prefilters shall be installed in a prefabricated channel rack.
- C. Prefilters shall be lift-out upstream of the filter.

2.9 Final Filters:

- A. Final filters shall be high performance, 2" deep pleated, totally rigid, and disposable type. Each filter shall consist of high density charged fiber media, media supports, and enclosing frame with gasket seal.
- B. Final filter media shall have an average of 90-95% on the ASHRAE Test Standard (52-76) and a MERV 15 rating. Filters shall be Underwriters' Laboratories Standard 900 approved. Basis of Design: Columbus Industries, Inc CI Micro Shield Zero-Bypass.
- C. Holding Frames: Holding frames shall be factory fabricated of 16 gauge galvanized steel and shall be equipped with gaskets on all 4 sides of the filter and 2 heavy duty positive sealing fasteners. Each fastener shall be capable of withstanding 25 lbs pressure without deflection and be attached or removed without the use of tools.
- D. Final filters shall be slide out through access door.

2.10 Water Coils:

- A. All coils shall meet or exceed all capacities specified on the mechanical schedule for the project at full rated conditions and part-load conditions. All coil performance shall be certified by the manufacturer in accordance with ARI Standard 410.
- B. Construct coils of configuration plate fins and seamless tubes. Aluminum 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.
- C. Construct coil casings of minimum 16 gauge steel with formed end supports and top and bottom channels. Coils in cooling service shall have stainless steel casings and coils in heating-only service shall have galvanized steel casings.
- D. Coils shall be fully enclosed within casing and cooling coils shall be on mounted 304 stainless steel angle racks manufactured to allow coils to slide out individually. Heating coils shall be mounted on galvanized angle racks manufactured to allow coils to slide out individually.
- E. Removable coil access panels shall be provided for removal of coils through the casing wall. Coils shall be individually removable away from the access side. Coils must be individually racked, removable through the side access panels.
- F. Pipe connections shall be on the same end, extended through the casing for ease of connection, employing a plate over the connection to minimize leakage, and shall be threaded flanged.
- G. Water coils shall be drainable.
- H. 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.
- I. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.



- J. Coil height shall not exceed 36". Provide multiple stacked coil as required.
- K. Construct headers of round copper pipe.
- L. Construct tubes of 0.625 O.D. minimum 0.025 thick of Copper and construct fins of 0.010 thick of Aluminum.
- M. Provide vent and drain for complete coil drainage.

2.11 UVC Light Fixture:

- A. UV-C fixturing shall consist of a power supply, power supply housing, "plenum rated" wiring loom, lamp plug, lamp-plug protector, encapsulated lamp, and lamp support.
- B. Power supply shall be CSA and UL Listed as a variable input type (120-277 Vac  $\pm 10\%$ ), 50-60 Hz with a programmed rapid start. They shall be designed as high power factor, class P, sound rated "A", type 1 outdoor and with inherent thermal protection and no PCBs. They shall be capable of operating in temperatures of from 33-190°F, designed to facilitate plug-and-play wiring and be capable of producing the specified output and organism destruction at no more than 15W of power consumption for each square foot of treated, cross sectional area. The power supply shall be capable of properly powering 1- 145W UV-C lamp or 1- or 2- 75W UV-C lamps while ensuring at least 9000 hours of lamp life, and with greater than 80% of its initial output, at the lamps "end of lamp life" phase. Power supply shall be protected against "end of lamp life" conditions, warranted for 5 years, and be labeled for field wiring. Power supply shall be installed interior or exterior to air handler within a power supply housing.
- C. Power supply housing shall be constructed of 20ga galvanized, powder coated steel. They shall be designed to facilitate NEC regulated power supply installation outside plenums. Each housing shall be capable of properly holding, grounding, and wiring either four or eight ballasts within to protect against electrical shock and moisture, as well as RF and EMI leaks.
- D. Plenum rated wiring looms shall be of sufficient length to facilitate lamp connection to a remotely located power supply. The lamp and loom shall be capable of being mounted anywhere in the system and/or as shown on the drawings. The loom shall meet UL Subject 13 and UL 1581, and Article 725 of the NEC. The loom jacket shall be constructed of UV-C resistant materials and shall have an internal aluminum/Mylar shield.
- E. Lamp plug shall be of the 4-pin type capable of accommodating a single-ended HO lamp.
- F. Lamp plug protector shall be of UV resistant materials and designed to shrink 3-1 over the lamp plug and wiring loom for protection against electrical shock, moisture, and separation.
- G. Lamp supports may be single or dual types, magnetically or permanently affixed within the irradiated cavity to interior surface of air handler or to vertical supports (by others). They shall be constructed of UVC resistant materials and provide for maximum flexibility in quick lamp positioning, removal, and holding power.
- H. Each lamp shall contain less than 8 milligrams of mercury and shall be hermetically laminated with a thin layer of UV-C transmissible Teflon® to provide protection against lamp breakage and to ensure lamp contents from a broken lamp are contained. Lamp life shall be 9000 hours with no more than a 20% output loss at the end of the lamp's life. Lamps shall be constructed with UV-C proof material bases and shall not produce ozone.
- I. Fixtureless lamps are to be installed in sufficient quantity and in such a manner so as to provide an equal distribution of the available UV-C energy. When installed, the UV-C energy produced shall be of the lowest possible reflected and shadowed losses and



shall be distributed in a 360-degree pattern within the cavity to provide the highest UV-C energy absorption by microbial products in the air.

- J. Intensity – The minimal UV-C energy striking a surface shall be sufficient to continuously destroy a mono-layer of mold and/or bacteria in less than one hour while operating in air temperatures of 1-70°C.
- K. Installation – The ballast housing shall be capable of installation within the air stream and/or within a power supply housing. Lamps shall be mounted to irradiate the intended surface(s) as well as all of the available line of sight airstream through proper lamp placement and incident angle reflection.
- L. All doors to any UV-C assembly and/or within view of any UV-C assembly must include mechanical interlock switch to ensure that all UV-C assemblies will be de-energized when any of these accesses are opened.
- M. Provide auxiliary relay to control the UV-C lights via building automation system.

2.12 Variable Frequency Drives:

- A. Comply with applicable requirements in Division 23 Section "Variable Frequency Drives".
- B. All motors in the fan array shall be provided with an individual VFD without a bypass. All motor circuit protectors can be located in starting device enclosure or, if required by design, in a separate enclosure. Motor circuit protector enclosure must be located and mounted at a minimal distance from motors in the fan array. Provide remote indication and start/stop of individual fans by means of auxiliary contacts.
- C. Provide cooling provisions and filtration for VFD enclosure.

PART 3 - EXECUTION

3.1 Examination:

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine casing insulation materials and filter media before air-handling unit installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for hydronic, and condensate drainage piping systems and electrical services to verify actual locations of connections before installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Installation:

- A. Equipment Mounting:
  - 1. Arrange installation of units to provide access space around air-handling units for service and maintenance.
- B. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with new, clean filters upon building occupancy.
- C. Install filter-gauge, static-pressure taps upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum in accessible position. Provide filter gauges on filter banks, installed with separate static-pressure taps upstream and downstream of filters.

3.3 Connections:

- A. Comply with requirements for piping specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.



- B. Install piping adjacent to air-handling unit to allow service and maintenance.
- C. Connect piping to air-handling units with flexible connectors.
- D. Connect condensate drain pans and extend to nearest floor drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.
- E. Hot- and Chilled-Water Piping: Comply with applicable requirements in Division 23 Section "Hydronic Piping" and Section "Hydronic Piping Specialties". Install shutoff valve and union or flange at each coil supply connection. Install balancing valve and union or flange at each coil return connection.
- F. Connect duct to air-handling units with flexible connections. Comply with requirements in Division 23 Section "Ductwork Accessories".

3.4 Field Quality Control:

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
  - 1. Hydronic Leak Test: After installation, fill water coils with water, and test coils and connections for leaks.
  - 2. Airside Leak Test: Completely pressurize casing and field pressure test any unit requiring field assembly. Field assembled units shall be tested for 1% or less leakage at design airflow and 8" wg at positive and negative pressure. Test shall be conducted without additional sealant systems required by factory and with only blank-offs at inlet and outlet.
  - 3. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Make corrections.
- C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections. Make correction at manufacturer's direction and retest for compliance.
- D. Prepare test and inspection reports once units are operational. Include description of corrective actions taken for any failed tests and inspections.

3.5 Adjusting:

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Division 23 Section "HVAC Testing and Balancing" for air-handling system testing, adjusting, and balancing.

3.6 Cleaning:

- A. After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems and after completing startup service, clean air-handling units internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters following cleaning.

END OF SECTION



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PART 1 - GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the electrical work as herein called for and shown on the drawings.
- 1.2 Related Documents:
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
  - B. This is a Basic Requirements Section. Provisions of this section apply to work of all Division 26 sections.
  - C. Review all other contract documents to be aware of conditions affecting work herein.
  - D. Definitions:
    - 1. Provide: Furnish and install, complete and ready for intended use.
    - 2. Furnish: Supply and deliver to project site, ready for subsequent requirements.
    - 3. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.
- 1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.7 Field Measurements and Coordination:
- A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications.
  - B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
  - C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with a minimum cutting and patching.
  - D. Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on electrical drawings, be guided by architectural details and conditions existing at job



and coordinate this work with that of others.

- E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings, and passageways. Cut no structural members without written approval.
- F. Carefully examine any existing conditions, wiring, devices, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- G. Because of the small scale of the drawings, it is not possible to indicate all precise locations for all devices and equipment. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate devices, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or raceway cannot be fitted, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee:

- A. The Contractor shall guarantee labor, materials, and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- B. Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

1.9 Approval Submittals:

- A. When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
  - 1. Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
    - a. Submittals shall be properly organized in accordance with the approved submittal control log.
    - b. Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
    - c. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
    - d. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the coversheet.



- e. Submittals that include a series of fixtures or devices (such as lighting or panelboards) shall be organized by the device name or type and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether those items are used on other fixtures.
  - f. Do not include pages in submittal which do not apply to the project. If submittal includes products not intended for installation, clearly indicate all materials in the submittal which are intended for installation.
  - g. The electrical design shown on the drawings supports the equipment basis of design specifications at the time of design. If equipment by any division is submitted with different electrical requirements, it is the responsibility of the submitting contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the proposed electrical configuration in the relevant submittal with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost.
- B. If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- C. Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.
- D. Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations, and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications, and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports, and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

## PART 2 - PRODUCTS

- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the



best of their respective kinds, suitable for the conditions and duties imposed on them at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

- A. All equipment and materials shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- B. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings, and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated, or painted.
- C. The label of the approving agency, such as UL, by which a standard has been established for the particular item, shall be in full view.
- D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.
- H. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

- A. Where a particular system, product or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product, or material specified.
- B. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
  - 1. Required product cannot be supplied in time for compliance with Contract time requirements.
  - 2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.
  - 3. Substantial cost advantage is offered to Owner after deducting offsetting disadvantages including delays, additional compensation for redesign,



investigation, evaluation, and other necessary services and similar considerations.

- C. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:
1. Principal of operation.
  2. Materials of construction or finishes.
  3. Thickness of gauge of materials.
  4. Weight of item.
  5. Deleted features or items.
  6. Added features or items.
  7. Changes in other work caused by the substitution.
  8. Electrical ratings and properties.
  9. If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

### PART 3 - EXECUTION

- 3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any installation which is not orderly and reasonably neat, or does not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.
- 3.2 Coordination:
- A. The Contractor shall be responsible for complete coordination of the electrical systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for raceway or other appurtenances passing through slabs or walls.
  - B. Any additional steel supports required for the installation of any electrical equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.
  - C. It shall be the Contractor's responsibility to see that all equipment such as terminal cabinets, fire alarm components, control panels, and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.
  - D. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.
  - E. The contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
  - F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.
  - G. Start of work will be construed as acceptance of suitability of work of others.



- 3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.
- 3.4 Phasing: Provide all required temporary wiring, lighting, fire alarm, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.
- 3.5 Cutting and Patching: Notify General Contractor to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts, and washers. Level equipment.
- 3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 26. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.8 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.9 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.10 Record Drawings:
- A. During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all switches, receptacles, devices, equipment, and other systems which are not installed exactly as shown on the contract drawings.
  - B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.
- 3.11 Acceptance:
- A. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
  - B. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
  - C. Operation and Maintenance Manuals: Provide O&M manual as dictated by Division 1. Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section.



Manuals shall contain:

1. Detailed operating instructions and instructions for making minor adjustments.
  2. Complete wiring, control, and single line diagrams.
  3. Routine maintenance operations.
  4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
  5. Copies of approved submittals.
  6. Copies of all manufacturer's warranties.
  7. Copies of test reports and verification submittals.
- D. Record Drawings: Submit record drawings.
- E. Acceptance will be granted on the basis of tests and inspections of job. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.
- F. Control Diagrams: Frame under clear plastic and mount on equipment room wall.
- G. Single Line Diagrams: Frame under clear plastic and mount on equipment room wall.



PROJECT NAME  
PROJECT NUMBER

ARCHITECT: Company Name

ENGINEER: Mitchell Gulledge Engineering

CONTRACTOR: Contractor Name

SUBCONTRACTOR: Sub Name

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: mm/dd/yyyy

SECTION: 26 XX XX/Section Name

# SAMPLE

Any standard heading is acceptable.

1. Product 1: Manufacturer, Model
2. Product 2: Manufacturer, Model
3. Product 3: Manufacturer, Model
4. Product 4: Manufacturer, Model
5. Product 5: Manufacturer, Model

List each product individually. Include manufacturer name and model.

**Include GC or CM  
Approval stamp indicating  
review and acceptance by  
responsible contractor.**

END OF SECTION



## PART 1 - GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the fire protection work as herein called for and shown on the drawings.
- 1.2 This is a Basic Electrical Requirements section. Provisions of this section apply to work of all Division 26 sections.

## PART 2 - CODES

- 2.1 All work under Division 26 shall be constructed in accordance with the codes listed herein. The design has been based on the requirements of these codes; and while it is not the responsibility of the Contractor to verify that all work called for complies with these codes, he shall be responsible for calling to the Architect/Engineer's attention any drawings or specifications that are not in conformance with these or other codes prior to ordering equipment or installing work.
- 2.2 Comply with regulations and codes of utility suppliers.
- 2.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 2.4 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.
- 2.5 Additional codes or standards applying to a specific part of the work may be included in that section.
- 2.6 The following codes and standards shall govern all work:
  - A. Florida Building Code – Sixth Edition (2017)
  - B. Florida Building Code – Sixth Edition (2017) – Existing Building
  - C. Florida Building Code – Sixth Edition (2017) – Energy Conservation
  - D. Florida Building Code – Sixth Edition (2017) – Mechanical
  - E. Florida Building Code – Sixth Edition (2017) – Plumbing
  - F. Florida Building Code – Sixth Edition (2017) – Fuel Gas
  - G. Florida Building Code – Sixth Edition (2017) – Accessibility
  - H. Florida Fire Prevention Code Sixth Edition
    - 1. Fire Code (NFPA 1 – 2015 Edition)
    - 2. Life Safety Code (NFPA 101 – 2015 Edition)
  - I. National Electric Code (NFPA 70 – 2014)
  - J. Fire Alarm and Signaling Code (NFPA 72 – 2013)

## PART 3 - STANDARDS

All materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

- 3.1 Underwriters' Laboratories (UL)
- 3.2 American National Standards Institution (ANSI)
- 3.3 American Society of Testing Materials (ASTM)
- 3.4 National Fire Protection Association (NFPA)
- 3.5 National Electrical Manufacturers Association (NEMA)
- 3.6 Institute of Electrical and Electronics Engineers (IEEE)
- 3.7 National Electrical Contractors Association (NECA)
- 3.8 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- 3.9 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)



END OF SECTION



## PART 1 - DIVISION 1 - GENERAL REQUIREMENTS

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.2 This is a Basic Electrical Requirements section. Provisions of this section apply to work of all Division 26 sections.
- 1.3 Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 26 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

## PART 2 - DIVISION 3 - CONCRETE

- 2.1 Refer to Division 3, Concrete for:
  - A. Rough grouting in and around electrical work.
  - B. Patching concrete cut to accommodate electrical work.
- 2.2 The following is part of Division 26 work, complying with the requirements of Division 3:
  - A. Curbs, foundations, and pads for electrical equipment.
  - B. Man holes, hand holes, and vaults of electrical work.
  - C. Underground structural concrete to accommodate electrical work.
  - D. Concrete encasement of electrical conduits and cables.

## PART 3 - DIVISION 4 - MASONRY

- 3.1 Refer to Division 4, Masonry for:
  - A. Installation of access doors in walls.

## PART 4 - DIVISION 5 - METALS

- 4.1 Refer to Division 5, Metals for:
  - A. Framing openings for electrical equipment.
- 4.2 The following is part of Division 26 work:
  - A. Supports for electrical work.

## PART 5 - DIVISION 6 - WOOD AND PLASTIC

- 5.1 Refer to Division 6, Wood for:
  - A. Framing openings for electrical equipment

## PART 6 - DIVISION 7 - THERMAL AND MOISTURE PROTECTION

- 6.1 Refer to Division 7, Thermal and Moisture Protection for:
  - A. Installation of all roof curbs and roof supports for electrical work.
  - B. Caulking and waterproofing of all wall and roof mounted electrical work.
  - C. Providing all roof curbs and all flashing for metal roofs.
- 6.2 The following is part of Division 26 work, complying with the requirements of Division 7.
  - A. Fire barrier penetration seals.

## PART 7 - DIVISION 9 - FINISHES



7.1 Refer to Division 9, Finishes for:

- A. Painting piping, and equipment.
- B. Painting structural metal and concrete for electrical work.
- C. Painting access panels.
- D. Painting color-coded electrical work indicated for continuous painting. See color schedule in Division 26 section, "Electrical Identification".
- E. Installation of access doors in gypsum drywall.

7.2 Colors shall be selected by the Architect for all painting of exposed electrical work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.

7.3 Perform the following as part of Division 26 work:

- A. Touch up painting of factory finishes.
- B. Painting of all hangers.

PART 8 - DIVISION 10 - SPECIALTIES

8.1 Refer to Division 10 - Specialties for:

- A. Fire extinguishers and fire extinguisher cabinets and accessories.

PART 9 - DIVISION 11 - EQUIPMENT

9.1 Refer to Division 11 - Equipment for all food service equipment to be provided. This includes the cooking hoods with fire suppression.

9.2 Refer to Division 11 - Equipment for all laboratory equipment including cabinets, casework, student stations, demonstration desks, fume hoods, snorkel exhausts, canopy hoods, safety stations, eyewashes, and all related fixtures, fittings, and trim.

PART 10 - DIVISION 21 - FIRE PROTECTION

10.1 Fire Protection and Electrical Contractors shall coordinate the exact electrical requirements of all fire protection equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the fire protection equipment basis of design. If fire protection equipment is submitted with different electrical requirements, it is the responsibility of the fire protection contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the fire protection submittal with a written statement that this design will be provided at no additional cost. Fire Protection submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost to the Owner.

10.2 Electrical contractor shall provide disconnect switches, starters, and contactors for fire protection equipment unless specifically noted as being furnished as part of fire protection equipment.

10.3 Electrical contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all fire protection equipment, switches, starters, contactors, controllers, and similar equipment.

PART 11 - DIVISION 22 - PLUMBING

11.1 Plumbing and Electrical Contractors shall coordinate the exact electrical requirements of all plumbing equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the plumbing equipment basis of design. If



plumbing equipment is submitted with different electrical requirements, it is the responsibility of the plumbing contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the plumbing submittal with a written statement that this design will be provided at no additional cost. Plumbing submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost to the Owner.

- 11.2 Electrical contractor shall provide disconnect switches, starters, and contactors for plumbing equipment unless specifically noted as being furnished as part of plumbing equipment.
- 11.3 Electrical contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all plumbing equipment, switches, starters, contactors, controllers, and similar equipment.

#### PART 12 - DIVISION 23 - HVAC

- 12.1 Mechanical and Electrical Contractors shall coordinate the exact electrical requirements of all mechanical equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the mechanical equipment basis of design. If mechanical equipment is submitted with different electrical requirements, it is the responsibility of the mechanical contractor to resolve all required electrical design changes (wire and conduit size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the mechanical submittal with a written statement that this design will be provided at no additional cost. Mechanical submittals made with no written reference to the electrical design will be presumed to work with the electrical design. Any corrections required will be at no additional cost to the Owner.
- 12.2 Mechanical contractor shall provide all HVAC control wiring including the Energy Management Control system sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26. The intent is for the mechanical contractor to be responsible for the entire HVAC control system, including point-to-point wiring, and associated raceway and boxes. Electrical contractor shall notify mechanical contractor upon discovery of any mechanical controls installation which does not meet Division 26 requirements.
- 12.3 Electrical Contractor is expected to be familiar with the entirety of the mechanical scope. Review mechanical sheets, specifications, and other portions of the Contract Documents prior to bidding. Electrical Contractor is responsible for all line voltage (greater than 100V) work unless otherwise noted. Electrical Contractor shall coordinate with Mechanical Contractor, and shall make themselves available as necessary to support the mechanical scope.
- 12.4 Electrical contractor shall provide disconnect switches, starters, and contactors for mechanical equipment unless specifically noted as being furnished as part of mechanical equipment.
- 12.5 Electrical contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all mechanical equipment, switches, starters, contactors, controllers, and similar equipment.

#### PART 13 - DIVISION 27 - COMMUNICATIONS

- 13.1 Electrical and Communications Contractors shall coordinate the exact Communications requirements of all electrical equipment being provided. Where



approval submittals are required, this coordination shall be accomplished prior to making the submittals. The Communications design shown on the drawings supports the electrical equipment basis of design. If electrical equipment is submitted with different Communications requirements, it is the responsibility of the electrical contractor to resolve all required Communications design changes (e.g. input/output voltage) and clearly show the new Communications design on the electrical submittal with a written statement that this design will be provided at no additional cost. Electrical submittals made with no written reference to the Communications design will be presumed to work with the Communications design. Any corrections required will be at no additional cost to the Owner.

- 13.2 Electrical Contractor is expected to be familiar with the entirety of the communications scope. Review communications sheets, specifications, and other portions of the Contract Documents prior to bidding. Electrical Contractor is responsible for all line voltage (greater than 100V) work unless otherwise noted. Electrical Contractor shall coordinate with Communications Contractor, and shall make themselves available as necessary to support the communications scope.
- 13.3 Unless otherwise instructed by Construction Manager or General Contractor, Division 26 shall be responsible for Division 27.

#### PART 14 - DIVISION 28 - ELECTRONIC SAFETY AND SECURITY (ESS)

- 14.1 Electrical and ESS Contractors shall coordinate the exact electrical requirements of all ESS equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the ESS equipment basis of design. If ESS equipment is submitted with different electrical requirements, it is the responsibility of the ESS contractor to resolve all required electrical design changes (e.g. input/output voltage) and clearly show the new electrical design on the ESS submittal with a written statement that this design will be provided at no additional cost. Electrical submittals made with no written reference to the ESS design will be presumed to work with the electrical design. Any corrections required will be at no additional cost to the Owner.
- 14.2 Electrical Contractor is expected to be familiar with the entirety of the fire alarm scope. Review fire alarm sheets, specifications, and other portions of the Contract Documents prior to bidding. Electrical Contractor is responsible for all line voltage (greater than 100V) work unless otherwise noted. Electrical Contractor shall coordinate with Fire Alarm Contractor, and shall make themselves available as necessary to support the fire alarm scope.
- 14.3 ESS contractor shall provide ESS modules, detectors, and other appurtenances for unless specifically noted as being furnished as part of electrical equipment.
- 14.4 ESS contractor shall provide all ESS wiring, raceway and devices, and make final ESS connections to all electrical equipment, detectors, modules, contacts, controllers, and similar equipment.
- 14.5 Unless otherwise instructed by Construction Manager or General Contractor, Division 26 shall be responsible for Division 28.

#### PART 15 - DIVISION 31 - EARTH WORK

- 15.1 Refer to Division 31, Sitework for:
  - A. Coordination with work of other trades.
  - B. Site domestic water piping.
  - C. Additional site electrical work.
- 15.2 The following work is part of Division 26:



- A. All site electrical conduit, wiring, boxes, lights, and other appurtenances, except where provided by Utility.

END OF SECTION



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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. Division 26 Basic Materials and Methods sections apply to work of this Section.

### 1.2 Summary:

- A. The extent of electrical grounding and bonding work is indicated by drawings and schedules and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment.
- B. The type of electrical grounding and bonding work specified in this Section includes the following:
  - 1. Solidly grounded.
- C. Applications of electrical grounding and bonding work in this Section include the following:
  - 1. Electrical power systems.
  - 2. Grounding electrodes.
  - 3. Separately derived systems.
  - 4. Raceways.
  - 5. Service equipment.
  - 6. Enclosures, pull boxes, junction boxes, etc.
  - 7. Equipment.
- D. Refer to other Division 26 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work.

### 1.3 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

### 1.4 Codes and Standards:

- A. Codes and Standards:
  - 1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction, and current NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.
  - 2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors". Provide grounding and bonding products which are UL listed and labeled for their intended usage. Solder lugs are not acceptable.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. All products shall be the produce of reputable and reliable manufacturers.



- B. The following manufacturers are recognized as being reputable and reliable:
  - 1. Burndy, Inc.
  - 2. Erico, Inc.
  - 3. Harger, Inc.
  - 4. Thermoweld, Inc.
- C. Additional manufacturers shall be considered reputable and reliable only if they verifiably satisfy the following requirements:
  - 1. History: Acceptable manufacturers shall have a history of producing similar products at least the past ten years. Such products shall have been sold in the state of Florida for at least the past five years.
  - 2. Volume: Acceptable manufacturers shall have produced and sold similar products in excess of one hundred (100) times annually the amount of product projected for used in this project. This requirement shall apply to each of the past ten years.
  - 3. Similar projects: Acceptable manufacturers shall have sold similar products which have been used in at least five similar projects in the past five years. Similar projects must be of a similar use, overall cost, and overall size.
- D. Documentation of the above manufacturer requirements shall be provided to Engineer upon request, but is otherwise unnecessary. If documentation is required, it shall consist of a signed statement from Manufacturer's representative on Manufacturer's letterhead (or the letterhead of Manufacturer's approved representative). Additional documentation may be required in rare cases.
- E. Any submittal by Contractor shall be considered indication by Contractor that Contractor stands behind for the suitability of a manufacturer, and that the manufacturer satisfies of the above requirements.
- F. Contact Engineer prior to bid with any questions regarding acceptable manufacturers.

2.2 Grounding and Bonding:

- A. Provide complete grounding and bonding assemblies, including, but not limited to,
  - 1. Cables/Wires,
  - 2. Connectors,
  - 3. Solderless Lug Terminals,
  - 4. Grounding Electrodes and Plate Electrodes,
  - 5. Bonding Jumper Braid,
  - 6. Surge Arresters, and
  - 7. Additional accessories needed for a complete installation.
- B. Where more than one type component product meets indicated requirements, selection is Contractor's option.
- C. Where materials or components are not indicated, provide products which comply with NEC, UL, and applicable industry standards.
- D. Conductors:
  - 1. Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
- E. Bonding Plates, Connectors, Terminals, and Clamps:
  - 1. Provide electrical bonding plates, connectors, terminals, lugs, and clamps as



recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.

### PART 3 - EXECUTION

#### 3.1 Examination:

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made and notify Engineer in writing of any condition detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer and Owner.

#### 3.2 Installation of Electrical Grounding and Bonding Systems:

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions and applicable portions of current NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products comply with requirements.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Provide all circuits with an insulated equipment grounding conductor. Under no circumstances shall raceways be the sole equipment grounding conductor.
- D. Terminate insulated equipment grounding conductors with grounding lug, bus, or bushing. Conductors shall not be looped under screw or bolt heads.
- E. Connect together service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
  - 1. Provide minimum #12 AWG equipment grounding conductor in each conduit unless otherwise indicated. Equipment grounding conductor shall have continuous green insulation if #6 or smaller, green marking tape if #4 or larger.
  - 2. Equipment grounding conductor shall be connected to ground buses in equipment enclosures.
  - 3. Equipment grounding conductor bonded to all outlet, pull, and junction boxes by a lug or screw approved for the purpose before installation of the boxes. Ground pigtails and/or ground clips are not acceptable.
- F. Grounding type bushings shall be installed on all feeder and subfeeder conduits entering panelboards, pull boxes and transformers and all conduit entering oversized, concentric, and eccentric knock-outs.
- G. Tighten grounding and bonding connectors and terminal, including screws and bolts, in accordance with manufacturer's published torque tightening values for connectors and bolts. Where manufacturer's torqueing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.
- H. Install clamp-on connectors on clean metal contact surfaces, to ensure electrical conductivity and circuit integrity. All ground clamps and lugs shall be listed for application and shall be made completely of bronze or brass.

END OF SECTION



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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. This Section is a general Division 26 materials and methods section, and applies to all other Division 26 sections involving materials and methods specified herein.

### 1.2 Description of Work:

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this Section include the following:
  - 1. Copper conductors.
  - 2. Fixture wires.
  - 3. Split bolt connectors.
  - 4. Wirenut connectors.
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
  - 1. For power distribution circuits.
  - 2. For lighting circuits.
  - 3. For appliance and equipment circuits.
  - 4. For motor branch circuits.
  - 5. For control circuits.

### 1.3 Codes and Standards:

- A. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color coding of electrical wires and cables.
- B. IEEE Compliance: Comply with applicable requirements of IEEE Std. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- C. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D 753.

### 1.4 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data.

## PART 2 - PRODUCTS

### 2.1 General Wiring Products:

- A. Unless otherwise noted, all wiring shall be copper, with conductivity of not less than 98% at 20°C (68°F).

### 2.2 Acceptable Manufacturers:

- A. All products shall be the produce of reputable and reliable manufacturers.
- B. The following manufacturers are recognized as being reputable and reliable:
  - 1. Cerro Wire
  - 2. Encore Wire Corporation
  - 3. General Cable
  - 4. Southwire Company



- C. Additional manufacturers shall be considered reputable and reliable only if they satisfy the following requirements:
    - 1. History: Acceptable manufacturers shall have a history of producing similar products at least the past ten years. Such products shall have been sold in the state of Florida for at least the past five years.
    - 2. Volume: Acceptable manufacturers shall have produced and sold similar products in excess of one hundred (100) times annually the amount of product projected for used in this project. This requirement shall apply to each of the past ten years.
    - 3. Similar projects: Acceptable manufacturers shall have sold similar products which have been used in at least five similar projects in the past five years. Similar projects must be of a similar use, overall cost, and overall size.
  - D. Documentation of the above manufacturer requirements shall be provided to Engineer upon request, but is otherwise unnecessary. If documentation is required, it shall consist of a signed statement from Manufacturer's representative on Manufacturer's letterhead (or the letterhead of Manufacturer's approved representative). Additional documentation may be required in rare cases.
  - E. Any submittal by Contractor shall be considered indication by Contractor that Contractor stands behind for the suitability of a manufacturer, and that the manufacturer satisfies of the above requirements.
  - F. Contact Engineer prior to bid with any questions regarding acceptable manufacturers.
- 2.3 Building Wires: Provide factory fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.
- A. Dual-listed THHN/THWN-2: For dry, damp, and wet locations.
  - B. All wiring for conventional devices shall be stranded wire with the exceptions as noted on the electrical drawings.
- 2.4 Color Coding: The following systems of color coding shall be strictly adhered to. There shall be no color change for switch legs. Switch legs shall be marked at all junctions with colored tape on each wire with tape of contrasting color. Three way travelers shall be purple. In cases where more than one set of travelers are in the same conduit, travelers shall be marked with circuit number and colored tape. Colored tape shall be same color as corresponding switch leg marking.
- A. Note: Verify that the following corresponds to existing wiring prior to proceeding.
  - B. All wiring shall be the indicated color. Tape is not an acceptable method of indicating phase legs.
  - C. 120/208V Wye
    - 1. Phase A: Black
    - 2. Phase B: Red
    - 3. Phase C: Blue
    - 4. Neutral: White
    - 5. EGC (Ground): Green
  - D. 277/480V Wye
    - 1. Phase A: Brown
    - 2. Phase B: Orange
    - 3. Phase C: Yellow
    - 4. Neutral: Grey



5. EGC (Ground): Green with Yellow Stripe

- E. The color code assigned to each phase wire shall be consistently followed throughout.

PART 3 - EXECUTION

3.1 Delivery, Storage, and Handling:

- A. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris, and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

3.2 Installation of Wires and Cables:

- A. General: Install electrical cables, wires, and wiring connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
- B. Unless otherwise noted, all branch circuit conductors shall be 12 AWG minimum.
- C. Per UF Standards, demolish and replace of all aluminum branch circuit wiring discovered during construction.
- D. Install all line voltage wiring in conduit, unless otherwise indicated in writing by Engineer.
- E. Pull conductors simultaneously where more than one is being installed in same raceway.
- F. Use lubricant for pulling conductors. Use only products indicated for the purpose by the manufacturer.
- G. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.
- H. Minimize conductor splices.
- I. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced. Use splice and tap connectors which are compatible with conductor material.
- J. Provide a 6" loop in each conductor in all joint boxes and pull boxes.
- K. Conductors of systems of different voltages or types shall not enter the same conduit or junction box. The number of current carrying conductors and total number of conductors to be installed in conduits shall be as noted below.
  - 1. Single phase 120V or 277V circuits: Limit three per raceway.
  - 2. All other circuits: Dedicated raceway.
  - 3. Deviation of installation as identified above requires prior written approval from Engineer.
- L. Circuits shall be installed such that the continuity of the ground, neutral, and hot circuits shall not be interrupted by the removal of any device or fixture.
- M. For the purposes of thermal derating calculations, neutrals shall be considered current carrying except for balanced three-phase linear loads.
- N. Multiwire branch circuits are prohibited. All 120V and 277V circuits shall be provided a dedicated neutral conductor.

3.3 Field Quality Control:

- A. Prior to energization of circuitry, check installed feeder wires and cables with



megohmmeter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the ENGINEER indicating the insulation resistance level for each cable. Owner shall be given the option to witness all tests.

- B. Prior to energization, test wires and cables for electrical continuity and for short circuits.
- C. Subsequent to wire and cable hook ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. This Section is a general Division 26 materials and methods section, and applies to all other Division 26 sections involving materials and methods specified herein.

### 1.2 Description of Work:

- A. Extent of raceway work is indicated by drawings and schedules.
- B. Types of raceways specified in this section include the following:
  - 1. Electrical metallic tubing (EMT)
  - 2. Rigid metal conduit, galvanized (RMC)
  - 3. Rigid nonmetallic conduit (RNC)
  - 4. Liquid tight flexible metal conduit (LFMC)
  - 5. Flexible metal conduit, steel only (FMC)

### 1.3 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. All products shall be the produce of reputable and reliable manufacturers.
- B. The following manufacturers are recognized as being reputable and reliable:
  - 1. Allied Tube & Conduit
  - 2. Carlon
  - 3. Cantex
  - 4. Wiremold
  - 5. Wheatland Tube
- C. Additional manufacturers shall be considered reputable and reliable only if they verifiably satisfy the following requirements:
  - 1. History: Acceptable manufacturers shall have a history of producing similar products at least the past ten years. Such products shall have been sold in the state of Florida for at least the past five years.
  - 2. Volume: Acceptable manufacturers shall have produced and sold similar products in excess of one hundred (100) times annually the amount of product projected for used in this project. This requirement shall apply to each of the past ten years.
  - 3. Similar projects: Acceptable manufacturers shall have sold similar products which have been used in at least five similar projects in the past five years. Similar projects must be of a similar use, overall cost, and overall size.
- D. Documentation of the above manufacturer requirements shall be provided to Engineer upon request, but is otherwise unnecessary. If documentation is required, it shall consist of a signed statement from Manufacturer's representative on Manufacturer's letterhead (or the letterhead of Manufacturer's approved representative). Additional documentation may be required in rare cases.
- E. Any submittal by Contractor shall be considered indication by Contractor that Contractor stands behind for the suitability of a manufacturer, and that the



manufacturer satisfies of the above requirements.

- F. Contact Engineer prior to bid with any questions regarding acceptable manufacturers.

2.2 UL Listed Materials:

- A. Provide raceway products and components which have been UL listed and labeled for the intended use.
- B. Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems.

2.3 Products – Metal Conduit and Tubing:

- A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thicknesses) for each indicated use.
- B. Where types and grades are not indicated, provide proper selection determined by Contractor to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- C. Minimum size conduit shall be 1/2" for all systems.

Minimum size flexible conduit shall be 3/4" for all systems (3/8" for pre-assembled light fixture whips). Maximum length shall be 6 feet. Minimum length shall be 4 feet.

- D. Cast zinc conduit fittings are prohibited. Any cast zinc fitting installed by this project shall be replaced at Contractor's expense.
- E. All fittings shall be provided with insulated throats or plastic bushings prior to pulling wires or cables.
- F. Electrical Metallic Tubing (EMT):
  - 1. Conduit: Shall be mild steel, electrically welded, galvanized, and produced to ANSI Specification C80.3 and Federal Specification WW-C-563, latest revisions and shall be labeled with the Underwriter's Laboratories marking.
  - 2. Fittings: Couplings and connectors for conduit shall be set screw type, steel, or malleable iron.
- G. Rigid Steel Conduit:
  - 1. Conduit: Shall be mild steel, manufactured, hot-dipped galvanized, and produced to ANSI specifications C80.1 and Federal Specification WW-C 581, latest revisions, and shall be labeled with the Underwriters' Laboratories marking.
  - 2. Fittings: Cast malleable iron, galvanized, or cadmium plated.
    - a. Use Type 1 fittings for rain-tight connections.
    - b. Use Type 2 fittings for concrete tight connections.
- H. Flexible Metal Conduit:
  - 1. Conduit: UL 1. Formed from continuous length of spirally wound, interlocked zinc coated strip steel.
  - 2. Fittings: Flexible Metal Conduit Fittings: Provide conduit fittings for use with flexible steel conduit of threadless hinged clamp type. Inside type fittings are not allowed.
    - a. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, and male threaded end provided with locknut.
    - b. 45° or 90° Terminal Angle Connectors: Two piece body construction with removable upper section, female end with clamp and deep slotted machine



screw for securing conduit, and male threaded end provided with locknut.

I. Liquid Tight Flexible Metal Conduit:

1. Conduit: Provide liquid tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double wrapped steel; galvanized inside and outside; coat with liquid tight jacket of flexible polyvinyl chloride (PVC).
2. Fittings: Provide cadmium plated, malleable iron fittings with compression type steel ferrule and neoprene gasket sealing rings, with insulated, or noninsulated throat.

J. No ENT, corrugated flexible conduit, or MT cable shall be installed or reused.

K. No intermediate metal conduit (IMC) shall be installed.

L. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes, and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded conduit-entrance ends, removable covers, either cast or of galvanized steel, and corrosion-resistant screws. SLB type are not permitted.

2.4 Products – Nonmetallic Conduit and Ducts:

- A. General: Provide nonmetallic conduit, ducts, and fittings of types, sizes, and weights for each indicated use. Where types and grades are not indicated, provide proper selection determined by Contractor to fulfill wiring requirements which comply with provisions of NEC and Specifications for raceways.
- B. 90°C, UL rated, constructed of polyvinyl chloride. For direct burial, UL listed and in conformity with NEC Article 352.
- C. Conduit and Tubing Accessories: Provide conduit, tubing, and accessories of types, sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.
- D. Data conduit shall comply with "Pathways for Telecom Cables" paragraph, below.

2.5 Pathways for Telecom Cables:

A. General

1. Any pathway that is not accessible or does not provide a clear and workable pathway will be rejected.
2. All components of pathway systems in contact with telecom cables shall be listed and indicated for the use. This includes Category 6 ratings, etc.

B. Cable Trays

1. Default cable tray type is ladder tray in telecom rooms, and basket tray throughout the rest of the building.
2. Size cable trays for the number of cables called for on the plans. Where no cable quantities are called for, assume three outlets per telecom outlet box.
  - a. Cable trays shall have a minimum 50% spare capacity.
  - b. Capacity requirements shall be met at all points, including at corners and other locations where tray capacity is reduced.
  - c. Minimum cable tray width is 12".
  - d. Minimum cable tray height is 4".
  - e. Verify cable tray capacities prior to submittal. Notify Engineer of any conflicts found during verification.
3. Center-supported cable tray is not acceptable.



C. Conduits for Telecom Cables

1. Conduit intended for telecom cables shall be a minimum 1" trade size unless otherwise indicated.
2. Conduits terminating not into a box shall be capped with a bushing.
3. Conduits terminating at cable trays shall be bonded to the cable tray with a bonding jumper or a clip listed for the purpose.

PART 3 - EXECUTION

3.1 Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Notify Owner and Engineer in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in acceptable manner.

3.2 Provide raceways for each installation location as follows:

- A. Below grade: PVC
- B. Within concrete: PVC
- C. Exterior above-grade locations: rigid galvanized steel
- D. Damp and wet locations: rigid galvanized steel
- E. Interior locations subject to physical abuse: rigid galvanized steel
  1. Exception: In corrosive environments such as agricultural buildings, green houses, etc, use Schedule 80 PVC with corrosion resistant hardware and accessories. Ensure proper support per NEC Article 352.
- F. Interior locations not subject to physical abuse: EMT
  1. Exception: In corrosive environments such as agricultural buildings, green houses, etc, use Schedule 40 PVC with corrosion resistant hardware and accessories. Ensure proper support per NEC Article 352.
- G. Whips to light fixtures: 48" to 72" FMC or prefabricated whip.
- H. Connections to any vibrating or mechanically active equipment: FMC.
  1. Exception: Utilize LFMC in exterior locations, or where subject to moist or humid atmosphere, or where subject to water, oil, or grease exposure.
- I. Connection to any equipment subject to movement: FMC
  1. Exception: Utilize LFMC in exterior locations, or where subject to moist or humid atmosphere, or where subject to water, oil, or grease exposure.
- J. FMC, LFMC, and LFNC shall not be used for any other applications without written consent from Engineer.

3.3 Raceway Size:

- A. Sizes of raceways shall be not less than NEC requirements using THHN/THWN2 for sizing and shall not in any case be less than indicated on the drawings.
- B. Larger size raceways and/or pull boxes shall be installed if there is excessive length of unbroken run or excessive number of bends.

3.4 General Requirements:

- A. Install conduits without damaging or penetrating structural members.
- B. Conduits shall not be installed below equipment.
- C. Metallic conduit in contact with concrete, grout, mortar, or other cementitious products such as grouted cells, headers, lintels, etc. shall be provided a bituminous coating



before installation.

- D. All conduit installed in walls and above ceilings shall be 100% complete and approved by inspectors before covering is installed. Such coverings include drywall, insulation, ceiling tiles, and any other material which obscures the installation.
- E. Conduit installed above accessible ceilings shall be supported from the building structure and shall not be supported from or attached to the suspended ceiling suspension system.
- F. Where feasible, avoid conduit runs within partitions and walls.
- G. Mechanically assemble metal enclosures, and raceways for conductors to form a continuous conductive system.
- H. Connect to electrical boxes, fittings, and cabinets to provide effective electrical continuity and rigid mechanical assembly.
- I. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
- J. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
- K. Raceway penetrations of fire rated walls and/or floors shall be sealed to maintain the rating(s). All relevant materials and methods shall be per a UL detail satisfying NFPA rating requirements.
- L. Fire rating of construction assemblies are existing to remain. Any ratings indicate within other portions of the Contract Documents is purely intended for the Contractor's convenience, and is not meant to replace a careful review of existing life safety plans.
- M. Submit complete data on fire stopping materials and construction methods for review by Architect prior to proceeding with work.
- N. Coordinate with other work including wires/cables, boxes, and panel work, as necessary to interface installation of electrical raceways and components with other work.
- O. Use Manufacturer-provided dimensions to lay out all equipment electrical connections. Set conduit and boxes for connection to units only after receiving review of dimensions and coordinating with other trades.
- P. Provide nylon pull cord in empty conduits.
- Q. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.
- R. Field bend conduit with benders designed for the purpose.
- S. Any conduit with kinks, tears, or other material damage shall be replaced at Contractor's expense.
- T. Conduits are not to cross utility shafts or duct openings.
- U. Keep conduits a minimum distance of six inches (6") from parallel runs of flues, hot water pipes, or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.
- V. Support riser conduit at each floor level with clamp hangers.
- W. Use of running threads at conduit joints and terminations is prohibited.
- X. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- Y. Under no circumstances shall PVC or PVC-coated conduit be utilized within an air plenum. In particular, Contractor is to avoid LFMC within air handler plenums, etc.

### 3.5 Flexible Conduit:

- A. Flexible conduit shall not pass through walls or ceilings. Provide a junction box at the point of transition.



- B. Flexible conduit shall not be used within walls, except where written permission is given by Engineer and Owner.

3.6 Conduits Installed in Exterior, Wet, or Damp Locations:

- A. Metallic raceways exterior, wet, or damp locations shall have conduit threads painted with cold galvanizing paint. Remove oil and clean prior to painting. Draw up coupling and conduit sufficiently tight to ensure water tightness.
- B. All wall penetrations entering wet locations shall be sloped downward at least 1/2".

3.7 Special EMT Requirements:

- A. EMT shall not be installed below 8" AFF.
- B. EMT shall not be installed exposed below 72" AFF.
- C. EMT shall be installed in dry and indoor locations only.

3.8 Conduits Installed Below Grade:

- A. All underground wiring and ductbanks shall have metalized warning tape installed above conduit, ductbank, or electrical line that identifies the specific system buried below. Tape shall consist of a minimum 3.5 mil solid foil core encased in a protective plastic jacket (total thickness 5.5 mils) and be 6" wide with black lettering imprinted on a color coded background that conforms to APWA color code specifications. Tape shall be installed from 18" to 30" above a conduit, ductbank, or electrical line, and in no case less than 6" below grade. No additional tracer wire is required.
- B. All rigid metal conduit below grade shall be provided a bituminous coating.
- C. Metallic raceways installed below grade shall have conduit threads painted with cold galvanizing paint. Remove oil and clean prior to painting. Draw up coupling and conduit sufficiently tight to ensure water tightness.
- D. Install all underground conduits a minimum of 42" below finished grade (to top of conduit), except where below building foundation. Underground conduit shall be inspected and approved prior to backfilling. Primary raceway shall be buried 48" to top of conduit.
- E. Conduit below concrete slabs and footers under or inside building foundations shall be minimum of 6" below bottom of concrete and/or at an adequate depth to conceal radius of bends.

3.9 Conduits within Concrete Slabs or Encased in Concrete:

- A. No conduit shall be installed within slabs without prior written approval from Structural Engineer. Provide Structural Engineer with whatever description and drawings of the proposed installation which Structural Engineer may require.
- B. All of the following are subject to the alteration by Structural Engineer:
  - 1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel, or at 90 degrees, to main reinforcing steel.
  - 2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
  - 3. Conduits crossing in slab must be reviewed for proper cover by Engineer, Architect, and Owner.
  - 4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.

3.10 Coatings:

- A. Apply any coatings in accordance with manufacturer's instructions and recommendations.



- B. Reapply bituminous coating locally after making threaded connections.
- C. Any conduit requiring bituminous coating shall be coated without holidays. Inspect coating prior to burial or pouring, and touch up as needed.
- D. In lieu of bituminous coatings, raceways with factory-applied polyethylene or PVC protective coatings may be utilized. Install per manufacturer's instructions and recommendations. Seal all joints.

3.11 Conduits Above Grade:

- A. Install exposed conduits and all conduit above grade and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls and building structure.
- B. Install exposed conduit work as not to interfere with ceiling inserts, lights, or ventilation ducts or outlets.
- C. Securing and Supporting:
  - 1. Secure conduits within three feet of fittings, boxes, etc., and on spacing not to exceed ten feet.
    - a. Conduits may be supported in lieu of securing, where permitted by Code.
  - 2. Support conduits by use of hangers, clamps, or clips.
  - 3. Conduit shall not be supported from suspended ceiling supports or grid systems.
- D. Limit penetrations of vapor- and water-barriers. Utilize curbs, etc. wherever possible. Seal any penetrations of vapor- and water-barriers with approved methods.
- E. Conduit shall not be installed on roof tops or walkway covers.
- F. Conduit penetrating concrete floors not within 12" of walls shall have couplings installed flush with top slab.
- G. Flexible metal conduit shall not be installed in damp or wet locations, through walls, or used as a raceway in concealed or inaccessible areas. It shall be supported within 12" of connectors and at least once every 54".

3.12 PVC Conduits:

- A. PVC subject to physical damage shall be Schedule 80. All other PVC shall be heavy wall type (Schedule 40) conduit.
- B. PVC conduit shall be installed with rigid steel elbows and risers. (Exception: low voltage with inner ducts may be PVC.)
- C. Make solvent cemented joints in accordance with recommendations of manufacturer.
- D. Install PVC conduits in accordance with NEC and in compliance with local utility practices.
- E. Conduit and elbows shall be installed on the secondary side at power company's transformers. Wire and cable installation shall be such that wire pulling rope or cable will not damage elbows.
- F. Conduit, elbows, and risers shall be installed for all primary services per Utility and Owner requirements.
- G. All elbows shall be RMC, except where required otherwise by Utility.
- H. All risers shall be RMC, except where required otherwise by Utility.

3.13 General Conduit Fitting Requirements:

- A. Grounding type bushings shall be installed on all feeder and subfeeder conduits entering panelboards, pull boxes, and transformers and all conduit entering oversized, concentric, and eccentric knock-outs.
- B. Miscellaneous fittings such as reducers, chase nipples, 3 piece unions, split couplings, and plugs shall be designed and listed for the specific use.



- C. Provide either plastic bushings or plastic insulating throats for all fittings prior to pulling wire.
- D. Install insulated-type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge shall have phenolic insulating ring molded into bushing. Bushings shall be installed during rough-in and before installing conductors.
- E. Snap-on bushings are prohibited.

3.14 Threaded Conduit Fitting Requirements:

- A. Provided locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.
- B. Bushings for threaded conduits smaller than 1" shall have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation. Bushings shall be installed during rough-in and before pulling wire.
- C. Bushing of standard or insulated type shall have screw type grounding terminal. Bushings shall be installed on all threaded conduit.

3.15 Pathways for Telecom Cables:

A. General

- 1. Label all pathways for telecom cables in accordance with UF IT Labeling Standard. Refer to Appendix 1 of the University of Florida Telecommunications Standard.

B. Cable Trays

- 1. Cable trays shall have devices installed at all corners and bends to protect cables and prevent minimum bend radius from being violated.
- 2. Cable tray shall be trapeze- or wall-hung. Center-supported cable tray is not acceptable. Wall hung cable trays shall additionally be supported by threaded rod on the side of the cable tray farther from the wall.

C. Conduits for Telecom Cables

- 1. Conduits intended for telecom cables shall not exceed the following:
  - a. Two 90° bends, turns, sweeps, etc. between pull boxes,
  - b. A total of 270° of bends, turns, sweeps, offsets, etc. between pull boxes,
  - c. 100' length between pull boxes, or
  - d. 200' total length.
- 2. Changes in direction shall be made with sweeps, elbows, etc. Changes in direction shall not be made in pull boxes.
- 3. Conduit bodies are not acceptable for telecom conduits, regardless of whether they may be used elsewhere in the project. This is not intended to indicate that conduit bodies are acceptable for other purposes.
- 4. Ream and bush all conduits intended for telecom cables.
- 5. Provide a 200lb nylon pull cord in each conduit intended for telecom cables.
- 6. Provide a minimum of one 1" conduit from each work area outlet (telecom outlet box) to the nearest cable tray. Where no cable tray is within 30 feet, route conduit to nearest telecom room.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. This Section is a general Division 26 materials and methods section, and applies to all other Division 26 sections involving materials and methods specified herein.

### 1.2 Description of Work:

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this Section include the following:
  - 1. Outlet boxes.
  - 2. Junction boxes.
  - 3. Pull boxes.
  - 4. Floor boxes.

### 1.3 Codes and Standards:

- A. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- B. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

### 1.4 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. All products shall be the produce of reputable and reliable manufacturers.
- B. The following manufacturers are recognized as being reputable and reliable:
  - 1. CDR
  - 2. Hubbell-Raco
  - 3. MacLean Highline
  - 4. Republic Steel
  - 5. Square D
  - 6. Thomas & Betts
  - 7. Quazite
  - 8. Wiremold
  - 9. Legrand
- C. Additional manufacturers shall be considered reputable and reliable only if they verifiably satisfy the following requirements:
  - 1. History: Acceptable manufacturers shall have a history of producing similar products at least the past ten years. Such products shall have been sold in the state of Florida for at least the past five years.
  - 2. Volume: Acceptable manufacturers shall have produced and sold similar products in excess of one hundred (100) times annually the amount of product projected for used in this project. This requirement shall apply to each of the



- past ten years.
3. Similar projects: Acceptable manufacturers shall have sold similar products which have been used in at least five similar projects in the past five years. Similar projects must be of a similar use, overall cost, and overall size.
- D. Documentation of the above manufacturer requirements shall be provided to Engineer upon request, but is otherwise unnecessary. If documentation is required, it shall consist of a signed statement from Manufacturer's representative on Manufacturer's letterhead (or the letterhead of Manufacturer's approved representative). Additional documentation may be required in rare cases.
  - E. Any submittal by Contractor shall be considered indication by Contractor that Contractor stands behind for the suitability of a manufacturer, and that the manufacturer satisfies of the above requirements.
  - F. Contact Engineer prior to bid with any questions regarding acceptable manufacturers.

2.2 Products – Fabricated Materials:

- A. Outlet Boxes:
  1. Outlet wiring boxes shall be galvanized coated flat rolled sheet steel, of shapes, volumes, and dimensions as indicated, suitable for installation at respective locations.
  2. Outlet boxes shall be constructed with mounting holes, and with cable and conduit size knockout openings in bottom and sides.
  3. Minimum dimensions for device boxes, junction boxes, pull boxes, and other boxes in walls shall be a minimum of:
    - a. four inch (4") square, two and one-eighth inch (2-1/8") deep for telecommunications devices, and
    - b. four inch (4") square, one and one-half inch (1-1/2") deep for all other boxes.
  4. Dimensions of ceiling boxes shall be a minimum of:
    - a. four inch (4") square or octagonal, one and one-half inch (1-1/2") deep for exposed work or furred ceiling work, and
    - b. three inches (3") deep for concrete work.
  5. Plaster rings and/or fixture studs shall be provided where required.
  6. Flush-mounted boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.
  7. Outlet boxes for exposed wall mounting shall be cast metal type "FS" or "FD" boxes with suitable cast aluminum covers.
  8. Outlet boxes shall be sound attenuated for back to back installations.
  9. Exterior boxes:
    - a. All exterior boxes shall be appropriately listed or indicated for the use.
    - b. Boxes for exterior receptacles shall be provided with in-use weatherproof receptacle covers. Such covers shall have spring hinged lids.
    - c. Weatherproof covers shall meet code requirements for covers intended for use with attachment plugs.
  10. Sectional or gangable boxes shall not be installed.
  11. Through-wall boxes shall not be installed.
  12. Box extensions or "goofings" shall not be installed.
  13. "Handy" boxes, etc. shall not be permitted.



- B. All pull boxes used outside and underground shall be pre-cast concrete polymer, with concrete polymer cover. Such boxes shall be of sufficient size to make all entrances and exits from box in one horizontal plane.
- C. Junction and Pull Boxes: Provide galvanized code gauge sheet steel junction and pull boxes, with screw on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.
- D. Floor Boxes: Provide raintight adjustable floor boxes as indicated, with threaded conduit entrance ends, and vertical adjusting rings, gaskets, brass floor plates with flush screw on covers with ground flange and stainless steel cover screws. Carpet and tile plates to be brass.
- E. Cover Plates:
  - 1. All cover plates shall be abuse resistant nylon or stainless steel.

### PART 3 - EXECUTION

#### 3.1 General:

- A. Install all electrical boxes and fittings as indicated, in accordance with manufacturer's instructions, applicable code, and recognized industry practices, to fulfill project requirements.
- B. The location of any pull box shall be approved by Architect and Owner before installation, unless said pull box is installed in an accessible above-ceiling space, or a dedicated mechanical or electrical room.
- C. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- D. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- E. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- F. All outlet and device boxes shall be independently supported from structure.
- G. Install electrical boxes only in accessible locations.
- H. Orient all boxes for ease of accessibility. Install overhead boxes cover-down unless otherwise directed.
- I. Coordinate all boxes with other trades.
  - 1. Any box without a minimum 6" front clearance will be adjusted or reinstalled at Contractor's expense.
  - 2. Any box installed such that access is effectively blocked by other trades shall be adjusted or reinstalled at Contractor's expense.
- J. Secure electrical boxes firmly and rigidly to structure, or solidly embed electrical boxes in concrete or masonry.
- K. Protect installed boxes from construction debris and damage.
- L. All outside, above grade pull boxes shall be galvanized.
- M. All flush mounted boxes, regardless of system or voltage, shall be installed flush within 1/8" of wall finish or finished face of tackboards, sound boards, cabinets, etc. Box extension or goof rings shall not be installed.
- N. Boxes shall not be installed back-to-back.
- O. Boxes within the same stud cavity shall be separated by a minimum of 12".
- P. Boxes for flush mounting in concrete block:
  - 1. Boxes for flush mounting in concrete block shall be provided covers with square



- corners on the raised portion of the cover.
- 2. Such covers shall be of sufficient depth to be flush with the face of the block.
- 3. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted, but not more than applicable code.
- 4. Boxes installed in block walls shall be secured in place with mortar.
- 5. Boxes shall be flush with any combustible surface including black splash, tack board or sound board.

Q. Exterior Boxes:

- 1. Unless otherwise noted, exterior boxes on walls shall be installed flush with wall. Coordinate with masonry as required.
- 2. Provide suitable installation for each application, including face plate gaskets and corrosion resistant plugs and fasteners.

3.2 Boxes in Rated Partitions:

- A. Maintain all fire and heat ratings by installing boxes in rated partitions according to a UL detail for an acceptable product. No UL rating detail shall be used prior to approval by Architect.
- B. All boxes installed in rated walls shall be rigidly secured to structure.
- C. All voids between boxes and surrounding wall surfaces shall be completely filled with an approved material.

3.3 Outlet Boxes:

- A. Position recessed outlet boxes accurately to allow for surface finish thickness.
- B. Set floor boxes level and flush with finish flooring material.
- C. Outlet Box Accessories: Provide compatible outlet box accessories as required for installation, including:
  - 1. box supports,
  - 2. bonding accessories,
  - 3. mounting ears and brackets,
  - 4. wallboard hangers,
  - 5. box extension rings,
  - 6. fixture studs,
  - 7. cable clamps, and
  - 8. metal straps for supporting outlet boxes.
- D. Rigidly support all outlet boxes from both sides, or from back, such that box cannot move or deflect into the wall when devices are installed or modified.

3.4 Identification:

- A. Box lids and conduit couplings shall be color coded as follows:
  - 1. 120/208V Wye: Black, with hand written white labels.
  - 2. 277/480V Wye: Brown
  - 3. Fire Alarm: Red
  - 4. Telecom: Blue
  - 5. All others: Paint a unique color.
  - 6. Exception: Coordinate color coding requirements with Architect and Owner where boxes are visible in public spaces.
- B. Covers of all junction boxes, pull boxes, etc. shall be marked by circuit number using indelible ink, 3/4" minimum height. Locate marker so it can be readily identified without



removal of the cover plate.

1. Exception: Where box covers are visible in public spaces, marker label shall be on the inside of the box cover.

END OF SECTION



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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. This Section is a Division 26 Basic Electrical Materials and Methods section, and is part of each Division 26 section making reference to wiring devices specified herein.

### 1.2 Description of Work:

- A. Extent of electrical identification work is indicated by drawings, schedules, and other specification sections.
- B. Types of electrical identification work specified in this Section include the following:
  - 1. Equipment/System identification signs.
- C. See other specification sections for additional identification requirements for specific equipment and system components. Where electrical system signage is called for elsewhere in the Contract Documents, but not described in detail, provide signage per the requirements of this section.

### 1.3 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data.

## PART 2 - PRODUCTS

### 2.1 Electrical Identification Materials:

- A. Engraved Plastic Laminate Signs:
  - 1. Provide engraving stock melamine plastic laminate, in sizes and thicknesses indicated.
  - 2. Engrave with engraver's standard letter style, of sizes and wording indicated.
  - 3. Default color shall be white face with black core plies, resulting in black letters on a field of white. Provide alternative colors as indicated on plans or in other specification sections.
  - 4. Signs for Fire Alarm warning systems shall be red face and white core plies, resulting in white letters on a field of red.
  - 5. Thickness: Minimum one-sixteenth inch (1/16"), except as otherwise indicated.
  - 6. Fasteners: Self-tapping stainless steel screws, except contact type permanent adhesive where screws cannot or should not penetrate substrate.

### 2.2 Lettering and Graphics:

- A. General: Coordinate names, abbreviations, and other designations used in electrical identification work with corresponding designations shown, specified or scheduled.
- B. Provide numbers, lettering, and wording as indicated, or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

## PART 3 - EXECUTION

### 3.1 Application and Installation:

- A. General Installation Requirements:
  - 1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.



2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
  3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- B. Equipment/System Identification:
1. Provide engraved plastic laminate signs with text matching terminology and numbering of the contract documents. Provide signs for each unit of the following categories of electrical work:
    - a. Switchboards,
    - b. Panelboards,
    - c. Electrical cabinets,
    - d. Disconnect enclosures,
    - e. Starters,
    - f. Access panels/doors to electrical facilities,
    - g. Terminal cabinets,
    - h. Fire alarm control panels,
    - i. Fire alarm extender panels,
    - j. Any other enclosure housing active components.
  2. Unless otherwise noted, install signs and labels to maximize visibility and readability without interference with operation and maintenance of equipment.
  3. All power junction box covers shall be marked with panel name and circuit numbers. All other (Fire Alarm, intercom, etc.) junction box covers shall be marked according to system type. These markings shall be made with a permanent type marker.
  4. Panel schedules shall be typed, and shall indicate room numbers and load information.
  5. Above ceiling identification: to electrical equipment installed above finished ceiling, identification shall be placed:
    - a. on access panel,
    - b. next to access panel, or
    - c. on to a permanent part of the ceiling system, such as a tee-bar of a lay-in type ceiling.
  6. Secure all labels and signs to substrate with approved fasteners, unless fasteners would violate listings or create an unsafe condition. Where fasteners cannot be used, utilize approved permanent adhesive means of attachment.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Summary:

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for panelboards as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
  - 1. Provide lighting and appliance panelboards as specified herein and where shown and scheduled on the Drawings.

### 1.2 Submittals:

- A. General: See submittal procedures in Division 1.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Clearly indicate all variations and options proposed for installation.
- C. Configuration: Submit panelboard configuration information, including the physical locations and connections of all active and conductive components.
- D. Shop Drawings: Submit scaled shop drawings depicting the intended installation location for each panelboard, relevant clearance requirements, and all other equipment intended for installation nearby. Indicate all relevant dimensions, and document that installation is feasible as proposed.
- E. Include panelboards in dimensioned electrical room shop drawings.

### 1.3 Operation and Maintenance:

- A. Operation and Maintenance Data: Prior to substantial completion, submit operation and maintenance data for panelboards. Submit as indicated in Section 26 00 00 and Division 1.

### 1.4 Quality Assurance:

- A. Qualifications:
  - 1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of panelboards of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years.
  - 2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing panelboards similar in type and scope to that required for this Project and shall be approved by the manufacturer.
  - 3. Documentation of qualifications, examples of past projects, and references, shall be provided to Owner and/or Engineer upon request, but are not required as part of the standard submittal procedure.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
  - 1. Without limiting the generality of other requirements of this Section, all work specified herein shall conform to or exceed the applicable requirements of the following standards; provided, that wherever the provisions of said publications



are in conflict with the requirements specified herein, the more stringent requirements shall apply:

- a. FS W-C-375.
  - b. FS W-P-115 (Type I, Class 1).
  - c. NEMA AB 1.
  - d. NEMA PB 1.
  - e. NEMA PB 1.1.
  - f. NEC.
  - g. UL 50.
  - h. UL 67.
  - i. UL 489.
  - j. UL 924 (for emergency panels).
- C. Pre-Installation Conference: Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, manufacturer's representatives, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.
- D. Single Source Responsibility: Obtain panelboards and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer.

1.5 Delivery, Storage, and Handling:

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 Warranty:

- A. General: See closeout procedures in Division 1.
- B. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace panelboards that fail in materials or workmanship within the specified warranty period.
  1. Warranty Period: Warranty period shall be one year from the date of substantial completion.

PART 2 - PRODUCTS

2.1 Manufacturers:

- A. Approved Manufacturers: All panelboard products shall be the produce of one of the following:
  1. Square D (Schneider Electric)
  2. General Electric
  3. Cutler Hammer (Eaton)
  4. Siemens



B. Basis of Design:

1. Items specified are to establish a standard of quality for design, function, materials, and appearance.
2. Equivalent products by other manufacturers are acceptable.
3. The Design Professional will be the sole judge of the basis of what is equivalent.
4. Any adjustments required to meet equivalency requirements shall be at Contractor's expense.
5. See Drawings for schedules indicating additional Basis of Design information.

2.2 Materials and Components:

A. General:

1. Minimum voltage rating shall be for the voltage indicated and scheduled on the Drawings.
2. Minimum per-phase continuous current ratings shall be as indicated and scheduled on the Drawings.
3. Minimum neutral continuous current ratings shall be as indicated and scheduled on the Drawings.
4. Minimum short circuit current rating shall be as indicated and scheduled on the Drawings, in RMS symmetrical amperes at the AC voltage indicated for the panelboard.
5. Enclosure NEMA rating shall be as indicated and scheduled on the Drawings.
6. Panelboards shall be suitable for use as service equipment when application requirements comply with UL 67 and NEC Article 230.

B. Feeder Connection(s):

1. Interiors shall be field convertible for top or bottom incoming feed.
2. Main circuit breakers shall be vertically mounted.
3. Sub-feed circuit breakers shall be vertically mounted.
4. Main lug interiors up to 400 amperes shall be field convertible to main circuit breaker.

C. Buses:

1. Provide one continuous bus bar per phase.
2. Each bus bar shall have sequentially phased branch circuit connectors suitable for plug-on or bolt-on branch circuit breakers.
3. The busing shall be fully rated.
4. Busing shall be plated copper.
5. Bus bar plating shall run the entire length of the bus bar.
6. Solid neutral(s) shall be plated and located in the mains compartment up to 225 amperes so incoming neutral cable may be of the same length.
7. Interior phase bus shall be pre-drilled to accommodate field installable options (i.e., sub-feed lugs, sub-feed circuit breakers, thru-feed lugs, etc.).

D. Circuit Breakers:

1. Circuit breakers shall be UL-listed with amperage ratings, interrupting ratings, and number of poles as indicated and scheduled on the Drawings.
2. Two-pole and three-pole circuit breakers shall have common tripping of all poles. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker that shall allow the user to



- simultaneously select the desired trip level of all poles. Circuit breakers shall have a push-to-trip button for maintenance and testing purposes.
3. Circuit breakers shall have an overcenter, trip-free, toggle mechanism which shall provide quick-make, quick-break contact action.
  4. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole.
  5. Main circuit breaker thermal elements shall be true rms sensing and shall be factory calibrated to operate in a 40°C ambient environment.
  6. Circuit breaker handle and faceplate shall indicate rated ampacity.
  7. Standard construction circuit breakers shall be UL-listed for reverse connection without restrictive line or load markings.
  8. Circuit breaker escutcheon shall have international I/O markings, in addition to standard on/off markings.
  9. Circuit breaker handle accessories shall provide provisions for locking handle in the on or off position.
  10. Circuit breakers shall be UL-listed for use with the following accessories, and shall be provided such accessories as indicated and scheduled on the Drawings:
    - a. Shunt trip.
    - b. Under voltage trip.
    - c. Ground fault shunt trip.
    - d. Auxiliary switch.
    - e. Alarm switch.
    - f. Compression lug kits.
  11. The exposed faceplates of branch circuit breakers shall be flush with one another.
  12. Molded case branch circuit breakers shall have bolt-on type bus connectors.
  13. Breaker shall be UL Listed with the following ratings: (15-125A) Heating, Air Conditioning, and Refrigeration (HACR), (15-30A) High Intensity Discharge (HID), (15-20A) Switch Duty (SWD), (15-50A) Equipment Protection Device (EPD) (480Y/277Vac maximum).
- E. Enclosures:
1. Type 1 Boxes:
    - a. Boxes shall be hot-dip zinc galvanized steel constructed in accordance with UL 50 requirements. Unpainted galvanized steel is not acceptable.
    - b. Boxes shall have removable endwalls with knockouts located on one end. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
    - c. Boxes in fire and/or temperature rated walls shall be provided with a listed mat or wrap installed per an applicable UL detail. 3M Interam Endothermic Mat or equal.
  2. Type 1 Fronts:
    - a. Front shall meet strength and rigidity requirements per UL 50 standards.
    - b. Front shall have grey enamel electrodeposited over cleaned phosphatized steel.
    - c. Fronts shall be hinged one-piece with door, or door-in-door.
    - d. Mounting shall be flush or surface as indicated and scheduled on the Drawings.



- e. Panelboards shall have mono-flat fronts with concealed door hinges and mounted with trim screws.
    - f. Front shall not be removable with the door locked.
    - g. Doors on front shall have rounded corners and edges shall be free of burrs.
    - h. Front shall have cylindrical tumbler type lock with catch and spring-loaded stainless steel door pull.
    - i. Lock assemblies shall be keyed alike.
    - j. One key shall be provided with each lock.
    - k. A clear plastic directory cardholder shall be mounted on the inside of door.
  - 3. Types 3R, 5, and 12:
    - a. Enclosures shall be constructed in accordance with UL 50 requirements.
    - b. Enclosures shall be painted with grey enamel electrodeposited over cleaned phosphatized steel.
    - c. Doors shall be gasketed and equipped with a tumbler type vault lock and two additional quarter turn fasteners on enclosures 59 inches (1499 mm) or more in height.
    - d. Lock assemblies shall be keyed alike.
    - e. One key shall be provided with each lock.
    - f. A clear plastic directory cardholder shall be mounted on the inside of door.
  - F. Grounding:
    - 1. A solidly bonded copper equipment ground bar shall be provided.
  - G. Identification:
    - 1. Nameplates shall contain system information and catalog number or factory order number. Interior wiring diagram, neutral wiring diagram, UL-listed label, and short circuit current rating shall be displayed on the interior or in a booklet format.
  - H. Safety:
    - 1. Current carrying parts shall be insulated from ground and phase-to-phase by high dielectric strength thermoplastic.
    - 2. Interior trim shall be of deadfront construction to shield user from energized parts. Deadfront trim shall have filler plates covering unused mountingspaces.
  - I. Miscellaneous:
    - 1. Interior leveling provisions shall be provided for flush-mounted applications.
    - 2. The entire panelboard shall be listed as a system, including all breakers, buses, enclosure, cover, etc.
    - 3. Lugs shall be UL-listed to accept solid or stranded copper conductors.
    - 4. Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating per NEC Table 310-15(B)(16). Branch circuit breakers rated 30 amperes and below may be UL-listed to accept 60°C rated wire.
    - 5. Lug body shall be bolted in place. Snap-in designs are not acceptable.
- 2.3 Arc Energy Protection:
- A. All circuit breakers set, or capable of being set, to 1200A or higher continuous trip rating shall be provided with arc energy reduction and documentation in accordance with NEC 240.87.
  - B. Provide documentation to relevant parties with location of all such circuit breakers.



- C. Each such circuit breaker shall be LSIG-type unless specifically indicated otherwise.
- D. Provide one of the following for each such circuit breaker:
  - 1. Zone-selective interlocking,
  - 2. Differential relaying,
  - 3. Energy-reducing maintenance switching with local status indicated,
  - 4. Energy-reducing active arc flash mitigation system
  - 5. An approved equivalent means, approved in writing by Engineer, Owner, and AHJ.

### PART 3 - EXECUTION

#### 3.1 Examination:

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
  - 1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

#### 3.2 Installation:

- A. General: Install panelboards and accessories in accordance with reviewed product data, final shop drawings, manufacturer's written instructions and recommendations, and as indicated on the Drawings.
  - 1. Install panelboards in accordance with manufacturer's written instructions, NEMA PB 1.1, and NEC standards.
  - 2. Install and configure software in accordance with manufacturer's written instructions.
- B. Labeling:
  - 1. Provide accurate, printed panelboard directories prior to substantial completion. Directory shall account for all addenda, field orders, and field modifications.
  - 2. Provide engraved laminated melamine label for equipment, in accordance with specification section 260553 Electrical Identification.
  - 3. Permanently label all adjustable trip circuit breakers with the designed trip ratings. Provide engraved laminated melamine label with this information, in accordance with specification section 260553 Electrical Identification.

#### 3.3 Field Quality Control:

- A. Inspect complete installation for physical damage, proper alignment, anchorage, and grounding.
- B. Measure steady state load currents at each panelboard feeder. Rearrange circuits in the panelboard to balance the phase loads within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.
- C. Check tightness of bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written specifications.

#### 3.4 Protection:



- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the panelboards shall be without damage at time of Substantial Completion.

END OF SECTION



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## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Conform to Division 1 and other sections of this division.
- B. This Section is a general Division 26 materials and methods section, and applies to all other Division 26 sections involving materials and methods specified herein.

### 1.2 Description of Work:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this Section include the following:
  - 1. Receptacles
  - 2. Ground Fault Circuit Interrupters
  - 3. Switches
  - 4. Wall Plates

### 1.3 Codes and Standards:

- A. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- B. UL Compliance: Comply with applicable requirements of UL 20, 486A, 498, and 943 pertaining to installation of wiring devices. Provide wiring devices which are UL listed and UL-labeled.

### 1.4 Submittals:

- A. Submit in accordance with General, Supplementary, and Special Conditions.
- B. Product Data: Submit manufacturer's data on electrical wiring devices.

## PART 2 - PRODUCTS

### 2.1 Acceptable Manufacturers:

- A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include, but are not limited to, the following (for each type and rating of wiring device):
  - 1. Hubbell, Inc.
  - 2. Leviton Manufacturing Co., Inc.
  - 3. Pass and Seymour, Inc.
  - 4. Eaton, Inc.

### 2.2 Fabricated Wiring Devices:

- A. General: Provide factory fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Stds. Pub/No.WD.
  - 1. Normal Power: Provide white color devices except as otherwise indicated.
  - 2. Emergency Power: Provide red color devices except as otherwise indicated.
  - 3. Optional Standby Power: Provide red color devices except as otherwise indicated.
  - 4. Receptacles:
    - a. Receptacles shall be specification grade, with back-fed wiring connections.
    - b. All receptacles shall be duplex NEMA 5-20R unless indicated otherwise.



- c. Base receptacle shall be NEMA 5-20R. Leviton 'S' Series (e.g. 5362-SW) is not acceptable. Provide additional features as described below.

B. Switches:

1. Snap: Provide toggle switches, rated 20 amps at 120/277 volts, quiet type, UL I without derating for tungsten lamp loads or inductive loads. The following catalog numbers are Leviton. "Slim" series (e.g. 1221S) are forbidden.

Type	Catalog No.
Single Pole	1221
Two Pole	1222
Three Way	1223
Four Way	1224

2.3 Wiring Device Accessories:

A. Wall Plates:

1. Unless otherwise indicated, wall plate material shall be as follows:
  - a. Interior finished spaces: Nylon.
  - b. Interior unfished spaces: Galvanized.
  - c. Exterior: Cover as part of weatherproof assembly.
2. Provide commercial specification grade wall plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices. Construct with metal screws for securing plates to devices: screw heads to match finish of plates.

PART 3 - EXECUTION

3.1 Installation of Wiring Devices:

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- C. Install wiring devices after wiring work is completed and inspected.
- D. Install wall plates after painting work is completed.
- E. Rear wire all wiring device connections. Side terminations are forbidden.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B. Use properly scaled torque indicating hand tool.
- G. Orient all receptacles with the ground pin up, except:
  1. Where receptacle serves equipment which may have a 90° plug, orient receptacle ground pin down.
  2. Orient horizontally installed receptacles (e.g. receptacles in surface raceway) with the neutral pin up.



- H. Wiring devices shall have pig-tail connection. Feed-thru wiring is not allowed.

3.2 Protection of Wallplates and Receptacles:

- A. At time of substantial completion, replace any wall plates and/or receptacles which have been damaged during construction, including those burned and scored by faulty plugs.

3.3 Grounding:

- A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds. Grounding conductor shall be bonded to all boxes with a separate screw. Screws used to support boxes are not to be used for grounding. Bonding screws shall be installed in box during rough-in installation. Bonding screws shall be green hexagonal type.

3.4 Identification:

- A. Switches: Each light switch shall be marked by circuit number using a numbered vinyl cloth adhesive marker, 1/4" minimum height. Locate marker behind cover plate so it can be readily identified by removal of the cover plate. Thomas and Betts E-Z Code Markers are acceptable.
- B. Receptacles: Each receptacle shall be marked by circuit number using a numbered vinyl cloth adhesive marker, 1/4" minimum height. Locate marker behind cover plate so it can be readily identified by removal of the cover plate. Thomas and Betts E-Z Code Markers are acceptable.
- C. Provide label on coverplate according to UF Standards.

3.5 Testing:

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION



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PART 1 - GENERAL

1.1 Summary:

- A. Scope: Provide labor, material, equipment, related services, and supervision required, including, but not limited to, manufacturing, fabrication, erection, and installation for interior lighting as required for the complete performance of the work, and as shown on the Drawings and as herein specified.
- B. Section Includes: The work specified in this Section includes, but shall not be limited to, the following:
  - 1. Provide interior lighting fixtures as specified herein and where shown and scheduled on the Drawings.
  - 2. Provide all necessary accessories and appurtenances as required for a functional installation of the interior lighting system.

1.2 Submittals:

- A. General: See submittal procedures in Division 1.
- B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Clearly indicate all variations and options proposed for installation.

1.3 Operation and Maintenance:

- A. Operation and Maintenance Data: Prior to substantial completion, submit operation and maintenance data for light fixtures. Submit as indicated in Section 26 00 00 and Division 1.

1.4 Quality Control:

- A. Qualifications:
  - 1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of light fixtures of types, sizes, and performance required, and whose products have been in satisfactory use in similar service for a minimum of five years.
  - 2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing light fixtures similar in type and scope to that required for this Project and shall be approved by the manufacturer.
  - 3. Documentation of qualifications, examples of past projects, and references, shall be provided to Owner and/or Engineer upon request, but are not required as part of the standard submittal procedure.
- B. Regulatory Requirements: Comply with applicable requirements of the laws, codes, ordinances, and regulations of Federal, State, and local authorities having jurisdiction. Obtain necessary approvals from such authorities.
  - 1. Without limiting the generality of other requirements of this Section, all work specified herein shall conform to or exceed the applicable requirements of the following standards; provided, that wherever the provisions of said publications are in conflict with the requirements specified herein, the more stringent requirements shall apply:
    - a. NFPA 70, National Electrical Code
    - b. ANSI/UL 1598-08 NMJ-J-307/1-ANCE/C22.2 NO.250.0-08, Luminaires
    - c. ANSI/UL 8750-2015 - Standard for Light Emitting Diode (LED) Equipment



for Use in Lighting Products

- d. UL 924 10th Edition - Standard for Emergency Lighting and Power Equipment

- C. Pre-Installation Conference: Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, manufacturer's representatives, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner and the Architect.
- D. Single Source Responsibility: Obtain each type of light fixture and required accessories from a single source with resources to produce products of consistent quality in appearance and physical properties without delaying the work. Any materials which are not produced by the manufacturer shall be acceptable to and approved by the manufacturer. This is not meant as a requirement that all light fixtures come from a single source. All parts and accessories for each individual light fixture shall meet this requirement.

1.5 Delivery, Storage, and Handling:

- A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.
- B. Store materials in their original, undamaged packages and containers, inside a well ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.6 Warranty:

- A. General: See closeout procedures in Division 1.
- B. Special Warranty: Submit a written warranty executed by the manufacturer, the Installer, and the Contractor, agreeing to repair or replace light fixtures that fail in materials or workmanship within the specified warranty period.
  - 1. Warranty Period: Warranty period shall be one year from the date of substantial completion.
- C. Provide additional Manufacturer's warranty information, as applicable.
- D. Per UF Standards, provide minimum two year warranty for mechanical defects. Warranty shall include parts and labor.
- E. Per UF Standards, provide minimum five year warranty for defective materials, including light source and driver. Warranty shall include parts and labor.

PART 2 - PRODUCTS

2.1 Manufacturers:

- A. Basis of Design:
  - 1. Items specified are to establish a standard of quality for design, function, materials, and appearance.
  - 2. Unless specifically noted otherwise, all Basis of Design light fixtures are open to submission of equivalent products.
  - 3. The Design Professional will be the sole judge of the basis of what is equivalent.
  - 4. Equivalency will be decided on quality, performance, aesthetics, and maintainability.
  - 5. Owner will be given the opportunity to reject specific manufacturers of equivalent



- materials based on negative past experience.
- 6. Any adjustments required to meet equivalency requirements shall be at Contractor's expense.
- 7. See Drawings for schedules indicating additional Basis of Design information.

2.2 Materials and Components:

A. General:

- 1. Color temperature shall be as indicated on the Light Fixture Schedule.
- 2. Luminous output shall be as indicated on the Light Fixture Schedule. Alternate fixtures within 5% do not require justification.
- 3. Fixture or lamp life rating in hours shall be per the Basis of Design. Life rating for LED fixtures shall be to 70% or 90% intensity per the Basis of Design.
- 4. CRI shall be per the Basis of Design.
- 5. Where not specified elsewhere, Color Rendering Index (CRI) [Ra]  $\geq 80$ .
- 6. R9 value shall be per the Basis of Design. (Note: R9 is a color rendering criterion providing additional information beyond CRI.)
- 7. Where not specified elsewhere, R9 value shall be positive.
- 8. TM-30 data shall be comparable to the Basis of Design, as determined by the Design Professional. (Note: TM-30 are color rendering criteria providing additional information beyond CRI.)
- 9. Where not specified elsewhere, TM-30 ratings: 'Rf $\geq 75$ , Rg $\geq 95$ , and Rcs,h1 $\geq 8\%$ .
- 10. Minimum rated life shall be comparable to Basis of Design, as determined by the Design Professional.
- 11. Where not specified elsewhere, minimum rated life shall be 68,000 hours at L70.
- 12. Materials (steel, aluminum, acrylic, polycarbonate, etc.) shall be per the basis of design.
- 13. Environmental ratings shall be per the Basis of Design.
- 14. Additional considerations shall be per notes on the Light Fixture Schedule and on the Drawings.
- 15. Confirm all finishes with Owner and Architect prior to ordering.
- 16. Per UF Standards, all fixtures shall be rated for a minimum of 80% output at 10 years of operation.

B. Compatibility with controls:

- 1. Per UF Standards, certify that fixtures have been tested, or will be tested, for flicker with controls as specified, including dimming.

C. Environmental Considerations:

- 1. All exterior fixtures shall be indicated for use in wet locations, even where installed in damp or dry locations.
- 2. Interior fixtures subject to high humidity or moisture shall be suitable for use in wet locations. This includes light fixtures for showers.

D. Construction/Finish:

- 1. No visible welding, no plane-protruding screws, latches, springs, hooks, rivets or plastic supports viewed from the occupied (room) side are allowed.

E. Maintainability:

- 1. Power supplies/drivers/ballasts, LED arrays, boards or light engines shall be easily field replaceable using common hand tools (e.g., screwdrivers, pliers, etc.) and without uninstalling the luminaire.



F. Maintenance Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - a. Fixtures: One for every thirty of each type and rating installed. Furnish at least one spare fixture for any type of fixture with at least ten units being installed by this project.
  - b. Lamps: One for every ten of each type and rating installed, rounded up. Furnish at least one of each type.
  - c. Track Heads: One for every ten of each type and rating installed, rounded up. Furnish at least one spare head for any type of head with at least ten units being installed by this project.
  - d. Diffusers and Lenses: One for every twenty of each type and rating installed, rounded up. Furnish at least one of each type.
  - e. Globes and Guards: One for every thirty of each type and rating installed, rounded up. Furnish at least one of each type.

PART 3 - EXECUTION

3.1 Examination:

- A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 Temporary Lighting:

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting.
- B. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.
- C. Contractor is responsible for replacing any light fixtures damaged over the course of construction.

3.3 Installation:

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Provide lamps in each luminaire.
- D. Supports:
  1. Sized and rated for luminaire weight.
  2. Able to maintain luminaire position after cleaning and relamping.
  3. Provide support for luminaire without causing deflection of ceiling or wall.
  4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
  5. Fixtures larger than 24"x24" shall be supported by all four corners.
  6. Fixtures 24"x24" and smaller shall be supported by two corners.
- E. Flush-Mounted Luminaire Support:



1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.
4. Do not use ceiling system as support for pendant luminaires.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Utilize back plates and/or other support methods were recommended by the manufacturer.
3. Do not attach luminaires directly to gypsum board.

G. Ceiling-Mounted Luminaire Support:

1. Do not support fixture from gypsum board.
2. Support fixture from structure, as required by the assembly.
3. Install per manufacturer's recommendations.

H. Suspended Luminaire Support:

1. Provide architectural finish items (escutcheons, etc.) at all ceiling penetrations. Coordinate finish with Architect.
2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Coordinate method of suspension with Architect.
5. Do not use ceiling system as support for suspended luminaires. Connect support wires or rods to building structure.

I. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

3.4 Identification:

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Electrical Identification".
- B. Per UF Standards, label each light fixture with a date of installation.

3.5 Field Quality Control:

- A. Perform the following tests and inspections:
  1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.



- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.
- D. Per UF Standards, certify that all light fixtures have been tested for flicker after installation of all lighting controls.

3.6 Adjusting:

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

3.7 Protection:

- A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the light fixtures shall be without damage at time of Substantial Completion.

3.8 Cleaning:

- A. Clean fixture surfaces of dirt, cement, plaster, and debris. Utilize cleansers compatible with fixture finishes and materials.

3.9 Training:

- A. Provide up to four hours of training from a factory authorized-representative, up to two sessions.
- B. Schedule training with Owner.
- C. Provide DVD recording of all training sessions. Ensure that audio is clear and intelligible.

END OF SECTION



## PART 1 - GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the electronic safety and security work as herein called for and shown on the drawings.
- 1.2 Related Documents:
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
  - B. This is a Basic Requirements Section. Provisions of this section apply to work of all Division 28 sections.
  - C. Review all other contract documents to be aware of conditions affecting work herein.
  - D. Definitions:
    - 1. Provide: Furnish and install, complete and ready for intended use.
    - 2. Furnish: Supply and deliver to project site, ready for subsequent requirements.
    - 3. Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar requirements.
- 1.3 Permits and Fees: Contractor shall obtain all necessary permits, meters, and inspections required for his work and pay all fees and charges incidental thereto.
- 1.4 Verification of Owner's Data: Prior to commencing any work the Contractor shall satisfy himself as to the accuracy of all data as indicated in these plans and specifications and/or as provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Architect/Engineer in order that proper adjustments can be anticipated and ordered. Commencement by the Contractor of any work shall be held as an acceptance of the data by him after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the said data.
- 1.5 Delivery and Storage of Materials: Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. All material shall be stored to provide protection from the weather and accidental damage.
- 1.6 Extent of work is indicated by the drawings, schedules, and the requirements of the specifications. Singular references shall not be construed as requiring only one device if multiple devices are shown on the drawings or are required for proper system operation.
- 1.7 Field Measurements and Coordination:
- A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. Separate divisional drawings and specifications shall not relieve the Contractor or subcontractors from full compliance of work of his trade indicated on any of the drawings or in any section of the specifications.
  - B. Verify all field dimensions and locations of equipment to ensure close, neat fit with other trades' work. Make use of all contract documents and approved shop drawings to verify exact dimension and locations.
  - C. Coordinate work in this division with all other trades in proper sequence to ensure that the total work is completed within contract time schedule and with a minimum cutting and patching.
  - D. Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on electronic safety and security drawings, be guided by architectural details and



conditions existing at job and coordinate this work with that of others.

- E. Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval.
- F. Carefully examine any existing conditions, wiring, devices, and premises. Compare drawings with existing conditions. Report any observed discrepancies. It shall be the Contractor's responsibility to properly coordinate the work and to identify problems in a timely manner. Written instructions will be issued to resolve discrepancies.
- G. Because of the small scale of the drawings, it is not possible to indicate all precise locations for all devices and equipment. Drawings are essentially diagrammatic. Study carefully the sizes and locations of structural members, wall and partition locations, trusses, and room dimensions and take actual measurements on the job. Locate devices, equipment, and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and for coordination with all trades. Contractor shall not order materials or perform work without such verification. No extra compensation will be allowed because field measurements vary from the dimensions on the drawings. If field measurements show that equipment or raceway cannot be fitted, the Architect/Engineer shall be consulted. Remove and relocate, without additional compensation, any item that is installed and is later found to encroach on space assigned to another use.

1.8 Guarantee:

- A. The Contractor shall guarantee labor, materials, and equipment for a period of one (1) year from Substantial Completion, or from Owner's occupancy, whichever is earlier. Contractor shall make good any defects and shall include all necessary adjustments to and replacement of defective items without expense to the Owner.
- B. Owner reserves right to make emergency repairs as required to keep equipment in operation without voiding Contractor's Guarantee Bond nor relieving Contractor of his responsibilities during guarantee period.

1.9 Approval Submittals:

- A. When approved, the submittal control log and submittals shall be an addition to the specifications herewith, and shall be of equal force in that no deviation will be permitted except with the approval of the Architect/Engineer.
  - 1. Shop drawings, product literature, and other approval submittals will only be reviewed if they are submitted in full accordance with the General and Supplementary Conditions and Division 1 Specification sections and the following.
    - a. Submittals shall be properly organized in accordance with the approved submittal control log.
    - b. Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.
    - c. Submittals shall be properly identified by a cover sheet showing the project name, Architect and Engineer names, submittal control number, specification section, a list of products or item names with model numbers in the order they appear in the package, and spaces for approval stamps. A sample cover sheet is included at the end of this section.
    - d. Submittals shall have been reviewed and approved by the General Contractor (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the coversheet.



- e. Submittals that include a series of fixtures or devices (such as control panels, initiating devices, or notification appliances) shall be organized by the device name or type and be marked accordingly. Each fixture must include all items associated with that fixture regardless of whether those items are used on other fixtures.
  - f. The electronic safety and security design shown on the drawings supports the equipment basis of design specifications at the time of design. If equipment by any division is submitted with different electronic safety and security requirements, it is the responsibility of the submitting contractor to resolve all required electronic safety and security design changes (wire and conduit size, point(s) of connection, etc.) and clearly show the proposed electronic safety and security configuration in the relevant submittal with a written statement that this change will be provided at no additional cost. Submittals made with no written reference to the electronic safety and security design will be presumed to work with the electronic safety and security design. Any corrections required will be at no additional cost.
- B. If the shop drawings show variation from the requirements of contract because of standard shop practice or other reasons, the Contractor shall make specific mention of such variation in writing in his letter of transmittal and on the submittal cover sheet in order that, if acceptable, Contractor will not be relieved of the responsibility for executing the work in accordance with the contract.
- C. Review of shop drawings, product literature, catalog data, or schedules shall not relieve the Contractor from responsibility for deviations from contract drawings or specifications, unless he has in writing called to the attention of the Architect/Engineer each such deviation in writing at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings, product literature, catalog data, or schedules. Any feature or function specified but not mentioned in the submittal shall be assumed to be included per the specification.
- D. Submit shop drawings as called for in other sections after award of the contract and before any material is ordered or fabricated. Shop drawings shall consist of plans, sections, elevations and details to scale (not smaller than 1/4" per foot), with dimensions clearly showing the installation. Direct copies of small scale project drawings issued to the Contractor are not acceptable. Drawings shall take into account equipment furnished under other sections and shall show space allotted for it. Include construction details and materials.
- 1.10 Test Reports and Verification Submittals: Submit test reports, certifications, and verification letters as called for in other sections. Contractor shall coordinate the required testing and documentation of system performance such that sufficient time exists to prepare the reports, submit the reports, review the reports, and take corrective action within the scheduled contract time.
- 1.11 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. When a copy of approval submittals is included in the O&M Manual, only the final "Approved" or "Approved as Noted" copy shall be used. Contractor shall organize these data in the O&M Manuals tabbed by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit manuals at the Substantial Completion inspection.

## PART 2 - PRODUCTS

- 2.1 All materials shall be new or Owner-supplied reused as shown on the drawings, the best of their respective kinds, suitable for the conditions and duties imposed on them



at the building and shall be of reputable manufacturers. The description, characteristics, and requirements of materials to be used shall be in accordance with qualifying conditions established in the following sections.

2.2 Equipment and Materials:

- A. All equipment and materials shall be new and the most suitable grade for the purpose intended. Equipment furnished under this division shall be the product of a manufacturer regularly engaged in the manufacture of such items for a period of three years. Where practical, all of the components shall be products of a single manufacturer in order to provide proper coordination and responsibility. Where required, Contractor shall furnish proof of installation of similar units or equipment.
- B. Each item of equipment shall bear a name plate showing the manufacturer's name, trade name, model number, serial number, ratings and other information necessary to fully identify it. This plate shall be permanently mounted in a prominent location and shall not be concealed, insulated, or painted.
- C. The label of the approving agency, such as UL, by which a standard has been established for the particular item, shall be in full view.
- D. The equipment shall be essentially the standard product of a manufacturer regularly engaged in the production of such equipment and shall be a product of the manufacturer's latest design.
- E. A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.
- F. Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.
- G. Materials and equipment are specified herein by a single or by multiple manufacturers to indicate quality, material, and type of construction desired. Manufacturer's products shown on the drawings have been used as basis for design; it shall be the Contractor's responsibility to ascertain that alternate manufacturer's products, or the particular products of named manufacturers, meet the detailed specifications and that size and arrangement of equipment are suitable for installation.
- H. Model Numbers: Catalog numbers and model numbers indicated in the drawings and specifications are used as a guide in the selection of the equipment and are only listed for the contractor's convenience. The contractor shall determine the actual model numbers for ordering materials in accordance with the written description of each item and with the intent of the drawings and specifications.

2.3 Requests for Substitution:

- A. Where a particular system, product, or material is specified by name, consider it as standard basis for bidding, and base proposal on the particular system, product, or material specified.
- B. Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.
  - 1. Required product cannot be supplied in time for compliance with Contract time requirements.
  - 2. Required product is not acceptable to governing authority, or determined to be non-compatible, or cannot be properly coordinated, warranted or insured, or has other recognized disability as certified by Contractor.
  - 3. Substantial cost advantage is offered to Owner after deducting offsetting disadvantages including delays, additional compensation for redesign, investigation, evaluation, and other necessary services and similar



considerations.

- C. All requests for substitution shall contain a "Comparison Schedule" and clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include but shall not be limited to data as follows for both the specified and substituted products:
1. Principal of operation.
  2. Materials of construction or finishes.
  3. Thickness of gauge of materials.
  4. Weight of item.
  5. Deleted features or items.
  6. Added features or items.
  7. Changes in other work caused by the substitution.
  8. Electronic safety and security ratings and properties.
  9. If the approved substitution contains differences or omissions not specifically called to the attention of the Architect/Engineer, the Owner reserves the right to require equal or similar features to be added to the substituted products (or to have the substituted products replaced) at the Contractor's expense.

### PART 3 - EXECUTION

- 3.1 Workmanship: All materials and equipment shall be installed and completed in a first-class workmanlike manner and in accordance with the best modern methods and practice. Any installation which is not orderly and reasonably neat, or does not allow adequate space for maintenance, shall be removed and replaced when so directed by the Architect/Engineer.
- 3.2 Coordination:
- A. The Contractor shall be responsible for complete coordination of the electronic safety and security systems with shop drawings of the building construction so the proper openings and sleeves or supports are provided for raceway or other appurtenances passing through slabs or walls.
  - B. Any additional steel supports required for the installation of any electronic safety and security equipment, piping, or ductwork shall be furnished and installed under the section of the specifications requiring the additional supports.
  - C. It shall be the Contractor's responsibility to see that all equipment such as terminal cabinets, fire alarm components, control panels, and such other apparatus or equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the drawings.
  - D. All connections to fixtures and equipment shown on the drawings shall be considered diagrammatic unless otherwise indicated by detail. The actual connections shall be made to fully suit the requirements of each case and adequately provide for expansion and servicing.
  - E. The contractor shall protect equipment, material, and fixtures at all times. He shall replace all equipment, material, and fixtures which are damaged as a result of inadequate protection.
  - F. Prior to starting and during progress of work, examine work and materials installed by others as they apply to work in this division. Report conditions which will prevent satisfactory installation.
  - G. Start of work will be construed as acceptance of suitability of work of others.
- 3.3 Interruption of Service: Before any equipment is shut down for disconnecting or tie-



ins, arrangements shall be made with the Architect/Engineer and this work shall be done at the time best suited to the Owner. This will typically be on weekends and/or holidays and/or after normal working hours. Services shall be restored the same day unless prior arrangements are made. All overtime or premium costs associated with this work shall be included in the base bid.

- 3.4 Phasing: Provide all required temporary wiring, lighting, fire alarm, equipment, and devices as required. Maintain temporary services to areas as required. Remove all temporary material and equipment on completion of work unless Engineer concurs that such material and equipment would be beneficial to the Owner on a permanent basis.
- 3.5 Cutting and Patching: Notify General Contractor to do all cutting and patching of all holes, chases, sleeves, and other openings required for installation of equipment furnished and installed under this section. Utilize experienced trades for cutting and patching. Obtain permission from Architect/Engineer before cutting any structural items.
- 3.6 Equipment Setting: Bolt equipment directly to concrete pads or vibration isolators as required, using hot-dipped galvanized anchor bolts, nuts, and washers. Level equipment.
- 3.7 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 26. Obtain matched color coatings from the manufacturer and apply as directed. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.
- 3.8 Clean-up: Thoroughly clean all exposed parts of apparatus and equipment of cement, plaster, and other materials and remove all oil and grease spots. Repaint or touch up as required to look like new. During progress of work, contractor is to carefully clean up and leave premises and all portions of building free from debris and in a clean and safe condition.
- 3.9 Start-up and Operational Test: Start each item of equipment in strict accordance with the manufacturer's instructions; or where noted under equipment specification, start-up shall be done by a qualified representative of the manufacturer. Alignment, lubrication, safety, and operating control shall be included in start-up check.
- 3.10 Record Drawings:
  - A. During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all piping, ductwork, equipment, and other systems which are not installed exactly as shown on the contract drawings.
  - B. Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1 sections.
- 3.11 Acceptance:
  - A. Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.
  - B. Instructions: At completion of the work, provide a competent and experienced person who is thoroughly familiar with project, for one day to instruct permanent operating personnel in operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.
  - C. Operation and Maintenance Manuals: Furnish four complete manuals bound in ring binders with Table of Contents, organized, and tabbed by specification section. Manuals shall contain:
    - 1. Detailed operating instructions and instructions for making minor adjustments.
    - 2. Complete wiring, control, and single line diagrams.
    - 3. Routine maintenance operations.



4. Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
  5. Copies of approved submittals.
  6. Copies of all manufacturer's warranties.
  7. Copies of test reports and verification submittals.
- D. Record Drawings: Submit record drawings.
- E. Acceptance will be granted on the basis of tests and inspections of job. A representative of firm that performed test and balance work shall be in attendance to assist. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.
- F. Control Diagrams: Frame under clear plastic and mount on equipment room wall.
- G. Single Line Diagrams: Frame under clear plastic and mount on equipment room wall.



PROJECT NAME  
PROJECT NUMBER

ARCHITECT: Company Name

ENGINEER: Mitchell Gulledge Engineering

CONTRACTOR: Contractor Name

SUBCONTRACTOR: Sub Name

SUPPLIER: Supply Company

MANUFACTURER: Manufacturer

DATE: mm/dd/yyyy

SECTION: 26 XX XX/Section Name

# SAMPLE

Any standard heading is acceptable.

1. Product 1: Manufacturer, Model

2. Product 2: Manufacturer, Model

3. Product 3: Manufacturer, Model

4. Product 4: Manufacturer, Model

5. Product 5: Manufacturer, Model

List each product individually.  
Include manufacturer name and  
model.

**Include GC or CM  
Approval stamp indicating  
review and acceptance by  
responsible contractor.**

END OF SECTION



## 28 05 01 ELECTRONIC SAFETY AND SECURITY CODES AND STANDARDS

## PART 1 - GENERAL

- 1.1 The work covered by this division consists of providing all labor, equipment, and materials and performing all operations necessary for the installation of the fire protection work as herein called for and shown on the drawings.
- 1.2 This is a Basic Electronic Safety and Security Requirements section. Provisions of this section apply to work of all Division 28 sections.

## PART 2 - CODES

- 2.1 All work under Division 28 shall be constructed in accordance with the codes listed herein. The design has been based on the requirements of these codes; and while it is not the responsibility of the Contractor to verify that all work called for complies with these codes, he shall be responsible for calling to the Architect/Engineer's attention any drawings or specifications that are not in conformance with these or other codes prior to ordering equipment or installing work.
- 2.2 Comply with regulations and codes of utility suppliers.
- 2.3 Where no specific method or form of construction is called for in the contract documents, the Contractor shall comply with code requirements when carrying out such work.
- 2.4 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.
- 2.5 Additional codes or standards applying to a specific part of the work may be included in that section.
- 2.6 The following codes and standards shall govern all work:
  - A. Florida Building Code – Sixth Edition (2017)
  - B. Florida Building Code – Sixth Edition (2017) – Existing Building
  - C. Florida Building Code – Sixth Edition (2017) – Mechanical
  - D. Florida Building Code – Sixth Edition (2017) – Plumbing
  - E. Florida Building Code – Sixth Edition (2017) – Fuel Gas
  - F. Florida Building Code – Sixth Edition (2017) – Accessibility
  - G. Florida Fire Prevention Code Sixth Edition
    1. Fire Code (NFPA 1 – 2015 Edition)
    2. Life Safety Code (NFPA 101 – 2015 Edition)
  - H. National Electric Code (NFPA 70 – 2014)
  - I. Fire Alarm and Signaling Code (NFPA 72 – 2013)

## PART 3 - STANDARDS

All materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments, to the extent referenced:

- 3.1 Underwriters' Laboratories (UL)
- 3.2 American National Standards Institution (ANSI)
- 3.3 American Society of Testing Materials (ASTM)
- 3.4 National Fire Protection Association (NFPA)
- 3.5 National Electrical Manufacturers Association (NEMA)
- 3.6 Institute of Electrical and Electronics Engineers (IEEE)

END OF SECTION



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## PART 1 - DIVISION 1 - GENERAL REQUIREMENTS

- 1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- 1.2 This is a Basic Electronic safety and security Requirements section. Provisions of this section apply to work of all Division 28 sections.
- 1.3 Coordinate with the General Contractor for all cutting and patching. Contractors performing Division 28 work shall inform the General Contractor of all cutting and patching required prior to bidding and shall coordinate installation.

## PART 2 - DIVISION 3 - CONCRETE

- 2.1 Refer to Division 3, Concrete for:
  - A. Rough grouting in and around ESS work.
  - B. Patching concrete cut to accommodate ESS work.

## PART 3 - DIVISION 4 - MASONRY

- 3.1 Refer to Division 4, Masonry for:
  - A. Installation of access doors in walls.

## PART 4 - DIVISION 5 - METALS

- 4.1 Refer to Division 5, Metals for:
  - A. Framing openings for ESS equipment.
- 4.2 The following is part of Division 28 work:
  - A. Supports for ESS work.

## PART 5 - DIVISION 6 - WOOD AND PLASTIC

- 5.1 Refer to Division 6, Wood for:
  - A. Framing openings for ESS equipment.

## PART 6 - DIVISION 7 - THERMAL AND MOISTURE PROTECTION

- 6.1 Refer to Division 7, Thermal and Moisture Protection for:
  - A. Installation of all roof curbs and roof supports for ESS work.
  - B. Caulking and waterproofing of all wall and roof mounted ESS work.
  - C. Providing all roof curbs and all flashing for metal roofs.
- 6.2 The following is part of Division 28 work, complying with the requirements of Division 7.
  - A. Fire barrier penetration seals.

## PART 7 - DIVISION 9 - FINISHES

- 7.1 Refer to Division 9, Finishes for:
  - A. Painting piping, and equipment.
  - B. Painting structural metal and concrete for ESS work.
  - C. Painting access panels.
  - D. Painting color-coded ESS work indicated for continuous painting. See color schedule in Division 28 section, "Electronic safety and security Identification".
  - E. Installation of access doors in gypsum drywall.



- 7.2 Colors shall be selected by the Architect for all painting of exposed ESS work in occupied spaces, unless specified herein. Do not paint insulated or jacketed surfaces.
- 7.3 Perform the following as part of Division 28 work:
- A. Touch up painting of factory finishes.
  - B. Painting of all hangers.

PART 8 - DIVISION 10 - SPECIALTIES

- 8.1 Refer to Division 10 - Specialties for:
- A. Fire extinguishers and fire extinguisher cabinets and accessories.

PART 9 - DIVISION 11 - EQUIPMENT

- 9.1 Refer to Division 11 - Equipment for all food service equipment to be provided. This includes the cooking hoods with fire suppression.
- 9.2 Refer to Division 11 - Equipment for all laboratory equipment including cabinets, casework, student stations, demonstration desks, fume hoods, snorkel exhausts, canopy hoods, safety stations, eyewashes, and all related fixtures, fittings, and trim.

PART 10 - DIVISION 21 - FIRE PROTECTION

- 10.1 Fire Protection and Electronic safety and security Contractors shall coordinate the exact ESS requirements of all fire protection equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The ESS design shown on the drawings supports the fire protection equipment basis of design. If fire protection equipment is submitted with different ESS requirements, it is the responsibility of the fire protection contractor to resolve all required ESS design changes (e.g. input/output voltage) and clearly show the new ESS design on the fire protection submittal with a written statement that this design will be provided at no additional cost. Fire Protection submittals made with no written reference to the ESS design will be presumed to work with the ESS design. Any corrections required will be at no additional cost to the Owner.
- 10.2 Electronic safety and security contractor shall provide fire alarm modules, detectors, and other appurtenances for fire protection equipment unless specifically noted as being furnished as part of fire protection equipment.
- 10.3 Electronic safety and security contractor shall provide all fire alarm wiring, raceway and devices, and make final ESS connections to all fire protection equipment, detectors, modules, contacts, controllers, and similar equipment.

PART 11 - DIVISION 22 - PLUMBING

- 11.1 Plumbing and Electronic safety and security Contractors shall coordinate the exact ESS requirements of all plumbing equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The ESS design shown on the drawings supports the plumbing equipment basis of design. If plumbing equipment is submitted with different ESS requirements, it is the responsibility of the plumbing contractor to resolve all required ESS design changes (e.g. input/output voltage) and clearly show the new ESS design on the plumbing submittal with a written statement that this design will be provided at no additional cost. Plumbing submittals made with no written reference to the ESS design will be presumed to work with the ESS design. Any corrections required will be at no additional cost to the Owner.



- 11.2 Electronic safety and security contractor shall provide fire alarm modules, detectors, and other appurtenances for plumbing equipment unless specifically noted as being furnished as part of plumbing equipment.
- 11.3 Electronic safety and security contractor shall provide all fire alarm wiring, raceway and devices, and make final ESS connections to all plumbing equipment, detectors, modules, contacts, controllers, and similar equipment.

#### PART 12 - DIVISION 23 - HVAC

- 12.1 Mechanical and Electronic safety and security Contractors shall coordinate the exact ESS requirements of all mechanical equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The ESS design shown on the drawings supports the mechanical equipment basis of design. If mechanical equipment is submitted with different ESS requirements, it is the responsibility of the mechanical contractor to resolve all required ESS design changes (e.g. input/output voltage) and clearly show the new ESS design on the mechanical submittal with a written statement that this design will be provided at no additional cost. Mechanical submittals made with no written reference to the ESS design will be presumed to work with the ESS design. Any corrections required will be at no additional cost to the Owner.
- 12.2 Mechanical contractor shall provide all HVAC control wiring including the Energy Management Control system sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 28. The intent is for the mechanical contractor to be responsible for the entire HVAC control system, including point-to-point wiring, and associated raceway and boxes. Electronic safety and security contractor shall notify mechanical contractor upon discovery of any mechanical controls installation which does not meet Division 28 requirements.
- 12.3 Electronic safety and security contractor shall provide fire alarm modules, detectors, and other appurtenances for mechanical equipment unless specifically noted as being furnished as part of mechanical equipment.
- 12.4 Electronic safety and security contractor shall provide all fire alarm wiring, raceway and devices, and make final ESS connections to all mechanical equipment, detectors, modules, contacts, controllers, and similar equipment.
- 12.5 All duct-mounted smoke detectors shall be furnished and wired by the ESS contractor and installed by the mechanical contractor.

#### PART 13 - DIVISION 26 - ELECTRICAL

- 13.1 Electrical and ESS Contractors shall coordinate the exact electrical requirements of all ESS equipment being provided. Where approval submittals are required, this coordination shall be accomplished prior to making the submittals. The electrical design shown on the drawings supports the ESS equipment basis of design. If ESS equipment is submitted with different electrical requirements, it is the responsibility of the ESS contractor to resolve all required electrical design changes (e.g. input/output voltage) and clearly show the new electrical design on the ESS submittal with a written statement that this design will be provided at no additional cost. Electrical submittals made with no written reference to the ESS design will be presumed to work with the electrical design. Any corrections required will be at no additional cost to the Owner.
- 13.2 ESS contractor shall provide ESS modules, detectors, and other appurtenances unless specifically noted as being furnished as part of electrical equipment.



- 13.3 ESS contractor shall provide all ESS wiring, raceway and devices, and make final ESS connections to all electrical equipment, detectors, modules, contacts, controllers, and similar equipment.

PART 14 - DIVISION 31 - EARTH WORK

14.1 Refer to Division 31, Sitework for:

- A. Coordination with work of other trades.
- B. Site domestic water piping.
- C. Additional site Electronic Safety and Security (ESS) work.

14.2 The following work is part of Division 28:

- A. All site ESS conduit, wiring, boxes, and other appurtenances.

END OF SECTION



## PART 1 - GENERAL

### 1.1 Related Documents:

- A. Drawings and general provisions of the contract, including general and supplementary conditions and Division 1 specification sections apply to this section.
- B. The work covered by this section is to be coordinated with related work as specified elsewhere in the specifications. Requirements of the following divisions apply:
  - 1. Division 23 – HVAC
  - 2. Division 26 – Electrical
- C. The system and all associated operations shall be in accordance with the following:
  - 1. Florida Building Code, 6th Edition (2017)
  - 2. Florida Fire Prevention Code, 6th Edition (2017)
    - a. 2015 NFPA 1, Florida Edition.
    - b. 2015 NFPA 101, Florida Edition.
  - 3. 2013 NFPA 72, National Fire Alarm Code
  - 4. 2014 NFPA 70, National Electrical Code
  - 5. 2015 NFPA 90A
  - 6. 2007 ASME A17.1, Safety Code for Elevators and Escalators
  - 7. 2008 ASME A17.3, Safety Code for Existing Elevators and Escalators
  - 8. 2009 ICC/ANSI A117.1 Accessible and Useable Buildings and Facilities
  - 9. Local jurisdictional adopted codes and standards
  - 10. ADA Accessibility Guidelines

### 1.2 Summary:

- A. This section covers fire alarm systems, including initiating devices, notification appliances, controls, and supervisory devices.
- B. Work covered by this section includes the furnishing of labor, equipment, and materials for installation of the fire alarm system as indicated on the drawings and specifications.
- C. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:
  - 1. Fire alarm system detection and notification operations.
  - 2. Control and monitoring of
    - a. smoke control equipment,
    - b. fire suppression systems, and
    - c. equipment as indicated in the drawings and specifications.

### 1.3 Definitions:

- A. ADA: Americans with Disabilities Act
- B. AHJ: Authority Having Jurisdiction
- C. ANSI: American National Standards Institute
- D. ASME: American Society of Mechanical Engineers
- E. FACP: Fire Alarm Control Panel
- F. FM: Factory Mutual
- G. IBC: International Building Code
- H. ICC: International Code Council
- I. IDC: Initiating Device Circuit
- J. IEEE: Institute of Electrical and Electronic Engineers



- K. IFC: International Fire Code
- L. IMC: International Mechanical Code
- M. IRI: Industrial Risk Insurers
- N. LED: Light-Emitting Diode
- O. NAC: Notification Appliance Circuit
- P. NFPA: National Fire Protection Association
- Q. NICET: National Institute for Certification in Engineering Technologies
- R. RAC: Releasing Appliance Circuit
- S. SLC: Signaling Line Circuit
- T. UL: Underwriters Laboratories

1.4 Scope of Work:

- A. This is a modification and expansion of an existing system. Existing smoke detectors, and notification shall remain. Additional duct detection shall be added as called for on the plans.
- B. This project involves the expansion of an existing system. Of primary importance are:
  - 1. Notification coverage of the new and renovated building area.
  - 2. Manual initiation devices as required by Code.
  - 3. Automatic initiation devices as required by Code.
- C. See the electrical drawings for additional scope information.
- D. Note: Some portions of this specification may not be realizable with the existing system. Comply with those portions of this specification which the existing system is capable of supporting.
- E. Regardless of any other project conditions, the final product shall be compliant with current code requirements in all areas affected by this project. Where the existing system is incapable of addressing current code requirements, the required functionality shall be added.

1.5 System Description:

- A. General: Provide a complete, non-coded addressable, microprocessor-based fire alarm system with initiating devices, notification appliances, and monitoring and control devices as indicated on the drawings and as specified herein.
- B. Power Requirements:
  - 1. The control unit shall receive AC power via a dedicated circuit with in-line surge protection installed at the unit.
  - 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal AC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to battery standby upon power failure. All battery charging and recharging operations shall be automatic. Battery runtime calculations shall include a twenty percent margin of safety.
  - 3. All circuits requiring system-operating power shall be 24 VDC nominal voltage and shall be individually fused at the control unit.
  - 4. The incoming power to the system shall be supervised so that any power failure will be indicated at the control unit. "Power on" status shall be displayed continuously at the user interface while incoming power is present.
  - 5. The system batteries shall be supervised so that a low battery or a depleted battery condition, or disconnection of the battery shall be indicated at the control unit and displayed for the specific fault type.



6. The system shall support NAC lockout feature to prevent subsequent activation of notification appliance circuits after a depleted battery condition occurs in order to make use of battery reserve for front panel annunciation and control.
  7. The system shall support 100% of addressable devices in alarm or operated at the same time, under both primary (AC) and secondary (battery) power conditions.
  8. Loss of primary power shall sound a trouble signal at the FACP. FACP shall indicate when the system is operating on an alternate power supply.
- C. Software: The fire alarm system shall allow for loading and editing instructions and operating sequences as necessary.
1. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation.
  2. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
  3. Panels shall be capable of full system operation during new site specific configuration download, master exec downloads, and slave execdownloads.
  4. Panels shall automatically store all program changes to the panel's non-volatile memory each time a new program is downloaded. Panels shall be capable of storing the active site-specific configuration program and no less than 9 previous revisions in reserve. A compare utility program shall also be available to authorized users to compare any two of the saved programs. The compare utility shall provide a deviation report highlighting the changes between the two compared programs.
  5. Panels shall provide electronic file storage with a means to retrieve a record copy of the site-specific software and up to 9 previous revisions. Sufficient file storage shall be provided for other related system documentation such as record drawings, record of completion, owner's manuals, testing, and maintenance records, etc.
  6. The media used to store the record copy of site-specific software and other related system documentation shall be electrically supervised. If the media is removed a trouble shall be reported on the fire alarm control panel.
- D. History Logs: The system shall provide a means to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
- E. Recording of Events: The system shall be capable of recording all alarm, supervisory, and trouble events by means of system printer. The printout shall include the type of signal (alarm, supervisory, or trouble) the device identification, date and time of the occurrence. The printout shall differentiate alarm signals from all other printed indications.
- F. Wiring/Signal Transmission:
1. Transmission shall be hard-wired using separate individual circuits for each zone of alarm operation, as required or addressable signal transmission, dedicated to fire alarm service only.
  2. System connections for initiating device circuits shall be Class B signaling line circuits shall be Class B and notification appliance circuits shall be Class B.
  3. Circuit Supervision: Circuit faults shall be indicated by a trouble signal at the FACP. Provide a distinctive indicating audible tone and alphanumeric annunciation.



G. Required Functions: The following are required system functions and operating features:

1. Priority of Signals: Fire alarm events have highest priority. Subsequent alarm events are queued in the order received and do not affect existing alarm conditions. Priority two, supervisory and trouble events have second-, third-, and fourth-level priority, respectively. Signals of a higher-level priority take precedence over signals of lower priority even though the lower-priority condition occurred first. Annunciate all events regardless of priority or order received.
2. Noninterfering: An event on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. The activation of an addressable device does not prevent the receipt of signals from subsequent addressable device activations.
3. Transmission to an Approved Supervising Station: Automatically route alarm, supervisory, and trouble signals to an approved supervising station service provider, under another contract.
4. Annunciation: Operation of alarm and supervisory initiating devices shall be annunciated at the FACP and the remote annunciator, indicating the type of device, the operational state of the device (i.e. alarm, trouble or supervisory) and shall display the custom label associated with the device.
5. Selective Alarm: A system alarm shall include:
  - a. Indication of alarm condition at the FACP and the annunciator(s).
  - b. Identification of the device/zone that is the source of the alarm at the FACP and the annunciator(s).
  - c. Operation of audible and visible notification appliances until silenced at FACP.
  - d. Shutting down supply and return fans serving zone where alarm is initiated.
  - e. Closing smoke dampers on system serving zone where alarm is initiated.
  - f. Transmission of signal to the supervising station.
6. Supervisory Operations: Upon activation of a supervisory device such as a fire pump power failure, low air pressure switch, and tamper switch, the system shall operate as follows:
  - a. Activate the system supervisory service audible signal and illuminate the LED at the control unit and the remote annunciator.
  - b. Pressing the supervisory acknowledge key will silence the supervisory audible signal while maintaining the supervisory LED "on" indicating off-normal condition.
  - c. Record the event in the FACP historical log.
  - d. Transmission of supervisory signal to the supervising station.
  - e. Restoring the condition shall cause the supervisory LED to clear and restore the system to normal.
7. Alarm Silencing: If the "alarm silence" button is pressed, all audible alarm signals shall cease operation.
8. Priority Two Operations: Upon activation of a priority two condition such as gas detection, chemical leak detection, intrusion alert, weather alert, the system shall operate as follows:
  - a. Activate the system priority two audible signal and illuminate the LED at the control unit and the remote annunciator.



- b. Pressing the priority 2 acknowledge key will silence the audible signal while maintaining the priority 2 LED "on" indicating off-normal condition.
  - c. Record the event in the FACP historical log.
  - d. Transmission of priority two signal to the supervising station.
  - e. Restoring the condition shall cause the priority 2 LED to clear and restore the system to normal.
- 9. System Reset:
  - a. The "system reset" button shall be used to return the system to its normal state. Display messages shall provide operator assurance of the sequential steps ("in progress", "reset completed") as they occur. The system shall verify all circuits or devices are restored prior to resetting the system to avoid the potential for re-arming the system. The display message shall indicate "alarm present, system reset aborted".
  - b. Should an alarm condition continue, the system will remain in an alarmed state.
- 10. A manual evacuation (drill) switch shall be provided to operate the notification appliances without causing other control circuits to be activated.
- 11. Walktest: The system shall have the capacity of 8 programmable passcode protected one person testing groups, such that only a portion of the system need be disabled during testing. The actuation of the "enable one person test" program at the control unit shall activate the "one person testing" mode of the system as follows:
  - a. The city circuit connection and any suppression release circuits shall be bypassed for the testing group.
  - b. Control relay functions associated with one of the 8 testing groups shall be bypassed.
  - c. The control unit shall indicate a trouble condition.
  - d. The alarm activation of any initiating device in the testing group shall cause the audible notification appliances assigned only to that group to sound a code to identify the device or zone.
  - e. The unit shall automatically reset itself after signaling is complete.
  - f. Any opening of an initiating device or notification appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating the trouble condition.
- 12. Install Mode: The system shall provide the capability to group all non-commissioned points and devices into a single "install mode" trouble condition allowing an operator to clearly identify event activations from commissioned points and devices in occupied areas.
  - a. It shall be possible to individually remove points from install mode as required for phased system commissioning.
  - b. It shall be possible to retrieve an install mode report listing that includes a list of all points assigned to the install mode. Panels not having an install mode shall be reprogrammed to remove any non-commissioned points and devices.
- 13. Module Distribution:
  - a. The fire alarm control panel shall be capable of allowing remote location of the following modules; interface of such modules shall be through a ClassB



supervised serial communications channel (SLC):

- 1 Initiating device circuits
- 2 Notification appliance circuits
- 3 Auxiliary control circuits
- 4 Graphic annunciator LED/switch control modules
  - a In systems with two or more annunciators and/or command centers, each annunciator/command center shall be programmable to allow multiple annunciators/command centers to have equal operation priority or to allow hierarchal priority control to be assigned to individual annunciator/command center locations.
- 5 Initiating device signaling line circuits
- 6 Notification appliance signaling line circuits
- 7 Power supplies

14. The service provider shall provide a minimum of two technicians for any system testing or commissioning.

H. Analog Smoke Sensors:

1. Monitoring: FACP shall individually monitor sensors for calibration, sensitivity, and alarm condition, and shall individually adjust for sensitivity. The control unit shall determine the condition of each sensor by comparing the sensor value to the stored values.
2. Environmental Compensation: The FACP shall maintain a moving average of the sensor's smoke chamber value to automatically compensate for dust, dirt, and other conditions that could affect detection operations.
3. Programmable Sensitivity: Photoelectric smoke sensors shall have 7 selectable sensitivity levels ranging from 0.2% to 3.7%, programmed and monitored from the FACP.
4. Sensitivity Testing Reports: The FACP shall provide sensor reports that meet NFPA 72 calibrated test method requirements.
  - a. Reports shall be capable of being printed for annual recording and logging of the calibration maintenance schedule.
5. The FACP shall automatically indicate when an individual sensor needs cleaning. The system shall provide a means to automatically indicate when a sensor requires cleaning. When a sensor's average value reaches a predetermined value, (3) progressive levels of reporting are provided. The first level shall indicate if a sensor is close to a trouble reporting condition and will be indicated on the FACP as "almost dirty". This condition provides a means to alert maintenance staff of a sensor approaching dirty without creating a trouble in the system. If this indicator is ignored and the second level is reached, a "dirty sensor" condition shall be indicated at the FACP and subsequently a system trouble is reported to the supervising station. The sensor base LED shall glow steady giving a visible indication at the sensor location. The "dirty sensor" condition shall not affect the sensitivity level required to alarm the sensor. If a "dirty sensor" is left unattended, and its average value increases to a third predetermined value, an "excessively dirty sensor" trouble condition shall be indicated at the control unit.
6. The FACP shall continuously perform an automatic self-test on each sensor that



- will check sensor electronics and ensure the accuracy of the values being transmitted. Any sensor that fails this test shall indicate a "self test abnormal" trouble condition.
7. Multi-sensors shall combine photoelectric smoke sensing and heat sensing technologies. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7%/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
  8. Programmable Bases: It shall be possible to program relay and sounder bases to operate independently of their associated sensor.
  9. Magnet test activation of smoke sensors shall be distinguished by its label and history log entry as being activated by a magnet.
- I. Fire Suppression Monitoring:
1. Water Flow: Activation of a water flow switch shall initiate general alarm operations.
  2. Sprinkler Valve Tamper Switch: The activation of any valve tamper switch shall activate system supervisory operations.
  3. Water flow switch and sprinkler valve tamper switch shall be capable of existing on the same initiating zone. Activation of either device shall distinctly report which device is in alarm on the initiating zone.
- J. Audible Alarm Notification: By speakers in areas as indicated on drawings.
- K. Speaker: Speaker notification appliances shall be listed to UL 1480.
1. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
  2. The following taps are available: 0.25W, 0.50W, 1.0W, and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  3. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
- L. Manual Voice Paging:
1. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group.
  2. The control unit operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers.
  3. Total building paging shall be accomplished by the means of an "All Call" switch.
- M. Constant Supervision of Non-Alarm Audio Functions:
1. When required, the system shall be configured to allow Non-Alarm Audio (NAA) functions such as background music or general/public address paging.
  2. During NAA operation, the speaker circuit shall be electrically supervised to provide continuous monitoring of the speaker circuit.
  3. During an alarm condition, supervision shall be disabled and alarm signals delivered to speakers.
- N. Firefighter's Phone: Provide a supervised, two-way communication system between the Command Center/main fire alarm control unit and emergency phones.



1. The firefighter's phone system shall be capable of handling single or simultaneous conversations with all phones connected into the system. As many as six phones shall be able to be connected into the active conversation.
2. The phone system circuits shall be designed to prevent static, hum, or other interference for clear, intelligible two-way conversation between all phones of the system.
3. The phone system circuits shall be supervised, such that the FACU shall be able to differentiate between whether a handset has been plugged into the emergency phone jack and whether the circuit has a shorted wire.
4. A beeping busy signal shall indicate to the person attempting to use a remote phone that the signal is being received at the control unit and that the lines are intact.
5. The act of plugging a handset into an emergency phone jack or removal of any phone from its normal hook position shall cause an audible and visual indication at the control unit. Picking up of the master phone and acknowledgment of the phone circuit shall silence the tone and allow for direct two-way communications.
6. The act of unplugging handsets in use and replacement of remote phones to their cradle shall restore normal supervisory functions.
7. Provide emergency phone jacks for installation in each elevator car by the elevator contractor. Required wiring from elevator controls to each elevator car shall be furnished and installed by the elevator contractor.
8. Provide emergency phone jacks as shown on the plans. Each jack shall be mounted on a stainless steel single gang plate with the words "Fire Emergency Phone" screened on each.
9. Provide a minimum of five (5) pluggable emergency phones within a storage cabinet.

1.6 Acceptance Submittals:

- A. General: Submit the following for review by owner, architect, and engineer prior to purchasing materials. Submit according to conditions of contract and Division 1 specification sections.
  1. Product data sheets for system components highlighted to indicate the specific products, features, or functions required to meet this specification. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.
  2. Wiring diagrams from manufacturer.
  3. Shop drawings showing system details including location of FACP, all devices, circuiting and details of graphic annunciator.
  4. System power and battery charts with performance graphs and voltage drop calculations to assure that the system will operate in accordance with the prescribed backup time periods and under all voltage conditions per UL and NFPA standards.
  5. System operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
- B. Submission to Authority Having Jurisdiction: In addition to routine submission of the above material, make an identical submission to the authority having jurisdiction.



Include copies of shop drawings as required to depict component locations to facilitate review. Upon receipt of comments from the authority, make resubmissions, if required, to make clarifications or revisions to obtain approval.

1.7 O&M Submittals:

- A. General: Submit the following for inclusion in operating and maintenance manual. Submit according to conditions of contract and Division 1 specification sections.
  - 1. Updated system operation description including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. A list of all input and output points in the system shall be provided with a label indicating location or use of IDC, SLC, NAC, relay, sensor, and auxiliary control circuits.
  - 2. Operating instructions for FACP.
  - 3. Operation and maintenance data. Include data for each type product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations.
  - 4. Product certification signed by a certified representative of the manufacturer of the fire alarm system components certifying that their products comply with indicated requirements.
  - 5. Record of field tests of system.

1.8 Quality Control:

- A. Installer Qualifications: A factory authorized installer shall perform the work of this section.
- B. Each and every item of the fire alarm system shall be listed under the appropriate category by a nationally recognized testing laboratory and shall bear the respective "NRTL" label.

1.9 Project Conditions:

- A. Interruption of Existing Fire-alarm Service: Do not interrupt fire-alarm service to facilities occupied by owner or others unless permitted under the following conditions, and then only after arranging to provide temporary guard service according to requirements indicated:
  - 1. Notify architect no fewer than two days in advance of proposed interruption of fire-alarm service.
  - 2. Do not proceed with interruption of fire-alarm service without architect's written permission.

1.10 Software Service Agreement:

- A. Comply with UL 864.
- B. Technical Support: Beginning with substantial completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at project completion. Install and program software upgrades that become available within two years from date of substantial completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
  - 1. Provide 30 days' notice to owner to allow scheduling and access to system and to allow owner to upgrade computer equipment if necessary.

1.11 Maintenance Service:



- A. Warranty Maintenance Service: Provide maintenance of fire alarm systems and equipment for a period of 12 months, using factory-authorized service representatives
- B. Basic Services: Routine maintenance visits on an "as needed" basis at times scheduled with the owner. Respond to service calls within 24 hours of notification of system trouble either by customer visit or other customer contact as necessary. Adjust and replace defective parts and components with original manufacturer's replacement parts, components, and supplies.
- C. Additional Services: Perform services within the above 12-month period not classified as routine maintenance or as warranty work when authorized in writing. Compensation for additional services must be agreed upon in writing prior to performing services.
- D. Maintenance Service Contract: No later than 60 days prior to the expiration of the warranty maintenance services, deliver to the owner a proposal to provide contract maintenance and repair services for an additional one-year term. As an option with this proposal, deliver to the owner a proposal to provide scheduled inspection and testing services for a one-year term. Owner will be under no obligation to accept maintenance service contract proposal or inspection and testing proposal.

1.12 Extra Materials:

- A. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
  - 1. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed, rounded up. (e.g. if up to 6 units were installed, provide 1 spare. If 7 units were installed, provide 2 spares, etc.)
  - 2. Notification Appliances: Furnish quantity equal to 10 percent of each type and number of units installed, rounded up. (e.g. if up to 10 units were installed, provide 1 spare. If 11 units were installed, provide 2 spares, etc.)
  - 3. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of each type and number of units installed, rounded up. (e.g. if up to 10 units were installed, provide 1 spare. If 11 units were installed, provide 2 spares, etc.)
  - 4. Detector or Sensor Bases: Furnish quantity equal to 2 percent of each type and number of units installed, rounded up. (e.g. if up to 50 units were installed, provide 1 spare. If 51 units were installed, provide 2 spares, etc.)
  - 5. Printer Ribbons: Furnish 6 spare printer ribbons when a printer is provided.

PART 2 - PRODUCTS

2.1 Acceptable Equipment and Service Providers:

- A. Manufacturers:
  - 1. Subject to compliance with the requirements of this specification, provide products by one of the following:
    - a. Simplex (Tyco)
- B. Being listed as an acceptable manufacturer in no way relieves obligation to provide all equipment and features in accordance with these specifications.
- C. Alternate products must be submitted to the engineer two weeks prior to bid for approval. Alternate or as-equal products submitted under this contract must provide a detailed line-by-line comparison of how the submitted product meets, exceeds, or does not comply with this specification.



- D. The equipment and service provider shall be a nationally recognized company specializing in fire alarm and detection systems. This provider shall employ factory trained and NICET Level III certified technicians, and shall maintain a service organization within 100 miles of this project location. The equipment and service provider shall have a minimum of 10 years experience in the fire protective signaling systems industry.

2.2 Systems Operational Description:

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
  2. Heat detectors.
  3. Flame detectors.
  4. Smoke detectors.
  5. Duct smoke detectors.
  6. Verified automatic alarm operation of smoke detectors.
  7. Automatic sprinkler system water flow.
  8. Heat detectors in elevator shaft and pit.
  9. Fire-extinguishing system operation.
  10. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
  2. Identify alarm at fire-alarm control unit and remote annunciators.
  3. Transmit an alarm signal to the remote alarm receiving station.
  4. Unlock electric door locks in designated egress paths.
  5. Release fire and smoke doors held open by magnetic door holders.
  6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
  8. Recall elevators to primary or alternate recall floors.
  9. Activate emergency lighting control.
  10. Activate emergency shutoffs for gas and fuel supplies.
  11. Record events in the system memory.
  12. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
  2. Low-air-pressure switch of a dry-pipe sprinkler system.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of primary power at fire-alarm control unit.
  4. Ground or a single break in fire-alarm control unit internal circuits.
  5. Abnormal AC voltage at fire-alarm control unit.
  6. Break in standby battery circuitry.



7. Failure of battery charging.
  8. Abnormal position of any switch at fire-alarm control unit or annunciator.
  9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer where provided.

2.3 Addressable Initiating:

A. Addressable Manual Pull Stations:

1. General requirements for manual fire-alarm boxes: comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
2. Description: Addressable single-action type, red Lexan. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units. Station shall be pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Provide with a front-facing red LED that will flash each time it is scanned by the control unit (once every 4 seconds). In alarm condition, the station LED shall be on steady.
4. Indoor Protective Shield: Where required, or as indicated on the drawings, provide a factory-fabricated, tamperproof, clear Lexan enclosure shield and red frame that easily fits over manual pull stations which shall be hinged at the top to permit lifting for access to initiate a local alarm. Unit shall be NRTL listed. Lifting the cover shall actuate an integral battery-powered audible horn intended to discourage false-alarm operation. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
5. Pull station shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist.

B. Addressable Analog Smoke Sensors:

1. General Requirements for System Smoke Detectors:
  - a. Comply with UL 268, "smoke detectors for fire protective signaling systems". Include the following features:
    - 1 Factory Nameplate: Serial number and type identification.
    - 2 Operating Voltage: 24 VDC, nominal and shall be two-wire type.
    - 3 Self-restoring: Detectors do not require resetting or readjustment after actuation to restore normal operation.
    - 4 Plug-in Arrangement: Sensor and associated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. Base shall provide break-off plastic tab that can be removed to engage the head/base locking mechanism. Provide terminals in the fixed base for connection to building wiring. No special tools shall be required to remove head once it has been locked. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the



control unit. Sensors shall include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Sensor address shall be located in base to eliminate false addressing when replacing sensors. Integral addressable module shall be arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Each sensor base shall contain an integral visual-indicating LED that will flash to provide power-on status each time it is scanned by the control unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady. Base mounting: detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.

- b. Each sensor base shall contain a magnetically actuated test switch to provide for easy pre-certification alarm testing at the sensor location.
  - c. Each sensor shall be scanned by the control unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device", the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5% obscuration for photoelectric sensor, 135 deg F and 15 deg F rate-of-rise for the heat sensor, but shall indicate a "wrong device" trouble condition.
  - d. Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit. Provide multiple levels of detection sensitivity for each sensor.
  - e. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
  - f. The sensor's electronics shall be immune from nuisance alarms caused by EMI and RFI. Removal of the sensor head for cleaning shall not require the setting of addresses.
  - g. Bases: CO sensor, relay output, sounder and isolator bases shall be supported alternatives to the standard base.
2. Addressable Sensor Bases:
- a. Standard Base: Twist lock addressable base with address selection dip switch accessible from front with sensor removed. Integral red LED for power-on (pulsing), or alarm or trouble (steady on). Locking anti-tamper design mounts on standard outlet box.
  - b. Sensor Base with Remote Device Connection: All standard base features with wired connection for either a remote LED alarm indicator or remote relay (relay is unsupervised and requires separate 24VDC).
  - c. Supervised Relay Bases: All standard base features and shall be available in either a 4-wire sensor base to use with remote or locally mounted relay; requires separate 24 VDC, or as a 2-wire sensor base to use with remote or locally mounted relay; no separate power required. Supervised relay operation shall be programmable and shall be manually operated from control panel.
  - d. Sensor Base with Built-in Electronic Alarm Sounder: All standard base features and piezoelectric sounder shall provide high output (88 dBA) with low current requirements (20 mA). Sounder shall be synchronized via SLC



communications or by the NAC if NAC powered, sounder shall operation shall be programmable and shall be manually operated from control panel.

- e. 520 Hz Sensor Base with Built-in Electronic Low Frequency Sounder: All standard base features and piezoelectric sounder shall provide a low frequency 520 Hz square wave (85 dBA) with nominal current requirements (115 mA). Sounder shall be synchronized via SLC communications or by the NAC if NAC powered, sounder operation shall be programmable and shall be manually operated from control panel.
  - 1 Emitted tone shall be a 520Hz square wave signal in compliance with the requirements of the 2010 edition of NFPA 72 for sleeping areas.
  - 2 The 520Hz sounder base shall be listed to UL 268 and UL464, audible signal appliances.

C. Addressable Duct Smoke Sensor:

- 1. Standard Addressable Duct Smoke Sensor Unit: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct housing shall include relay or relay driver as required for fan shutdown.
  - a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
  - b. The duct housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "form C" contact rated at 7A@ 28VDC or 10A@ 120VAC. This auxiliary relay output shall be fully programmable independent of the sensor head for activation by other alarm initiating devices within the fire alarm system. Relay shall be mounted within 3 feet of HVAC control circuit.
  - c. Duct housing shall provide a magnetic test area and red sensor status LED and duct housing shall provide a relay control yellow LED trouble indicator.
  - d. Duct housing shall have a transparent cover to monitor for the presence of smoke. Cover shall secure to housing by means of four (4) captive fastening screws.
  - e. Duct housing shall provide two (2) test ports for measuring airflow and for testing. These ports will allow aerosol injection in order to test the activation of the duct smoke sensor.
  - f. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
  - g. Each duct smoke sensor shall be provided with a remote test station with an alarm LED and test switch.
  - h. Where indicated provide a NEMA 4X weatherproof duct housing enclosure that shall provide for the circulation of conditioned air around the internally mounted addressable duct sensor housing to maintain the sensor housing at its rated temperature range. The housing shall be UL listed to standard 268a.
- 2. Addressable Air Aspirating Duct Smoke Sensors: Photoelectric type smoke detection with an aspirating system shall provide remote sensor location for ducts with difficult service access. Detectors shall support remote housing up to 82ft with 1.05" od rigid pipe; detectors shall support remote housing up to 50ft with 3/4" od flexible tubing. Sampling tubes shall be provided per design and



dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. Duct detection system shall be UL listed to standards 268a, and ulc listed to standard s529.

- a. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct smoke sensor shall be provided by the FACP.
- b. The air aspirating duct detection system shall supervise air flow through the duct housing and shall communicate trouble to the fire alarm control panel on a high or low air flow condition.
- c. The air aspirating duct housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single form C contact rated at 7a@ 28VDC and 120VAC. This auxiliary relay output shall be fully programmable. Relay shall be mounted within 3 feet of HVAC control circuit.
- d. Air aspirating duct housing shall provide a magnetic test area and red sensor status LED.
- e. Each duct smoke sensor shall have a remote test station with an alarm LED and test switch.
- f. Each duct housing shall have remote functional smoke testing capability.
- g. Each duct housing shall be supplied with a replacement air inlet filter.
- h. Each duct housing shall have an optional water trap with a ball valve for draining to eliminate moisture buildup.
- i. The air aspirating detection system shall have an operating air velocity range of 0 to 4000 linear ft/minute) 0 to 1220 meters/minute.
- j. The addressable air aspirating detection system shall be capable of use in other areas as open area detection where point type detectors are not practical, such as; prison cells in correctional facilities, transformer vaults, cable tunnels, and MRI rooms.

D. Addressable Heat Sensors:

1. General Requirements for Heat Detectors: Comply with UL 521.
2. Heat detectors shall be sealed against intrusion by moisture, dust, and insects.
3. Thermal Sensor Combination Type: Fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
4. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag. Selectable rate compensated, fixed temperature sensing with or without rate-of-rise operation.
5. Mounting: Twist-lock base interchangeable with smoke-sensor heads.
6. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
7. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135 deg F or 155 deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15 deg F or 20 deg F per minute.
8. Sensor shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32 deg F to 155 degF.
9. Unless otherwise indicated, sensors shall be analog-addressable type,



individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for temperature by fire-alarm control unit.

- a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
- b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

E. Addressable Circuit Interface Modules:

1. Addressable Circuit Interface Modules: Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of AHU systems.
2. Addressable circuit interface modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line circuit or a separate two wire pair running from an appropriate power supply, as required.
3. There shall be the following types of modules:
  - a. Type 1: Monitor circuit interface module:
    - 1 For conventional 2-wire smoke detector and/or contact device monitoring with Class B or Class A wiring supervision. The supervision of the zone wiring will be Class B. This module will communicate status (normal, alarm, trouble) to the FACP.
    - 2 For conventional 4-wire smoke detector with Class B wiring supervision. The module will provide detector reset capability and over-current power protection for the 4-wire detector. This module will communicate status (normal, alarm, trouble) to the FACP.
  - b. Type 2: Line powered monitor circuit interface module:
    - 1 This type of module is an individually addressable module that has both its power and its communications supplied by the two wire signaling line circuit. It provides location specific addressability to an initiating device by monitoring normally open dry contacts. This module shall have the capability of communicating four zone status conditions (normal, alarm, current limited, trouble) to the FACP.
    - 2 This module shall provide location specific addressability for up to five initiating devices by monitoring normally closed or normally open dry contact security devices. The module shall communicate four zone status conditions (open, normal, abnormal, and short). The two-wire signaling line circuit shall supply power and communications to the module.
  - c. Type 3: Single address multi-point interface modules:
    - 1 This multipoint module shall provide location specific addressability for four initiating circuits and control two output relays from a single address. Inputs shall provide supervised monitoring of normally open, dry contacts and be capable of communicating four zone status



- conditions (normal, open, current limited, and short). The input circuits and output relay operation shall be controlled independently and disabled separately.
- 2 This dual point module shall provide a supervised multi-state input and a relay output, using a single address. The input shall provide supervised monitoring of two normally open, dry contacts with a single point and be capable of communicating four zone status conditions (normal, open, current limited, and short). The two-wire signaling line circuit shall supply power and communications to the module.
  - 3 This dual point module shall monitor an unsupervised normally open, dry contact with one point and control an output relay with the other point, using a single address. The two-wire signaling line circuit shall supply power and communications to the module.
- d. Type 4: Line powered control circuit interface module:
- 1 This module shall provide control and status tracking of a form "C" contact. The two-wire signaling line circuit shall supply power and communications to the module.
- e. Type 5: 4-20 mA analog monitor circuit interface module:
- 1 This module shall communicate the status of a compatible 4-20 mA sensor to the FACP. The FACP shall annunciate up to three threshold levels, each with custom action message; display and archive actual sensor analog levels; and permit sensor calibration date recording.
4. All circuit interface modules shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.

#### 2.4 Conventional Notification:

##### A. Standard Alarm Notification Appliances:

1. Speaker/Visible: Combination speaker/visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480.
  - a. Twisted/Shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC.
  - b. The following taps are available: 0.25W, 0.50W, 1.0W, and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  - c. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
  - d. The S/V installs directly to a 4" square, 1-1/2" deep electrical box with 1-1/2" extension.
2. Speaker: Speaker notification appliances shall be listed to UL 1480.



- a. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
  - b. The following taps are available: 0.25W, 0.50W, 1.0W, and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  - c. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
  - d. The speaker installs directly to a 4" square, 1-1/2" deep electrical box with 1-1/2" extension.
3. High Intensity Horn/Visible: Combination audible/visible (A/V) notification appliances shall be listed to UL 1971 and UL 1480. The strobe light shall consist of a xenon flash tube and associated lens/reflector system. Strobe appliances shall be provided with different minimum flash intensities of 135cd, 177cd, and 185cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific strobe.
  - a. Twisted/Shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC.
  - b. The following taps are available: 0.25W, 0.50W, 1.0W, and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  - c. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
  - d. The S/V installs directly to a 4" square, 1-1/2" deep electrical box with 1-1/2" extension.
4. Weatherproof Audible/Visible: Weatherproof horn/strobe shall be UL 1480 and UL 1971 listed for indoor applications with strobe intensity selectable as 15, 60, or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (wp75). The appliances shall be acceptable for indoor and outdoor, extended temperature, and extended humidity applications. The A/V device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover, and weatherproof mounting box. The candela levels shall be selectable by using a hardware selector on the appliance.
  - a. Twisted/Shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC.
  - b. The following taps are available: 0.25W, 0.50W, 1.0W, and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
  - c. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
  - d. The S/V installs directly to a 4" square, 1-1/2" deep electrical box with 1-1/2" extension.
5. Visible/Only: Strobe shall be listed to UL 1971. The v/o shall consist of a xenon flash tube and associated lens/reflector system. The v/o enclosure shall mount directly to standard single gang, double gang, or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 15cd, 30cd, 75cd, and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific visible/only appliance.



6. High Intensity Visible/Only: High intensity visible/only: visible/only: strobe shall be listed to UL 1971. The v/o shall consist of a xenon flash tube and associated lens/reflector system. The v/o appliance shall mount directly to standard single gang, double gang, or 4" square electrical box, without the use of special adapters or trim rings. V/O appliances shall be provided with different minimum flash intensities of 135cd, 177cd, and 185cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific visible/only appliance.
7. Weatherproof Visible Only: Weatherproof strobe shall be UL 1971 listed for indoor applications with strobe intensity selectable as 15, 60, or 75 cd or UL 1638 listed for outdoor applications with strobe rated at 75 cd (wp75). The appliances shall be acceptable for indoor and outdoor, extended temperature, and extended humidity applications. The v/o device shall consist of a xenon flash tube and associated lens/reflector system, weatherproof cover, and weatherproof mounting box. The candela levels shall be selectable by using a hardware selector on the appliance.
8. Notification appliance circuit provides synchronization of strobes at a rate of 1Hz and operates speakers with an a temporal code pattern operation. The circuit shall provide the capability to silence the audible signals, while the strobes continue to flash, over a single pair of wires. The capability to synchronize multiple notification appliance circuits shall be provided.
9. Accessories: The contractor shall furnish any necessary accessories.

B. NAC Power Extender:

1. The SLC NAC power extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be Class B rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
2. The internal power supply and battery charger shall be capable of charging up 12.7 ah batteries internally mounted or 18ah batteries mounted in an external cabinet.
3. The NAC extender panel may be mounted close to the host control unit or can be remotely located. The SLC addressable NAC extender panel when connected to an addressable panel shall connect to the host panel via an SLC communications channel. Via the SLC channel each output NAC can be individually controlled for general alarm or selective area notification.
4. For SLC connected NAC extender panels up to five panels can be connected on a single SLC channel.
5. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control unit may be used to activate all the circuits on the NAC power extender panel.
6. Alarms from the host fire alarm control panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its nacs for trouble conditions and shall report trouble conditions to the host panel.

2.5 Emergency Power Supply:

- A. General: Components include battery, charger, and an automatic transfer switch.
- B. Battery: Sealed lead-acid or nickel cadmium type. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes. Battery runtime



calculations shall include a twenty percent margin of safety.

### PART 3 - EXECUTION

#### 3.1 Installation, General:

- A. Install system components and all associated devices in accordance with applicable NFPA standards and manufacturer's recommendations.
- B. Installation personnel shall be supervised by persons who are qualified and experienced in the installation, inspection, and testing of fire alarm systems. Examples of qualified personnel shall include, but not be limited to, the following:
  - 1. Factory trained and certified personnel.
  - 2. National institute of certification in engineering technologies (NICET) fire alarm Level III certified personnel.
  - 3. Personnel licensed or certified by state or local authority.

#### 3.2 Equipment Installation:

- A. Furnish and install a complete fire alarm system as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, Ethernet drops, and all other necessary material for a complete operating system.
- B. Existing fire alarm equipment shall be maintained fully operational until the new equipment has been tested and accepted.
- C. Equipment Removal: After acceptance of the new fire alarm system, disconnect and remove the existing fire alarm equipment and restore damaged surfaces. Package operational fire alarm and detection equipment that has been removed and deliver to the owner. Remove from the site and legally dispose of the remainder of the existing material.
- D. Water-flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
- E. Device Location-indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- F. Install manual station with operating handle 48 inches (1.22 m) above floor. Install wall mounted audible and visual notification appliances not less than 80 inches (2.03 m) above floor to bottom of lens and not greater than 96 inches (2.44 m) above floor to bottom of lens.
- G. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- H. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control units, duct smoke detectors.
- I. Automatic Detector Installation: Conform to NFPA 72.

#### 3.3 Preparation:

- A. Coordinate work of this section with other affected work and construction schedule.

#### 3.4 Connections:

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in division 08 section "door hardware". Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system



in this section before making connections.

- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Smoke dampers in air ducts of designated air-conditioning duct systems.
  - 2. Alarm-initiating connection to elevator recall system and components.
  - 3. Alarm-initiating connection to activate emergency lighting control.
  - 4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 5. Supervisory connections at valve supervisory switches.
  - 6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 7. Supervisory connections at elevator shunt trip breaker.
  - 8. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
  - 9. Supervisory connections at fire-pump engine control panel.

3.5 Wiring Installation:

- A. System Wiring: Wire and cable shall be a type listed for its intended use by an approval agency acceptable to the authority having jurisdiction and shall be installed in accordance with the appropriate articles from the current approved edition of NFPA 70: National Electrical Code (NEC).
- B. Contractor shall obtain from the fire alarm system manufacturer written instruction regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the contractor without the prior written approval of the fire alarm system manufacturer.
- C. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
- D. Mount end-of-line device in box with last device or separate box adjacent to last device for Class B supervision.

3.6 Identification:

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 section "Electrical Identification".
- B. Fire alarm system wiring shall be identified by tags at every point of access, including pull boxes, terminal boxes, device boxes, etc.
- C. Install framed instructions in a location visible from fire-alarm control unit.

3.7 Grounding:

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.8 Field Quality Control:

- A. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.



- B. Service personnel shall be qualified and experienced in the inspection, testing, and maintenance of fire alarm systems. Examples of qualified personnel shall be permitted to include, but shall not be limited to, individuals with the following qualifications:
  - 1. Factory trained and certified.
  - 2. National institute for certification in engineering technologies (NICET) fire alarm certified.
  - 3. International municipal signal association (IMSA) fire alarm certified.
  - 4. Certified by a state or local authority.
  - 5. Trained and qualified personnel employed by an organization listed by a national testing laboratory for the servicing of fire alarm systems.
- C. Pretesting: Determine, through pretesting, the conformance of the system to the requirements of the drawings and specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.
- D. Inspection:
  - 1. Inspect equipment installation, interconnection with system devices, mounting locations, and mounting methods.
  - 2. Verify that units and controls are properly installed, connected, and labeled and that interconnecting wires and terminals are identified.
- E. Acceptance Operational Tests:
  - 1. Perform operational system tests to verify conformance with specifications:
    - a. Each alarm initiating device installed shall be operationally tested. Each device shall be tested for alarm and trouble conditions. Contractor shall submit a written certification that the fire alarm system installation is complete including all punch-list items. Test battery operated emergency power supply. Test emergency power supply to minimum durations specified. Test supervising station signal transmitter. Coordinate testing with supervising station monitoring firm/entity.
    - b. Test each notification appliance installed for proper operation. Submit written report indicating sound pressure levels at specified distances.
    - c. Test fire alarm control panel and remote annunciator.
    - d. Test 10% of existing system as required by NFPA 72. Coordinate exact scope of this work with Owner and AHJ.
  - 2. Provide minimum 10 days notice of acceptance test performance schedule to owner, and local authority having jurisdiction.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Use NFPA 72 forms for documentation.
- H. Final test, record of completion, and certificate of occupancy:
  - 1. Test the system as required by the authority having jurisdiction in order to obtain a certificate of occupancy. Provide completed NFPA 72 record of completion form to owner and AHJ.

3.9 Demonstration:



- A. Engage a factory-authorized service representative to train owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

3.10 Cleaning and Adjusting:

- A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Clean unit internally using methods and materials recommended by manufacturer.
- B. Occupancy Adjustments: When requested within one year of date of substantial completion, provide on-site assistance in adjusting sound pressure levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three visits to the site for this purpose.

3.11 Training:

- A. Provide the services of a factory-authorized service representative to demonstrate the system and train owner's maintenance personnel as specified below.
  - 1. Train owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 4 hours' training.
  - 2. Schedule training with the owner at least seven days in advance.

END OF SECTION



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# JHMHC COMMUNICORE AHU-5, 7, & 8 REPLACEMENT

## THE UNIVERSITY OF FLORIDA

MP05285  
1249 CENTER DRIVE  
GAINESVILLE, FL 32610



SITE LOCATION MAP



Sheet List	
Sheet Number	Sheet Name
M001	MECHANICAL LEGEND, NOTES & SCHEDULE
M002	MECHANICAL DETAILS
M100	MECHANICAL ROOF PLAN
M101	MECHANICAL AHU-5 PENTHOUSE PLANS
M102	MECHANICAL AHU-7 PENTHOUSE PLANS
M103	MECHANICAL AHU-8 PENTHOUSE PLANS
M301	MECHANICAL CONTROLS
M302	MECHANICAL CONTROLS
E001	ELECTRICAL LEGEND, DETAILS, & SCHEDULES
E010	ELECTRICAL BASEMENT PLAN
E020	ELECTRICAL GROUND FLOOR PLAN
E050	ELECTRICAL THIRD FLOOR PLAN
E100	ELECTRICAL ROOF PLAN
E101	ELECTRICAL AHU-5 PENTHOUSE PLANS
E102	ELECTRICAL AHU-7 PENTHOUSE PLANS
E103	ELECTRICAL AHU-8 PENTHOUSE PLANS
E201	ELECTRICAL SCHEDULES

ADDITIVE ALTERNATE #1  
ALL WORK ASSOCIATED WITH AHU-5 INCLUDING REPLACEMENT OF ALL PENTHOUSE  
LEVEL FIRE DAMPER.

ADDITIVE ALTERNATE #2  
ALL WORK TO REPLACE THE PENTHOUSE LEVEL FIRE DAMPERS FOR AHU-7&8.

UNIT PRICING:  
REFER TO FIRE DAMPER SCHEDULE.

100% CONSTRUCTION DOCUMENTS  
DECEMBER 20, 2019





## MECHANICAL LEGEND

24XCD YYYCFM		CEILING DIFFUSER: YYY=AIRFLOW 24=SQUARE SIZE, XX=NECK SIZE
24X24RAG YYYCFM XX"		RETURN AIR GRILLE YYY=AIRFLOW, XX=NECK SIZE
24X24EG YYYCFM XX"		EXHAUST GRILLE YYY=AIRFLOW, XX=NECK SIZE
		DUCT ELBOW (TURNING VANES SHOWN)
		FLEXIBLE DUCT CONNECTION
		FIRE DAMPER
		SMOKE DAMPER
		FIRE SMOKE DAMPER
		MOTORIZED DAMPER
		MANUAL BALANCING DAMPER
		EQUIPMENT TAG XX=EQUIP TYPE, YY=EQUIP. NO.
		CONNECT TO EXISTING
		THERMOSTAT
		HUMIDISTAT
		SMOKE DETECTOR
		SPECIFIED AIR BALANCE OFFSET IN CFM
		HARDWIRE INTERLOCK
		CONTROL DEVICE (SEE CONTROLS ABBREVIATIONS)
		GATE VALVE
		GLOBE VALVE
		CHECK VALVE
		BALL VALVE
		BUTTERFLY VALVE
		CALIBRATED BALANCING VALVE (CIRCUIT SETTER)
		RELIEF VALVE
		TWO WAY CONTROL VALVE
		THREE WAY CONTROL VALVE
		PLUG VALVE
		PRESSURE REDUCING VALVE
		STRAINER
		THERMOMETER
		SENSOR WELL
		UNION
		PRESSURE GAUGE
		ECCENTRIC REDUCER
		CONCENTRIC REDUCER
		VENTURI FLOW METER
		FLEXIBLE PIPE CONNECTION

## MECHANICAL ABBREVIATIONS

ABC	AIR CONDITIONING
ABS	ABSOLUTE
ABFS	ABOVE FINISHED FLOOR
ALUM	ALUMINUM
AMPS	AMPERES
ATM	ATMOSPHERE
AUTO	AUTOMATIC
BD	BALANCING DAMPER
BFC	BELOW FINISHED CEILING
BHM	BRAKE HORSE POWER
BT	BOTTOM THROAT
BTU	BRITISH THERMAL UNIT
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CJ	CAST IRON
CO	CLEAN OUT
DB	DRY BULB OR DECIBELS
DDC	DIRECT DIGITAL CONTROL
DIA	DIAMETER
DN	DOWN
EA	EACH
EAT	ENTERING AIR TEMPERATURE
EDB	ENTERING DRY BULB TEMPERATURE
EP	ELECTRIC PNEUMATIC
EWT	ENTERING WET BULB TEMPERATURE
EWB	ENTERING WATER TEMPERATURE
FA	FREE AREA IN SQUARE FEET
FLC	FAIL CLOSED; FLEXIBLE CONNECTION
FLA	FULL LOAD AMPS
FO	FAIL OPEN
FFM	FEET PER MINUTE
FFS	FEET PER SECOND
GAL	GALLON
GALV	GALVANIZED
GEN	GENERATOR
GPH	GALLON PER HOUR
GPM	GALLON PER MINUTE
HB	HORSE BIB
HP	HORSE POWER
HVAC	HEATING VENTILATING AND AIR-CONDITIONING
HZ	HERTZ
IN	INCHES
IN H2O	INCHES OF WATER
IN WG	INCHES OF WATER GAUGE
KW	KILOWATTS
LAT	LEAVING AIR TEMPERATURE
LRA	LEAVING DRY BULB TEMPERATURE
LDB	LOCK ROTOR DAMPER
LWT	LEAVING WET BULB TEMPERATURE
LWR	LEAVING WATER TEMPERATURE
MET	MECHANICAL EQUIPMENT ROOM
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OAS	OPERABLE AIR OPENING
PH	PHASE
ORV	PRESSURE REDUCING VALVE
OPB	OPPOSED BLADE DAMPER
PS	POUNDS PER SQUARE INCH
OZ	OUNCE
PE	PNEUMATIC ELECTRIC
PSIG	POUNDS PER SQUARE INCH GAUGE
RA	RETURN AIR
RPM	REVOLUTIONS PER MINUTE
SIS	STAINLESS STEEL
SA	SUPPLY AIR
SD	SPLITTER DAMPER
SEC	SECOND
SP	STATIC PRESSURE
SQ FT	SQUARE FOOT
STD	STANDARD
T	THROAT
TEMP	TEMPERATURE
TG	TRANSFER GRILLE
TSP	TOTAL STATIC PRESSURE
TT	TOP THROAT
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
V	VOLUME
W	WIDTH, WEST, WATER
W	WITH
W/O	WITHOUT
WB	WET BULB
WMS	WIRE MESH SCREEN

## MECHANICAL GENERAL NOTES

1. IN GENERAL, PLANS AND DIAGRAMS ARE SCHEMATIC ONLY AND SHOULD NOT BE SCALED.
2. THE INTENT OF THE SPECIFICATIONS AND DRAWINGS IS TO CLARIFY THE SCOPE OF WORK AND ALERT CONTRACTOR OF EXISTING CONDITIONS. THE CONTRACTOR SHALL VISIT THE SITE AND VERIFY ALL CLEARANCES BEFORE FABRICATION OF DUCTWORK AND PROVIDE ADDITIONAL OFFSET AND/OR CHANGES IN DUCT SIZES TO MEET FIELD CONDITIONS AND COORDINATE WITH ELECTRICAL, PLUMBING AND FIRE PROTECTION SUBCONTRACTOR BEFORE ANY CONSTRUCTION WORK.
3. SHOULD ANY CONFLICTS ARISE, THE CONTRACTOR SHALL NOTIFY THE ENGINEER OF THE CONFLICT BEFORE ANY CHANGES ARE MADE. THE CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL BEFORE PROCEEDING WITH ANY CHANGES.
4. DUCT DIMENSIONS SHOWN ON DRAWINGS ARE CLEAR INSIDE DIMENSIONS. DUCTWORK, DIFFUSERS, REGISTERS, GRILLES, AND OTHER ITEMS OF THE AIR HANDLING SYSTEM SHALL NOT BE SUPPORTED BY THE CEILING OR CEILING SUSPENSION SYSTEM.
5. ALL SUPPLY AND RETURN DUCTWORK SHALL BE EXTERNALLY INSULATED SHEET METAL CONSTRUCTION IN ACCORDANCE WITH LATEST SMACNA STANDARDS. ALL EXHAUST DUCTWORK SHALL BE CONSTRUCTED OF GALVANIZED STEEL METAL MATERIAL UNLESS NOTED OTHERWISE. APPLY LOW VOC DUCT MASTIC PER SMACNA AND LEED STANDARDS. PRESSURE TEST ALL DUCTWORK.
6. ALL WORK COVERED IN THIS SECTION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST PUBLISHED STANDARDS OF ASHRAE, AND NFPA. ALL DUCTWORK MUST BE INSTALLED 6" AWAY FROM ANY FIRE RATED WALL TO ALLOW FOR WALL INSPECTION.
7. THE CONTRACTOR IS RESPONSIBLE FOR ALL TRADES INSTALLATION SCHEDULES. FIXED WORK SUCH AS DUCTWORK AND GRAVITY PLUMBING SHALL BE INSTALLED PRIOR TO ANY TRADE WORK THAT CAN BE EASILY RELOCATED OR OFFSET SUCH AS ELECTRICAL CONDUITS, SMALL DIAMETER PLUMBING PRESSURE PIPING, ETC.
8. PENETRATIONS THROUGH SMOKE- OR FIRE-RATED ASSEMBLIES: PENETRATIONS FOR PIPES, CONDUITS OR OTHER PURPOSES THROUGH ASSEMBLIES (FLOORS, ROOF, WALLS, PARTITIONS, ETC.) WITH A REQUIRED FIRE RESISTANCE RATING SHALL BE SEALED TO THE PENETRATING MEMBER IN AN APPROVED MANNER WHICH MAINTAINS THE REQUIRED FIRE RESISTANCE RATING OF THE ASSEMBLY.
9. UNLESS OTHERWISE NOTED, INSTALL DUCTWORK AS HIGH AS POSSIBLE, TIGHT TO BOTTOM OF STRUCTURE. COORDINATE DUCT ELEVATION WITH RAIN LEADERS, WATER PIPING, SANITARY DRAINS AND MAJOR ELECTRICAL CONDUITS.
10. IT IS THE RESPONSIBILITY OF THE MECHANICAL INSTALLER TO PATCH AND REPAIR ANY DUCT OPENINGS WHICH RESULT FROM THE RELOCATION OR ELIMINATION OF ANY EXISTING AIR DEVICES. THE PATCH IS TO BE OF A SIMILAR MATERIAL TO THE REPAIRED DUCT AND TO BE SEALED IN ACCORDANCE WITH SMACNA STANDARDS.
11. ALL INSULATION SHALL HAVE A MINIMUM FLAME SPREAD/SMOKE DEVELOPED RATING OF 25/50.
12. SUBMIT EQUIPMENT AND MATERIAL SUBMITTALS.
13. AT THE CONCLUSION OF INSTALLATION THE CONTRACTOR SHALL SUBMIT TO THE ENGINEER FOR APPROVAL A COMPLETE CERTIFIED TEST AND BALANCE REPORT FROM AN AGENCY HAVING A MINIMUM OF THREE YEARS EXPERIENCE AND REGISTERED WITH THE NEBB OR ABC. REPORT SHALL ITEMIZE THE PERFORMANCE OF EACH AIR DEVICE AND A/C UNIT WITH REGARD TO CFM, STATIC PRESSURE AND TEMPERATURE. TABULATE ALL VALUES AND COMPARE TO EQUIPMENT TOTAL PERFORMANCE. PROVIDE PERCENT DEVIATIONS OF RECORDED VALUES FROM DESIGN VALUES. CONTRACTOR SHALL SUBMIT A CERTIFIED COPY OF THE TEST AND BALANCE REPORT TO THE ENGINEER FOR REVIEW AND APPROVAL.
14. CONTRACTOR SHALL ARRANGE TO PAY FOR ALL NECESSARY PERMITS, LICENSES AND INSPECTIONS AS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
15. CONTRACTOR SHALL PROVIDE EQUIPMENT SUBMITTAL DOCUMENTATION TO OWNER'S UTILITY PROVIDER FOR REBATE PURPOSES. REFER TO OWNER'S NON-TECHNICAL SPECIFICATIONS.

### TAB PRETEST NOTES

TAB CONTRACTOR SHALL PERFORM THE FOLLOWING MEASUREMENTS AND REPORT TO ENGINEER FOR REVIEW AND APPROVAL PRIOR TO START OF DEMOLITION. NOTIFY ENGINEER 24 HOURS IN ADVANCE OF PRETEST TO PROVIDE ENGINEER THE OPPORTUNITY TO PARTICIPATE IN THE PRE-TEST AND/OR CLARIFY ANY SPECIAL REQUIREMENTS. RECORD VALUES AS FOLLOWS:

- |    |       |   |
|----|-------|---|
| 1. | AHU-5 | A. INDIVIDUAL ZONE SUPPLY AIRFLOW BY PERFORMING A SUPPLY DUCT TRAVERSE IN MECHANICAL PENTHOUSE.                   |
|    |       | B. TOTAL SUPPLY AIRFLOW BY SUMMATION OF ALL ZONE SUPPLY AIRFLOWS.   |
|    |       | C. SUPPLY FAN TOTAL STATIC PRESSURE.  |
|    |       | D. EXTERNAL STATIC PRESSURE MEASURED UPSTREAM OF FILTER SECTION AND DOWNSTREAM OF THE HOT/COLD DECK ZONE DAMPERS. |
|    |       | E. TOTAL OUTDOOR AIRFLOW BY DUCT TRAVERSE.  |
|    |       | F. CHW FLOW MEASURED VIA EX VETURI FLOW METER WITH EX CHW CONTROL VALVE COMANDED TO 100% OPEN VALVE POSITION.     |
|    |       | G. CHW COIL PRESSURE DROP WITH CHW CONTROL VALVE AT 100% OPEN VALVE POSITION.                                     |
|    |       | H. HHW FLOW VIA EX VETURI FLOW METER WITH EX HHW CONTROL VALVE COMMANDED TO 100% OPEN VALVE POSITION.             |
|    |       | I. HHW COIL PRESSURE DROP WITH HHW CONTROL VALVE AT 100% OPEN VALVE POSITION.                                     |
| 2. | AHU-7 | A. TOTAL SUPPLY AIRFLOW BY SUPPLY DUCT TRAVERSE LOCATED IN THE MECHANICAL PENTHOUSE.                              |
|    |       | B. SUPPLY FAN TOTAL STATIC PRESSURE.  |
|    |       | C. EXTERNAL STATIC PRESSURE MEASURED UPSTREAM OF FILTER SECTION AND DOWNSTREAM OF THE COOLING COIL.               |
|    |       | D. TOTAL OUTDOOR AIRFLOW BY DUCT TRAVERSE.  |
|    |       | E. CHW FLOW MEASURED VIA EX VETURI FLOW METER WITH EX CHW CONTROL VALVE COMANDED TO 100% OPEN VALVE POSITION.     |
|    |       | F. CHW COIL PRESSURE DROP WITH CHW CONTROL VALVE AT 100% OPEN VALVE POSITION.                                     |
| 3. | AHU-8 | A. TOTAL SUPPLY AIRFLOW BY SUPPLY DUCT TRAVERSE LOCATED IN THE MECHANICAL PENTHOUSE.                              |
|    |       | B. SUPPLY FAN TOTAL STATIC PRESSURE.  |
|    |       | C. EXTERNAL STATIC PRESSURE MEASURED UPSTREAM OF FILTER SECTION AND DOWNSTREAM OF THE COOLING COIL.               |
|    |       | D. TOTAL OUTDOOR AIRFLOW BY DUCT TRAVERSE.  |
|    |       | E. CHW FLOW MEASURED VIA EX VETURI FLOW METER WITH EX CHW CONTROL VALVE COMMANDED TO 100% OPEN VALVE POSITION.    |
|    |       | F. CHW COIL PRESSURE DROP WITH CHW CONTROL VALVE AT 100% OPEN VALVE POSITION.                                     |

## EXISTING CONDITIONS NOTES

1. CONTRACTOR SHALL VISIT THE PROJECT SITE PRIOR TO START OF CONSTRUCTION. CONTRACTOR SHALL SURVEY THE PROJECT AREA AND BRING TO THE ENGINEER'S ATTENTION, ANY CONCERNS ABOUT PROJECT DESIGN, SCHEDULE OR FACILITY IMPACT.
2. COORDINATE ANY UTILITY OR EQUIPMENT OUTAGES WITH OWNER. PROVIDE MINIMUM NOTICE OF SEVEN DAYS PRIOR TO ANY OUTAGE.

## CODES AND STANDARDS

ALL PROJECT WORK SHALL BE GOVERNED BY AND ADHERE TO THE FOLLOWING CODES AND STANDARDS.

1. FLORIDA BUILDING CODE - SIXTH EDITION (2017)
  - A. FLORIDA BUILDING CODE - SIXTH EDITION (2017) - MECHANICAL
  - B. FLORIDA BUILDING CODE - SIXTH EDITION (2017) - EXISTING BUILDING
  - C. FLORIDA BUILDING CODE - SIXTH EDITION (2017) - ENERGY CONSERVATION
2. FLORIDA FIRE PREVENTION CODE SIXTH EDITION (2017)
  - A. FIRE CODE (NFA 1 - 2015 FLORIDA EDITION)
  - B. LIFE SAFETY CODE (NFPA 101 - 2015 FLORIDA EDITION)
3. NATIONAL ELECTRIC CODE (NFPA 70 - 2014)
4. FIRE ALARM AND SIGNALING CODE (NFPA 72 - 2013)
5. UNDERWRITERS' LABORATORIES (UL)
6. AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI)
7. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
8. SHEET METAL & AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
9. AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR-CONDITIONING ENGINEERS (ASHRAE)
10. AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL (AMCA)
11. NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)
12. ASSOCIATED AIR BALANCE COUNCIL (AABC)

## CUSTOM AIR HANDLING UNIT SCHEDULE

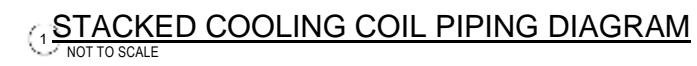
MANUFACTURER UNIT TYPE	TEMPERATURE CHILLED WATER	TEMPERATURE CHILLED WATER	TEMPERATURE CHILLED WATER
AIR HANDLER MARK	AHU-5	AHU-7	AHU-8
AIR HANDLER MODEL	CUSTOM	CUSTOM	CUSTOM
DESIGN CONDITIONS			
SUMMER OUTDOOR TEMP DB/WB (DEG F)	96/80	96/80	96/80
SUMMER INDOOR DB/WB (DEG F)	75/63	75/63	75/63
WINTER OUTDOOR TEMP (DEG F)	30	30	30
WINTER INDOOR (DEG F)	70	70	70
TOTAL AIR (CFM)	24,000	28,200	28,200
OUTSIDE AIR (CFM)	4,000	7,000	7,000
EXTERNAL STATIC PRESSURE ("WG)	2.5	2.5	2.5
TOTAL STATIC PRESSURE W/DIRTY FILTER ("WG)	6.0	6.0	6.0
COOLING COIL (CHW)			
ENTERING AIR TEMPERATURE (DB/WB DEG F)	73/63.3	80/67.4	80/67.4
LEAVING AIR TEMPERATURE (DB/WB DEG F)	55/54.5	55/54.5	55/54.5
ENTERING WATER TEMPERATURE (DEG F)	45	45	45
LEAVING WATER TEMPERATURE (DEG F)	60	60	60
CHILLED WATER FLOW (GPM)	84	152	152
TOTAL CAPACITY (BTUH)	627,000	1,134,000	1,134,000
SENSIBLE CAPACITY (BTUH)	465,000	705,000	705,000
MINIMUM ROWS & MAXIMUM FINS/INCH	8 & 10	8 & 10	8 & 10
MAX AIR PRESSURE DROP (IN WG)	1.0	1.0	1.0
MAX WATER PRESSURE DROP (FT WG)	3	3	3
CONTROL VALVE TYPE	2-WAY	2-WAY	2-WAY
CONTROL VALVE SIZE (IN)	2-1/2"	3"	3"
MAX CONTROL VALVE PRESSURE DROP (PSI)	5.0	5.0	5.0
HEATING COIL (HHW)			
ENTERING AIR TEMPERATURE (DEG F)	54	N/A	N/A
LEAVING AIR TEMPERATURE (DEG F)	116	N/A	N/A
ENTERING WATER TEMPERATURE (DEG F)	200	N/A	N/A
LEAVING WATER TEMPERATURE (DEG F)	160	N/A	N/A
HEATING HOT WATER FLOW (GPM)	41	N/A	N/A
MINIMUM ROWS & MAXIMUM FINS/INCH	2 & 10	N/A	N/A
CAPACITY (BTUH)	803,600	N/A	N/A
MAX AIR PRESSURE DROP (IN WG)	0.50	N/A	N/A
MAX WATER PRESSURE DROP (FT WG)	5.00	N/A	N/A
CONTROL VALVE TYPE	2-WAY	N/A	N/A
CONTROL VALVE SIZE (IN)	1-1/2"	N/A	N/A
MAX CONTROL VALVE PRESSURE DROP (PSI)	5.0	N/A	N/A
FAN SECTION			
NO OF FANS	6	6	6
FAN AIRFLOW (EACH) (MIN/MAX CFM)	2,000/4,000	2,000/4,700	2,000/4,700
FAN SPEED (EACH) (RPM)	2,250	2,250	2,250
VOLTS-PHASE	460-3	460-3	460-3
FAN POWER (EACH) (HP/BHP)	7.5	7.5	7.5
SINGLE VFD WITH BYPASS (HP)	50	50	50
FILTRATION			
2" PRE-FILTER	MERV 7	MERV 7	MERV 7
2" AFTER FILTER	MERV 15	MERV 15	MERV 15
WEIGHT (LBS)	13,000	12,750	12,750
DISCHARGE SOUND RATING (DB)			
63 Hz	89	91	91
125Hz	84	86	86
250Hz	90	94	94
SCHEDULE NOTES	(1)(2)(3)(4)(5)(6)(7)(8)(9)(10)	(1)(2)(3)(4)(5)(6)(8)(9)(10)	(1)(2)(3)(4)(5)(6)(8)(9)(10)
1) PROVIDE FIELD INSTALLED AHU MANUFACTURER UV LIGHTS.			
2) PROVIDE WINDOW FOR EACH ACCESS DOOR. SEE FLOORPLAN FOR DOOR SWING.			
3) PROVIDE TWO STACKED CHW COILS WITH INTERMEDIATE DRAIN PAN.			
4) PROVIDE 6" BASE RAIL.			
5) EACH FAN SIZED FOR 1/6 OF TOTAL AIRFLOW			
6) PROVIDE FLOW RING FOR EACH FAN.			
7) HEATING COIL LOCATED IN HOT DECK.			
8) PROVIDE SHIPPING SPLIT FOR FIELD ASSEMBLY.			
9) PROVIDE KNOCKDOWN CONSTRUCTION			
10) PROVIDE SERVICE LIGHTS IN EACH ACCESS SECTION			

## FIRE DAMPER SCHEDULE

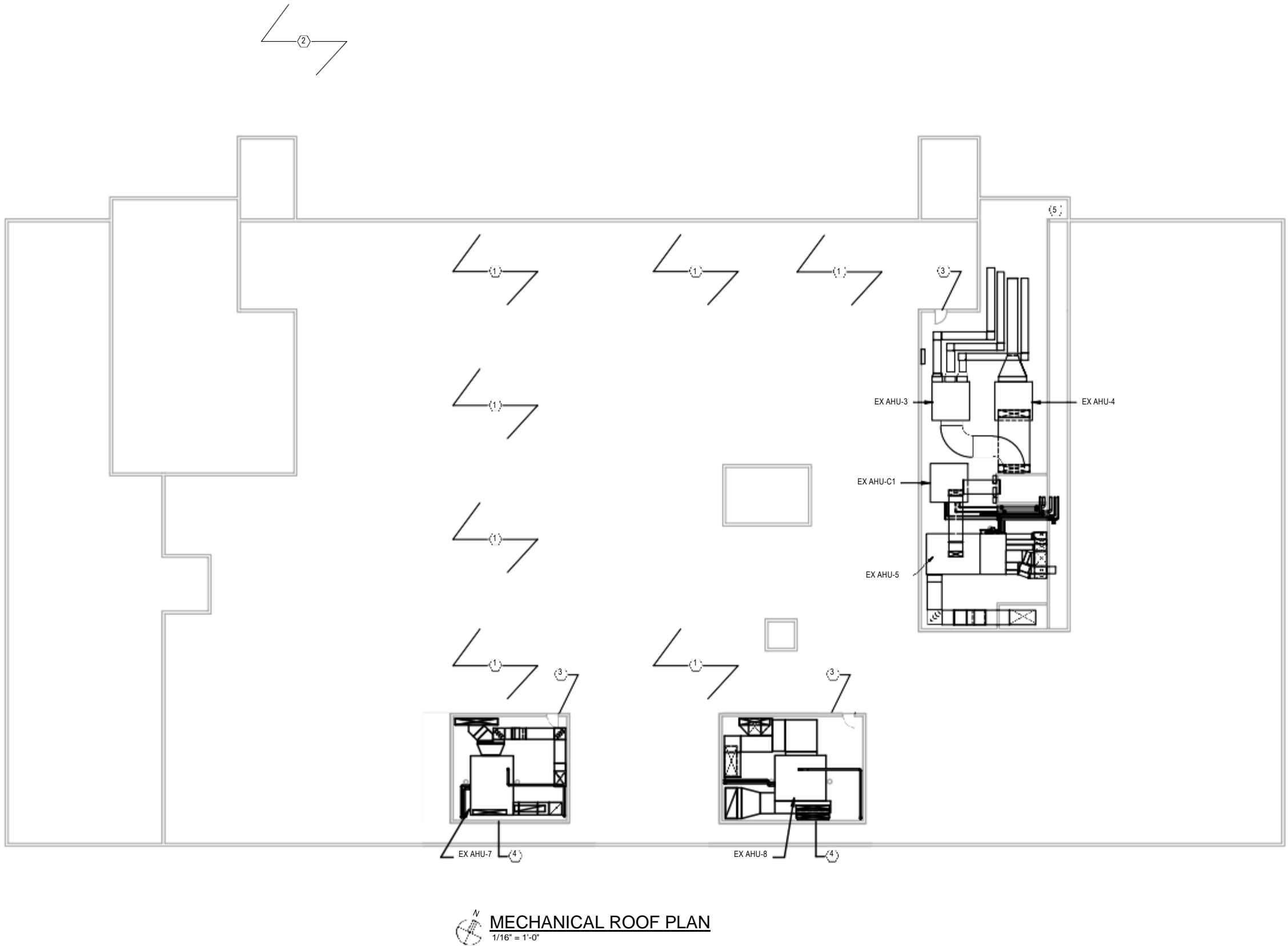
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(3) PROVIDE DEDUCTIVE UNIT PRICING ON BID FORM INCLUDING COMPLETE INSTALLATION FOR THREE DAMPER RANGES: 8 SQ FT OR LESS, BETWEEN 8 SQ FT AND 12 SQ FT, & 12 SQ FT OR MORE









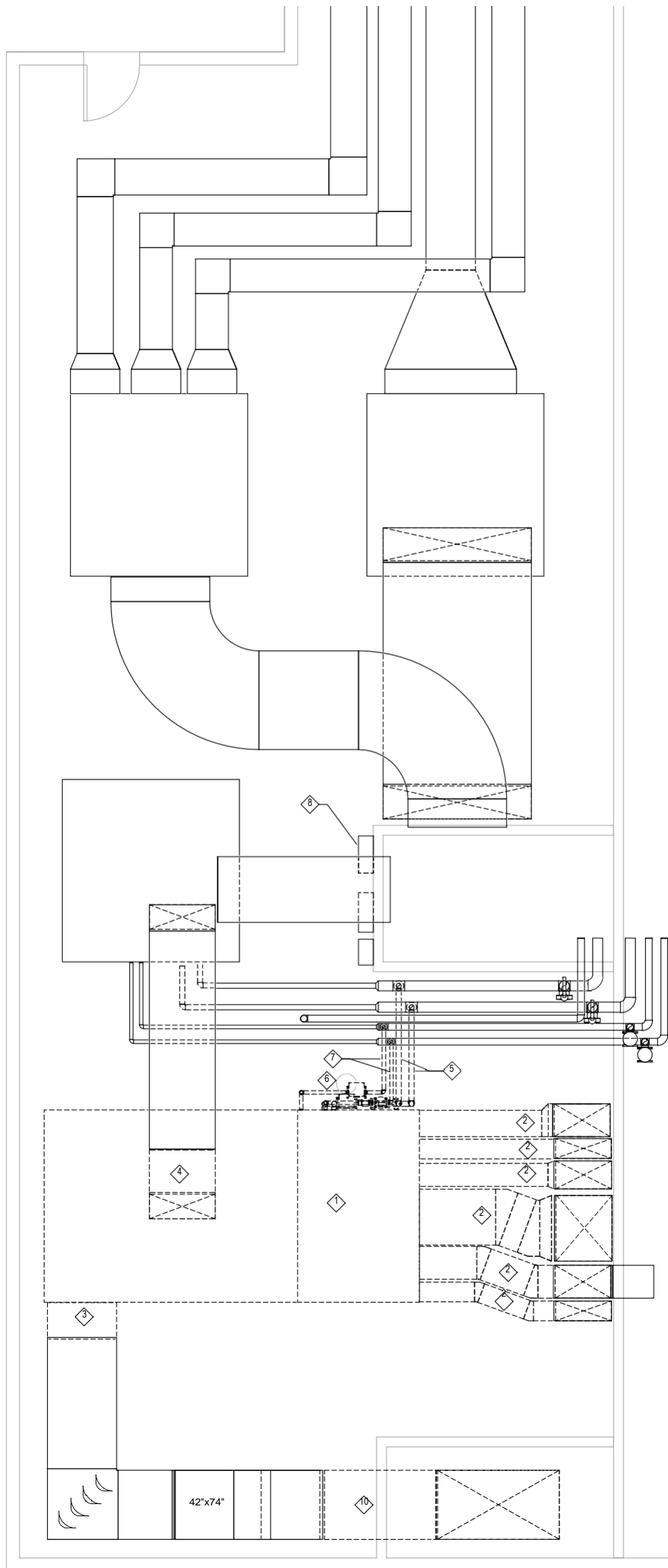
**PHASING NOTES:**

1. COORDINATE ANY CHILLED WATER OUTAGE WITH OWNER'S SCHEDULE. PROVIDE 2 WEEK NOTICE.
2. PHASE WORK TO PRIORITIZE AHU-8 REPLACEMENT FIRST AND AHU-7 SECOND.
3. PHASE WORK TO LIMIT OUTAGE OF EXISTING OPERATIONAL AHUs TO A 5 BUSINESS DAYS. PROVIDE PREMIUM TIME WORK AS REQUIRED TO COMPLETE REPLACEMENT WORK WITHIN THIS TIMEFRAME.
4. COORDINATE DRAINAGE AND REFILL OF CHILLED WATER SYSTEM FOR TIE-IN OF NEW INSULATED CHILLED WATER PIPING, VALVES, AND ACCESSORIES. ENSURE THAT PIPING IS PROPERLY FLUSHED PRIOR TO STARTUP.
5. PROVIDE CHEMICAL TREATMENT SERVICES FOR NEW PIPING AND REFILLED SYSTEM BY OWNER'S CHEMICAL TREATMENT COMPANY.

**SHEET NOTES:**

- ① PROTECT ROOF FROM DAMAGE, WEAR & TEAR, AND STAINING DURING CONSTRUCTION ACTIVITIES. PROVIDE ROOF PROTECTION.
- ② FIELD VERIFY LOCATION OF AVAILABLE STAGING, RIGGING, AND CRANE OPERATION ONSITE PRIOR TO BIDDING. PROTECT ALL EXISTING SITE INFRASTRUCTURE FROM DAMAGE DURING CONSTRUCTION ACTIVITIES. REPAIR ANY AND ALL DAMAGE FROM CONSTRUCTION ACTIVITIES AT NO ADDED COST TO OWNER.
- ③ EXISTING DOOR TO BE UTILIZED FOR ACCESS TO ROOF PENTHOUSES. COORDINATE PHYSICAL SIZE OF NEW EQUIPMENT COMPONENTS WITH AVAILABLE DOOR OPENING.
- ④ EXISTING ROOFTOP GOOSENECK OA INTAKE AND CURB.
- ⑤ FIELD VERIFY LOCATION OF EXISTING CHWS&R AND HHWS&R ISOLATION VALVES SERVING AHU-5, AHU-4, AHU-3 AND AHU-C1 PRIOR TO BIDDING.





**MECHANICAL AHU-5 PENTHOUSE - DEMOLITION**  
1/4" = 1'-0"

**TAB PRETEST NOTES:**

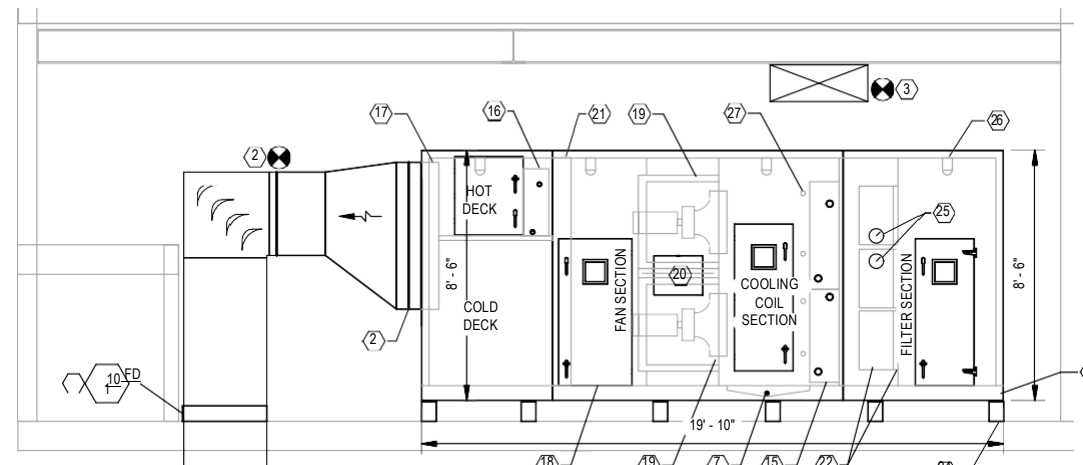
PRIOR TO START OF DEMOLITION TAB CONTRACTOR SHALL PERFORM PRETEST OF EXISTING SYSTEM AS DESCRIBED IN TAB PRETEST NOTES ON SHEET M001.

**GENERAL NOTES:**

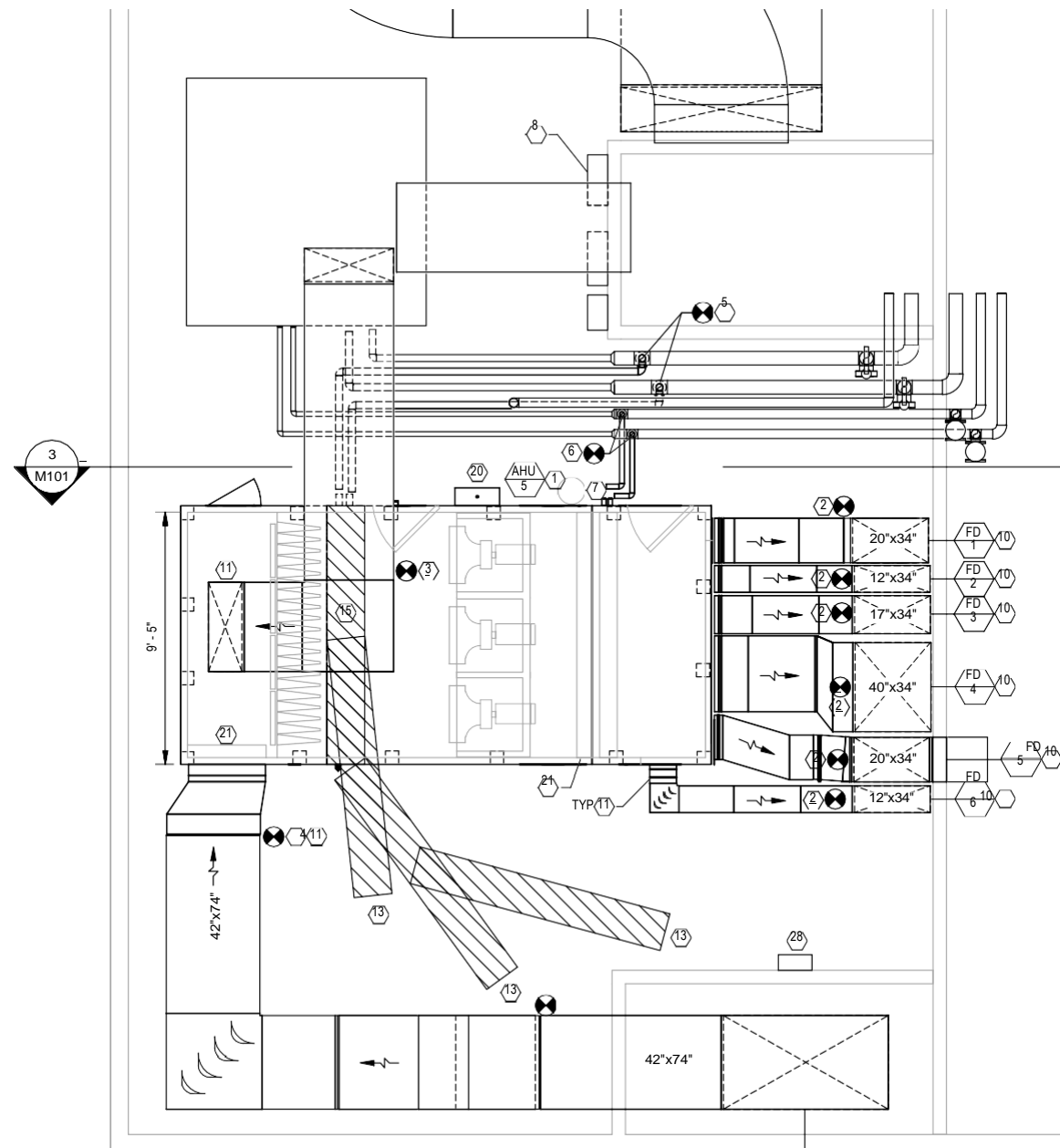
ENSURE THAT ALL HHW AND CHW OUTAGES ARE COORDINATED WITH THE OWNER.

**DEMOLITION NOTES:**

- 1 DEMOLISH EXISTING AIR HANDLER. TURNOVER EX FAN MOTOR TO OWNER.
- 2 DEMOLISH EXISTING SUPPLY DUCT
- 3 DEMOLISH EXISTING RETURN DUCT
- 4 DEMOLISH EXISTING OUTDOOR AIR DUCT. THE PRECONDITIONING UNIT SHALL REMAIN OPERATIONAL DURING CONSTRUCTION. PROVIDE CONSTRUCTION FILTER MEDIA AT DUCT DISCHARGE.
- 5 DEMOLISH EXISTING CHWS&R PIPING AND PIPING ACCESSORIES. UTILIZE ISOLATION VALVES LOCATED IN THE NORTH EAST CORNER OF THE AHU-5 PENTHOUSE.
- 6 DEMOLISH EXISTING CONDENSATE DRAIN PIPING
- 7 DEMOLISH EXISTING HHWS&R PIPING AND PIPING ACCESSORIES. UTILIZE ISOLATION VALVES LOCATED IN THE NORTH EAST CORNER OF THE AHU-5 PENTHOUS
- 8 DEMOLISH EXISTING AHU-5 CONTROLS. EX PANEL TO REMAIN.
- 9 DEMOLISH EXISTING THERMOSTATS LOCATED ON THIRD LEVEL.
- 10 DEMOLISH EXISTING RETURN DUCT TO ALLOW CHASE ACCESS AND NEW FIRE DAMPER INSTALLATION.



**AHU-5 SECTION**  
1/4" = 1'-0"



**MECHANICAL AHU-5 PENTHOUSE**  
1/4" = 1'-0"

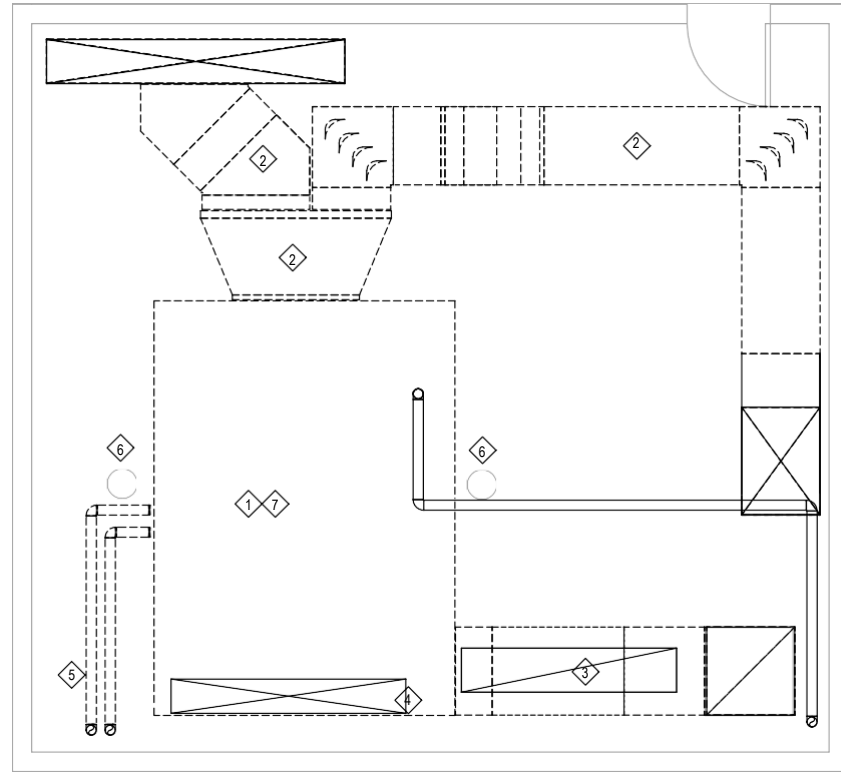
**ADDITIVE ALTERNATE NOTES:**


1. ALL WORK ASSOCIATED WITH AHU-5 IS ADDITIVE ALTERNATE #1

**SHEET NOTES:**

- 1 NEW AHU AND VFD ON STEEL SUPPORTS
- 2 NEW TO EXISTING SUPPLY DUCT CONNECTION
- 3 NEW TO EXISTING OA DUCT CONNECTION ABOVE AHU
- 4 NEW TO EXISTING RA DUCT CONNECTION
- 5 NEW COLD DECK 3" CHWS&R
- 6 NEW HOT DECK 2" HHWS&R
- 7 NEW 1-1/2" TRAPPED CONDENSATE DRAIN PIPE TO EX FLOOR DRAIN
- 8 NEW AHU CONTROLLER IN EXISTING PANEL.
- 9 PROVIDE BELIMO ACTUATORS AT TAMCO MIXING DAMPERS.
- 10 NEW FIRE DAMPERS AT FLOOR AND WALL
- 11 FLEXIBLE DUCT CONNECTION. TYPICAL.
- 12 REPLACE EXISTING THERMOSTATS IN THEIR EXISTING LOCATION ON THIRD FLOOR.
- 13 COOLING COIL PULL CLEARANCE
- 14 NEW DUCT INSIDE OF CHASE.
- 15 STACKED COOLING COIL
- 16 HEATING COIL
- 17 ZONE CONTROL DAMPER
- 18 ACCESS DOOR
- 19 SUPPLY FAN ARRAY
- 20 SUPPLY FAN CONTROL PANEL BY AHU MANUF.
- 21 SMOKE DAMPER
- 22 PRE-FILTER AND FINAL FILTER
- 23 BASERAIL
- 24 SUPPORT
- 25 FILTER AIR DIFFERENTIAL PRESSURE GAUGE
- 26 SERVICE LIGHT IN EACH SECTION
- 27 UV LIGHTS WITH CONTACTOR FOR BAS CONTROL
- 28 SINGLE VFD WITH BYPASS





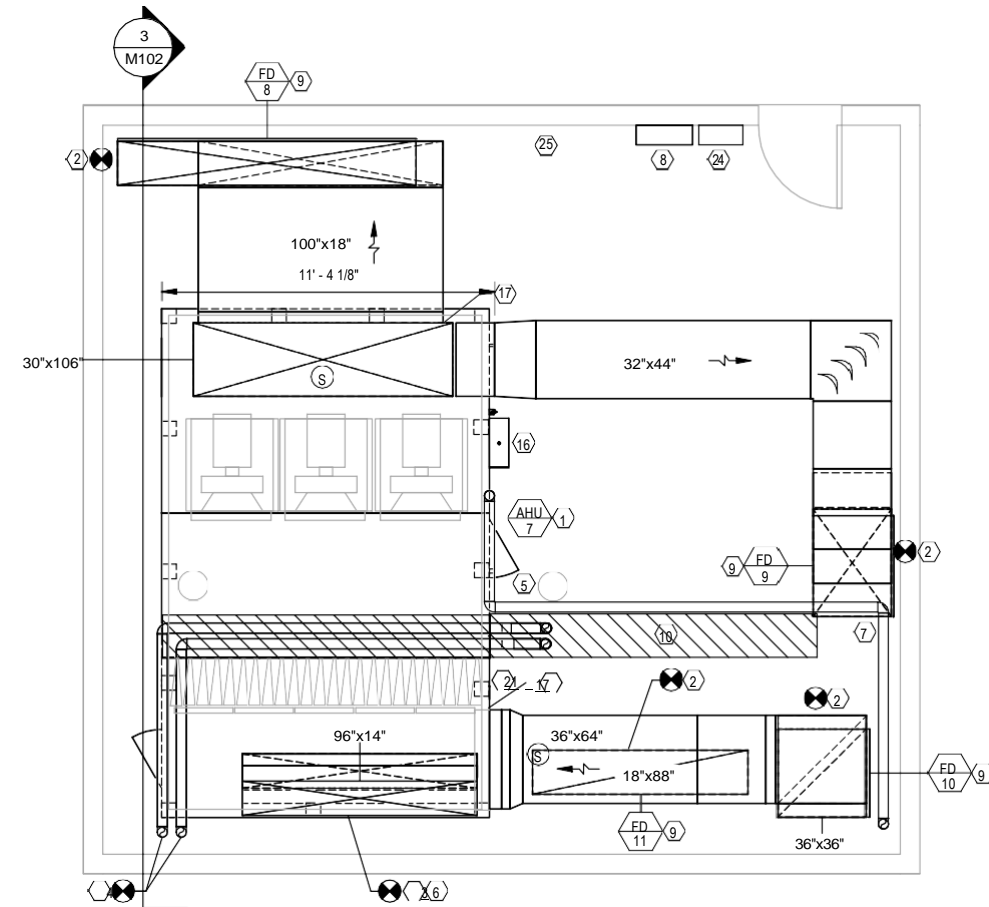
 **MECHANICAL AHU-7 PENTHOUSE - DEMOLITION**  
1/4" = 1'-0"

### GENERAL NOTES:

ENSURE CHW OUTAGES ARE COORDINATED WITH THE OWNER.

### DEMOLITION NOTES:

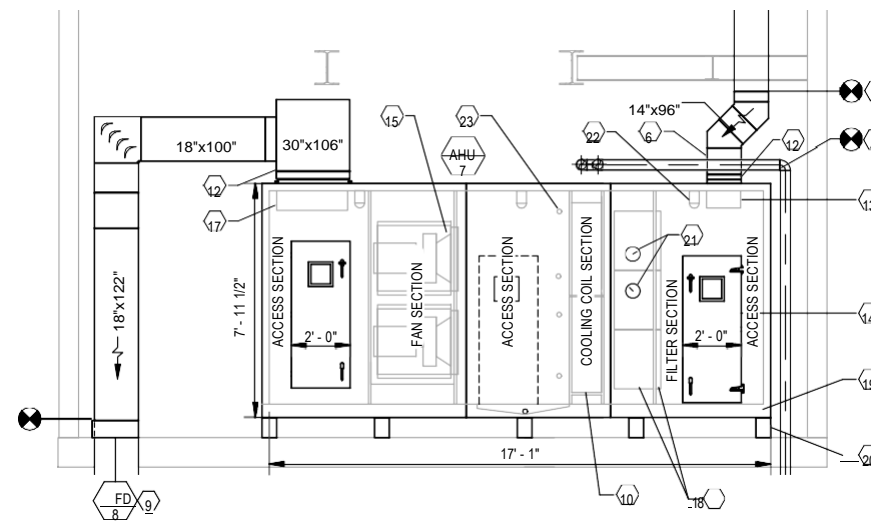
- 1 DEMOLISH EXISTING AIR HANDLER
- 2 DEMOLISH EXISTING SUPPLY DUCT
- 3 DEMOLISH EXISTING RETURN DUCT
- 4 DEMOLISH EXISTING OUTDOOR AIR DUCT
- 5 DEMOLISH EXISTING CHWS&R PIPING AND PIPING ACCESSORIES. UTILIZE CHWS&R ISOLATION VALVES LOCATED ABOVE CEILING ON 3RD FLOOR.
- 6 DEMOLISH EXISTING CONDENSATE DRAIN PIPING
- 7 DEMOLISH EXISTING AHU-7 CONTROLS




 **MECHANICAL AHU-7 PENTHOUSE**  
1/4" = 1'-0"

### SHEET NOTES:

- 1 NEW AHU AND VFD ON STEEL SUPPORTS
- 2 NEW TO EXISTING DUCT CONNECTION AT THE FLOOR
- 3 NEW TO EXISTING DUCT CONNECTION ABOVE AHU
- 4 NEW TO EXISTING 4" CHWS&R PIPE CONNECTION
- 5 NEW 2" TRAPPED CONDENSATE DRAIN PIPE TO EX FLOOR DRAIN
- 6 OUTDOOR AIRFLOW STATION IN VERTICAL
- 7 EX STORM PIPE ABOVE NEW DUCT
- 8 NEW CONTROL PANEL
- 9 NEW OUT OF FLOOR FIRE DAMPER
- 10 COOLING COIL PULL CLEARANCE
- 11 STACKED COOLING COIL
- 12 FLEXIBLE DUCT CONNECTION
- 13 OUTDOOR CONTROL DAMPER
- 14 ACCESS DOOR
- 15 SUPPLY FAN ARRAY
- 16 SUPPLY FAN CONTROL PANEL BY AHU MANUF.
- 17 SMOKE DAMPER
- 18 PRE-FILTER AND FINAL FILTER
- 19 BASERAIL
- 20 SUPPORT
- 21 FILTER AIR DIFFERENTIAL PRESSURE GAUGE
- 22 SERVICE LIGHT IN EACH SECTION
- 23 UV LIGHTS WITH CONTACTOR CONTROLLED BY BAS
- 24 SINGLE VFD WITH BYPASS
- 25 MAINTAIN EXISTING PNEUMATIC CONTROL TO THE REMAINDER OF THE BUILDING SERVICES.



 **AHU-7 SECTION**  
1/4" = 1'-0"



### TAB PRETEST NOTES:

PRIOR TO START OF DEMOLITION TAB CONTRACTOR SHALL PERFORM PRETEST  
OF EXISTING SYSTEM AS DESCRIBED IN TAB PRETEST NOTES ON SHEET M001.

### GENERAL NOTES:

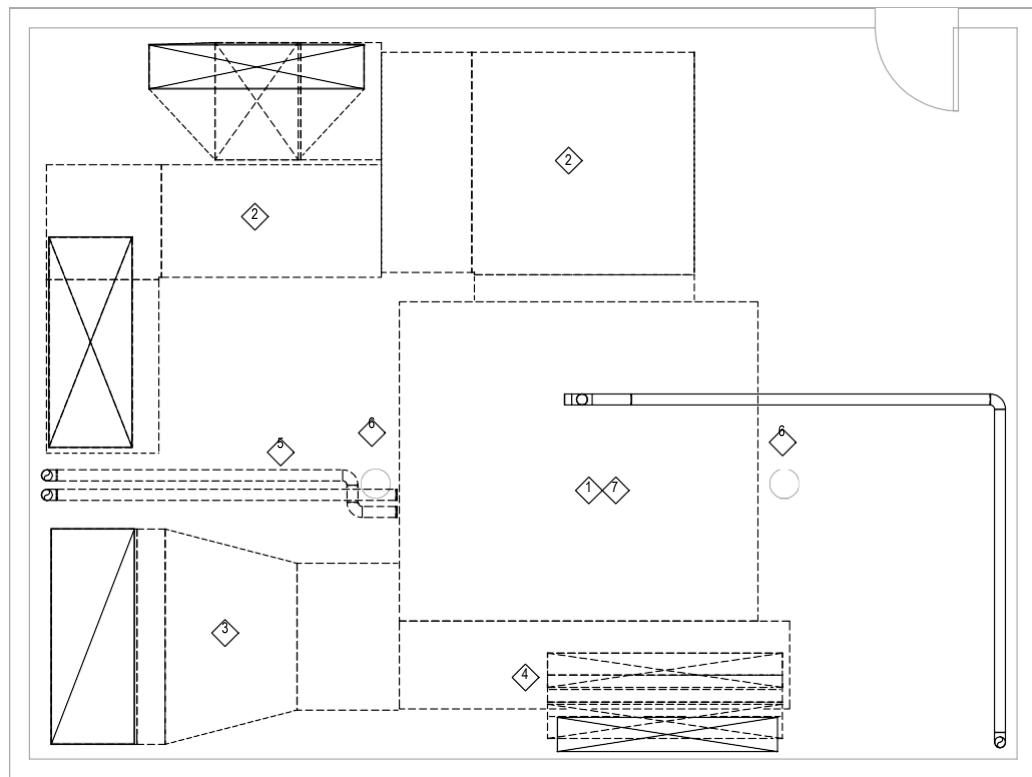
ENSURE CHW OUTAGES ARE COORDINATED WITH THE OWNER.

### DEMOLITION NOTES:

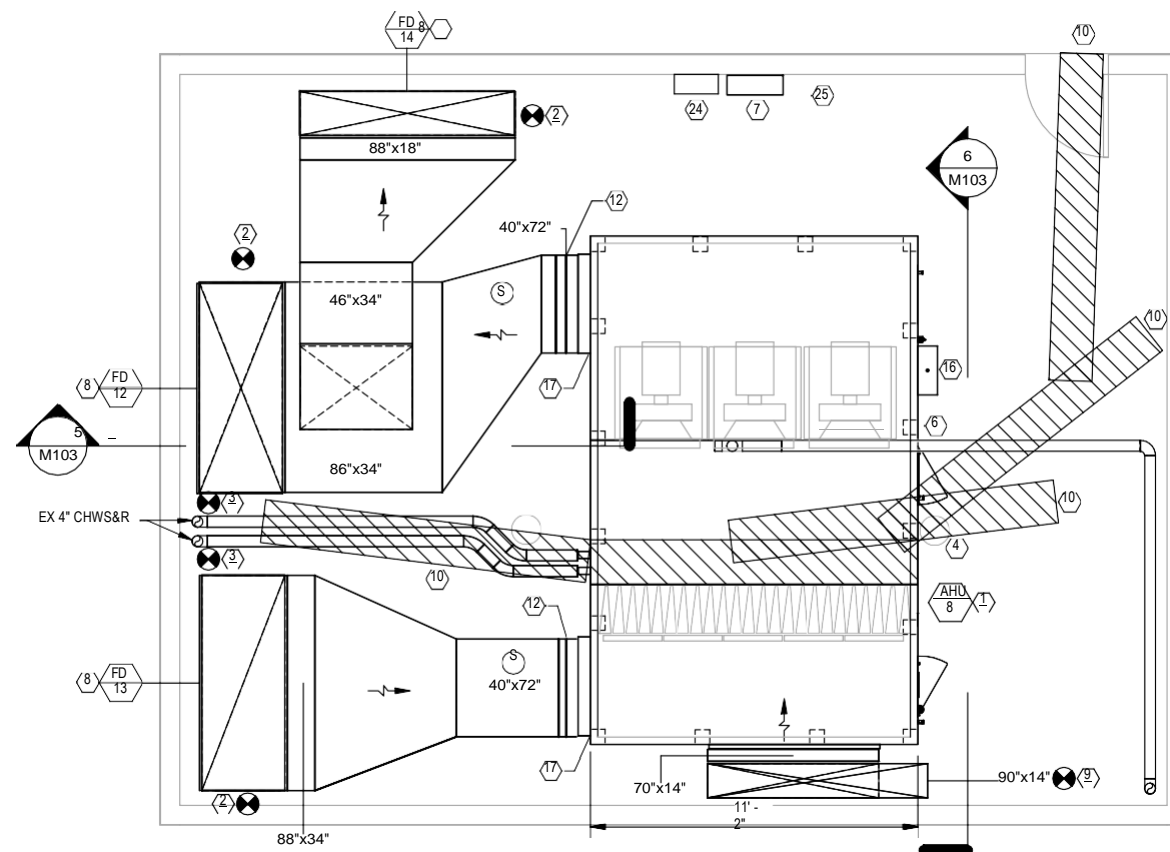
- DEMOLISH EXISTING AIR HANDLER. TURN OVER EX FAN MOTOR TO OWNER.
- DEMOLISH EXISTING SUPPLY DUCT
- DEMOLISH EXISTING RETURN DUCT
- DEMOLISH EXISTING OUTDOOR AIR DUCT
- DEMOLISH EXISTING CHWS&R PIPING AND PIPING ACCESSORIES. UTILIZE CHWS&R ISOLATION VALVES LOCATED IN CHASE ADJACENT TO RESTROOMS ON 3RD FLOOR.
- DEMOLISH EXISTING CONDENSATE DRAIN PIPING
- DEMOLISH EXISTING AHU-8 CONTROLS

### SHEET NOTES:

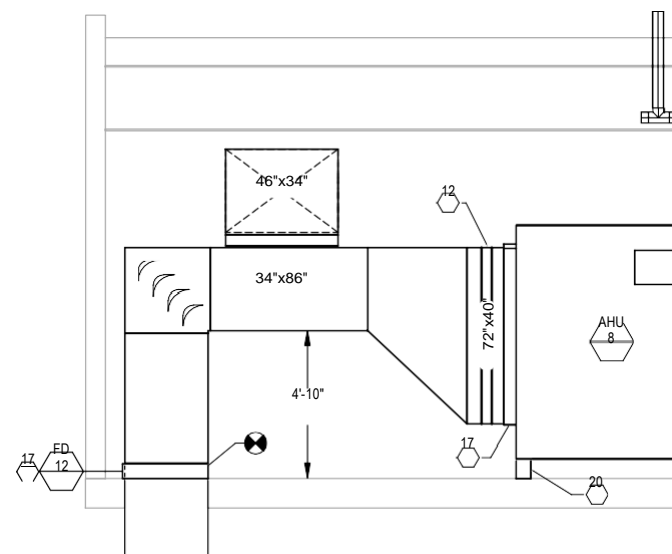
- NEW AHU AND VFD ON STEEL SUPPORTS
- NEW TO EXISTING DUCT CONNECTION AT THE FLOOR
- NEW TO EXISTING 4" CHWS&R PIPE CONNECTION
- NEW 2" TRAPPED CONDENSATE DRAIN PIPE TO EX FLOOR DRAIN
- OUTDOOR AIR CONTROL DAMPER IN VERTICAL
- EX STORM PIPE ABOVE AHU
- NEW CONTROL PANEL
- PROVIDE NEW OUT OF FLOOR FIRE DAMPER.
- NEW TO EXISTING OA DUCT CONNECTION AT ABOVE AHU
- COOLING COIL PULL CLEARANCE
- STACKED COOLING COIL
- FLEXIBLE DUCT CONNECTION
- OUTDOOR CONTROL DAMPER
- ACCESS DOOR
- SUPPLY FAN ARRAY
- SUPPLY FAN CONTROL PANEL BY AHU MANUF.
- SMOKE DAMPER
- PRE-FILTER AND FINAL FILTER
- BASERAIL
- SUPPORT
- FILTER AIR DIFFERENTIAL PRESSURE GAUGE
- SERVICE LIGHT IN EACH SECTION
- UV LIGHTS WITH CONTACTOR FOR BAS CONTROL
- SINGLE VFD WITH BYPASS
- MAINTAIN EXISTING PNEUMATIC SYSTEM FOR THE REMAINDER OF THE BUILDING SERVICE.



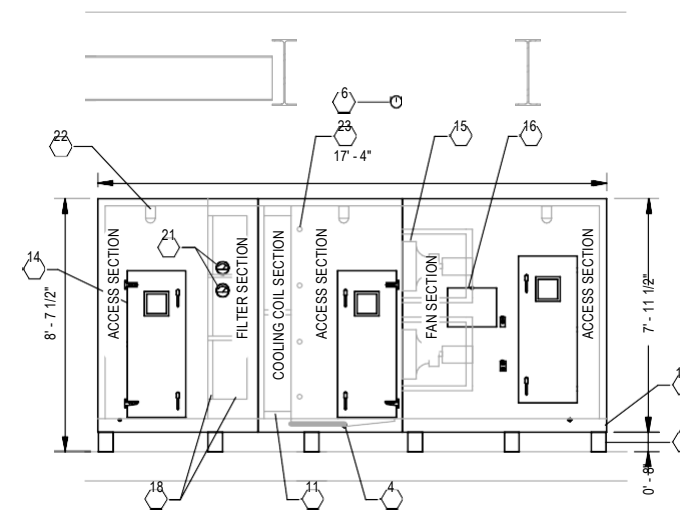
MECHANICAL AHU-8 PENTHOUSE - DEMOLITION  
1/4" = 1'-0"



MECHANICAL AHU-8 PENTHOUSE  
1/4" = 1'-0"



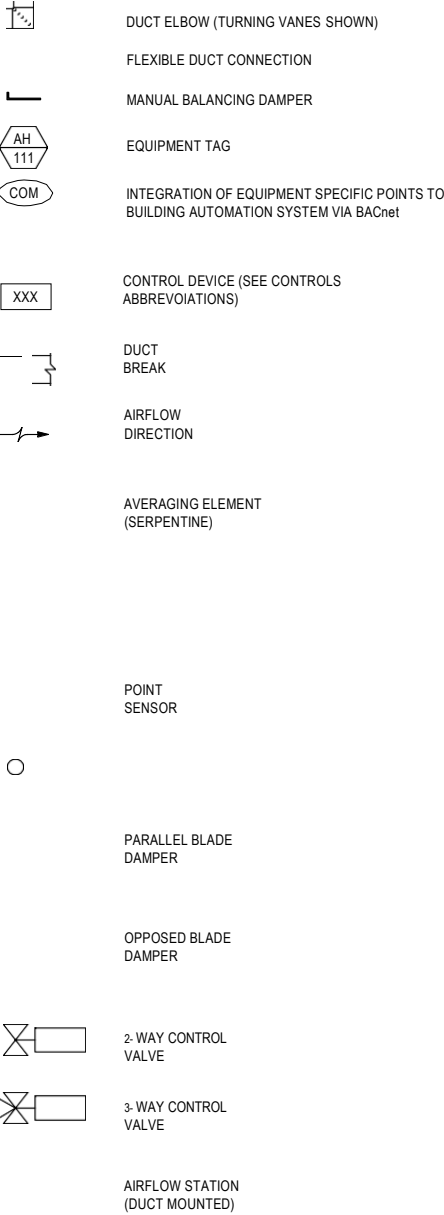
AHU-8 ELEVATION  
1/4" = 1'-0"



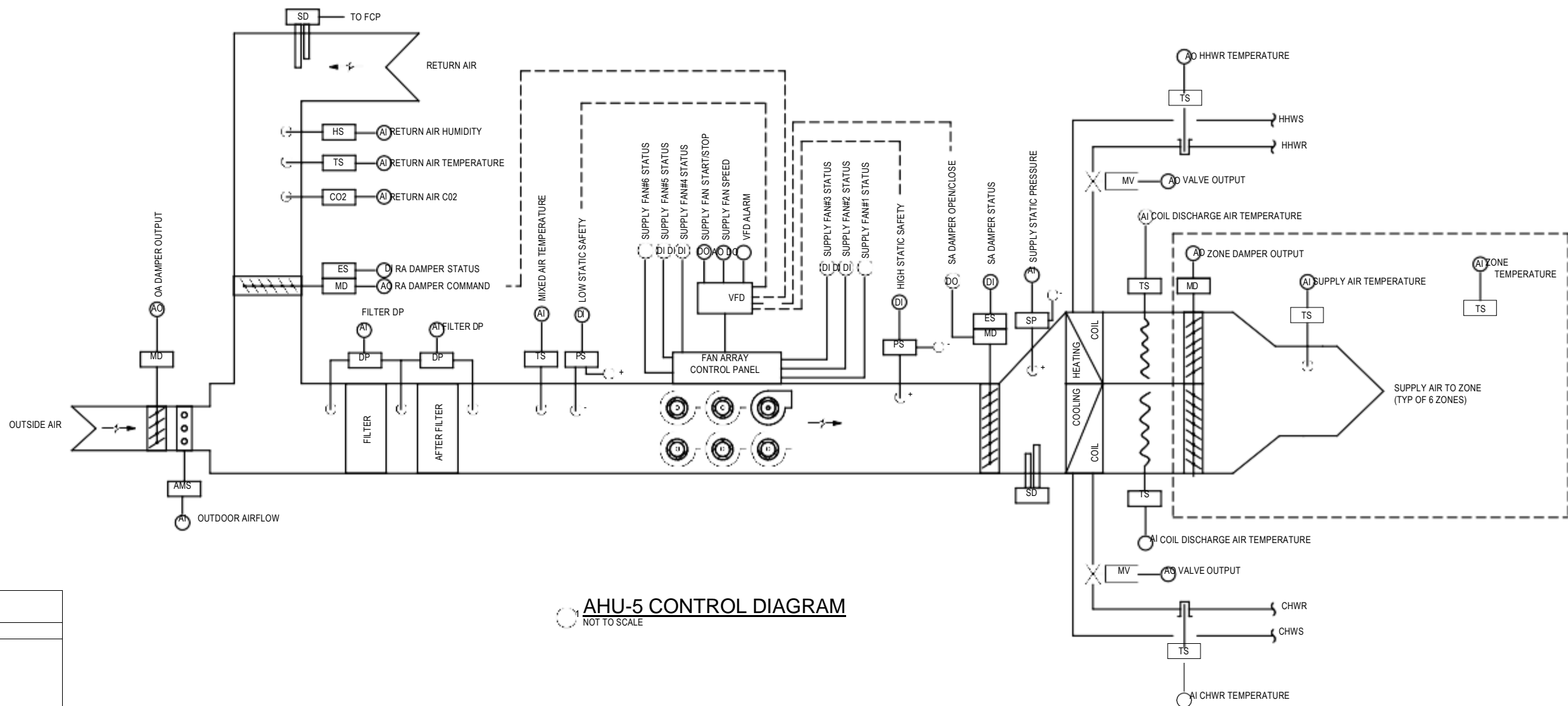
AHU-8 SECTION  
1/4" = 1'-0"



CONTROLS LEGEND







AHU-5 CONTROL DIAGRAM  
NOT TO SCALE

## AHU-5 CONTROL SEQUENCE

**OCCUPIED/UNOCCUPIED CONTROL:**  
THE AHU CONTROLLER SHALL ACTIVATE THE OCCUPIED AND UNOCCUPIED MODE BASED ON TIME OF DAY SCHEDULE. THE OCCUPIED SCHEDULE SHALL BE M-F 6AM TO 9PM. AN OVERRIDE SWITCH LOCATED AT THE THERMOSTAT IN ANY ASSOCIATED ZONE. WHEN ACTIVATED WILL FORCE THE SYSTEM INTO TEMPORARY OCCUPIED MODE FOR A TIME PERIOD OF 2 HOURS.

### SAFETIES:

- FIRE ALARM:** EXISTING FIRE ALARM RELAY SHALL SHUTDOWN AHU ON SIGNAL FROM FACP.
- LOW STATIC SAFETY:** UPON ACTIVATION OF THE LOW STATIC SAFETY SWITCH THE SUPPLY FAN SHALL SHUT OFF AND THE BAS SHALL COMMAND THE COOLING COIL CONTROL VALVE TO CLOSE. LOW STATIC SAFETY SWITCH REQUIRES MANUAL RESET.
- HIGH STATIC SAFETY:** UPON ACTIVATION OF THE HIGH STATIC SAFETY SWITCH THE SUPPLY FAN SHALL SHUT OFF AND THE BAS SHALL COMMAND THE COOLING COIL CONTROL VALVE TO CLOSE. HIGH STATIC SAFETY SWITCH REQUIRES MANUAL RESET.

**UNOCCUPIED MODE:**  
WHEN UNOCCUPIED MODE IS ACTIVATED THE BAS SHALL DISABLE FAN CONTROL, CLOSE OUTDOOR AIR DAMPER, AND DISABLE COOLING COIL CONTROL.

**UNOCCUPIED WARM UP MODE:**  
WHEN ANY ASSOCIATED ZONE TEMPERATURE FALLS BELOW UNOCCUPIED HEATING SET-POINT THE BAS SHALL ENABLE FAN CONTROL, DISABLE OUTDOOR AIR DAMPER CONTROL, AND DISABLE COOLING COIL CONTROL.

**UNOCCUPIED COOL DOWN MODE:**  
WHEN ANY ASSOCIATED ZONE TEMPERATURE RISES ABOVE UNOCCUPIED COOLING SET-POINT THE BAS SHALL ENABLE FAN CONTROL, DISABLE OUTDOOR AIR DAMPER CONTROL, AND ENABLE COOLING COIL AND HEATING COIL CONTROL.

**OCCUPIED MODE:**  
WHEN OCCUPIED MODE IS ACTIVATED BASED ON THE TIME OF DAY SCHEDULE OR LOCAL OVERRIDE AT ANY UNIT THERMOSTAT, BAS SHALL ENABLE FAN CONTROL, ENABLE OUTDOOR AIR DAMPER CONTROL, ENABLE COOLING COIL CONTROL AND HEATING COIL CONTROL.

**FAN SPEED CONTROL:**  
STATIC PRESSURE CONTROL: MODULATE FAN SPEED TO MAINTAIN A STATIC PRESSURE SETPOINT (ADJ) AS SENSED BY STATIC PRESSURE SENSOR MOUNTED IN UNIT CASING DOWNSTREAM OF SMOKE DAMPER.

**OUTSIDE AIR DAMPER CONTROL:**  
OPEN DAMPER AND ENABLE OUTDOOR AIR CONTROL SEQUENCE ON FAN START. IF FAN STATUS DOES NOT MATCH FAN COMMAND WITHIN 60 SECONDS AFTER DAMPER IS OPEN, CLOSE DAMPER. CLOSE DAMPER AND DISABLE OUTDOOR AIR CONTROL ON FAN STOP.  
DO NOT ALLOW THE OUTDOOR AIR VOLUME TO EXCEED THE MAXIMUM VALUE LISTED IN THE AHU SCHEDULE. THE OUTDOOR CFM SHALL BE MAINTAINED REGARDLESS OF SUPPLY FLOW OR FILTER LOADING.

**COLD DECK SUPPLY AIR TEMPERATURE CONTROL:**  
ENABLE COLD DECK SUPPLY CONTROL ROUTINE ON PROOF OF FAN START. CLOSE VALVE TO COIL ON FAN STOP. MODULATE CHILLED WATER VALVE TO MAINTAIN A DISCHARGE AIR TEMPERATURE SET-POINT OF 55 DEG F (ADJ).

**HOT DECK SUPPLY AIR TEMPERATURE CONTROL:**  
ENABLE HOT DECK SUPPLY CONTROL ROUTINE ON PROOF OF FAN START. CLOSE VALVE TO COIL ON FAN STOP. MODULATE HEATING HOT WATER VALVE TO MAINTAIN A DISCHARGE AIR TEMPERATURE SET-POINT OF 92 DEG F (ADJ).

**ZONE AIR TEMPERATURE CONTROL:**  
ENABLE ZONE AIR TEMPERATURE CONTROL ROUTINE ON PROOF OF FAN START. WHEN ZONE AIR TEMPERATURE FALLS BELOW ZONE TEMPERATURE SET-POINT MODULATE THE COLD DECK DAMPER CLOSED WHILE HOT DECK DAMPER OPENS. WHEN ZONE AIR TEMPERATURE RISES ABOVE THE ZONE AIR TEMPERATURE SET-POINT OPEN THE COLD DECK DAMPER WHILE HOT DECK DAMPER CLOSSES.

**ALARMS:**  
BAS SHALL ISSUE THE ALARMS INDICATED ON THE POINTS LIST.

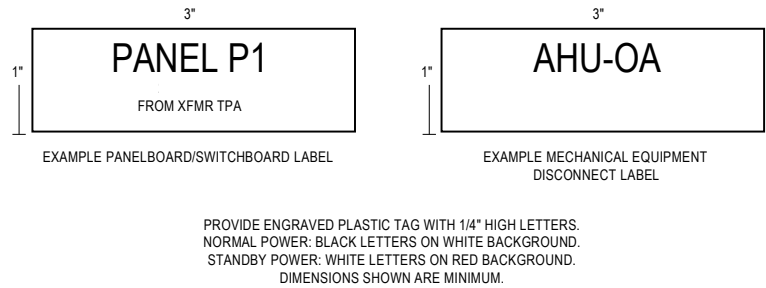
**INDICATION:**  
SHOW ALL POINTS LISTED ON BAS GRAPHICS SHOWN ON CONTROL DIAGRAM AND ON POINTS LIST.

## AHU-5 POINTS LIST

SYSTEM POINT DESCRIPTION	POINT TYPE		ALARMS		
	GRAPHICS	HARDWIRED INPUT HARDWIRED OUTPUT SOFTWARE POINT	ALARM DESCRIPTION	ALARM SETTING	TIME DELAY
OUTDOOR AIR DAMPER OUTPUT	X	AO			
OUTDOOR AIRFLOW	X	AI			
RETURN AIR HUMIDITY	X	AI			
RETURN AIR TEMPERATURE	X	AI			
RETURN AIR CO2	X	AI			
RETURN AIR SMOKE DAMPER STATUS	X	DI	SMOKE DAMPER ALARM	STATUS DOES NOT MATCH COMMAND	1 MIN
RETURN AIR SMOKE DAMPER OUTPUT	X	AO			
PRE-FILTER PRESSURE DROP	X	AI	DIRTY PRE-FILTER ALARM	DP ABOVE DIRTY SETTING	15 MIN
AFTER FILTER PRESSURE DROP	X	AI	DIRTY AFTER FILTER ALARM	DP ABOVE DIRTY SETTING	15 MIN
MIXED AIR TEMPERATURE	X	AI			
LOW STATIC PRESSURE SAFETY SWITCH STATUS	X	DI	LOW DP SAFETY ALARM	SWITCH ACTIVATED	1 MIN
SUPPLY FAN#1 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	1 MIN
SUPPLY FAN#2 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	2 MIN
SUPPLY FAN#3 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	3 MIN
SUPPLY FAN#4 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	4 MIN
SUPPLY FAN#5 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	5 MIN
SUPPLY FAN#6 STATUS	X	DI	FAN FAILURE	STATUS DOES NOT MATCH COMMAND	6 MIN
SUPPLY FAN START/STOP	X	DI			
SUPPLY FAN SPEED COMMAND	X	AO			
VRF ALARM	X	DI	VFD ALARM	ALARM ISSUED	0 MON
HIGH STATIC PRESSURE SAFETY SWITCH STATUS	X	DI	HIGH DP SAFETY ALARM	SWITCH ACTIVATED	1 MIN
SUPPLY SMOKE DAMPER COMMAND	X	DO			
SUPPLY SMOKE DAMPER STATUS	X	DI	SMOKE DAMPER ALARM	STATUS DOES NOT MATCH COMMAND	1 MIN
COOLING COIL DISCHARGE TEMPERATURE	X	AI			
COOLING COIL CONTROL VALVE OUTPUT	X	AO			
CHILLED WATER RETURN TEMPERATURE	X	AI			
HEATING COIL DISCHARGE TEMPERATURE	X	AI			
HEATING COIL CONTROL VALVE OUTPUT	X	AO			
HEATING HOT WATER RETURN TEMPERATURE	X	AI			
SUPPLY STATIC PRESSURE	X	AI			
ZONE A DAMPER OUTPUT	X	AO			
ZONE A SUPPLY AIR TEMPERATURE	X	AI			
ZONE A TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN
ZONE B DAMPER OUTPUT	X	AO			
ZONE B SUPPLY AIR TEMPERATURE	X	AI			
ZONE B TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN
ZONE C DAMPER OUTPUT	X	AO			
ZONE C SUPPLY AIR TEMPERATURE	X	AI			
ZONE C TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN
ZONE D DAMPER OUTPUT	X	AO			
ZONE D SUPPLY AIR TEMPERATURE	X	AI			
ZONE D TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN
ZONE E DAMPER OUTPUT	X	AO			
ZONE E SUPPLY AIR TEMPERATURE	X	AI			
ZONE E TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN
ZONE F DAMPER OUTPUT	X	AO			
ZONE F SUPPLY AIR TEMPERATURE	X	AI			
ZONE F TEMPERATURE	X	AI	ZONE TEMPERATURE ALARM	TEMP +/- 3 DEG FROM SET-POINT	30 MIN

NOTE:  
PROVIDE VFD INTEGRATION

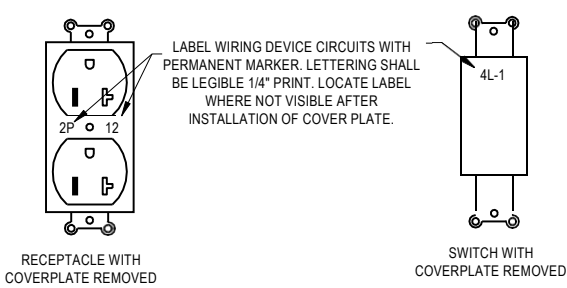




**ELECTRICAL EQUIPMENT LABELING DETAIL**

2

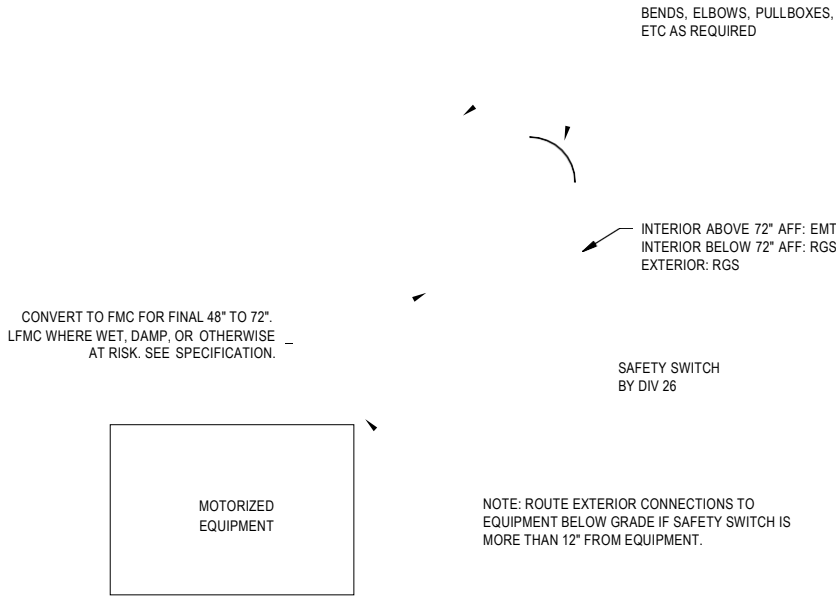
NOT TO SCALE



**ELECTRICAL WIRING DEVICE LABEL DETAIL**

3

NOT TO SCALE



**MOTORIZED EQUIPMENT CONNECTION DETAIL**

4

NOT TO SCALE

**LEGEND**

**RECEPTACLE:**

- Ⓛ DUPLEX RECEPTACLE. 18" AFF UNO.
- Ⓜ SPECIAL PURPOSE RECEPTACLE. 18" AFF UNO. COORDINATE WITH EQUIPMENT.

**RECEPTACLE SUBSCRIPTS:**

- G GFCI-TYPE RECEPTACLE
- GCB GFCI-TYPE POWER FROM BRANCH CIRCUIT BREAKER.
- WP WEATHER RESISTANT WIRING DEVICE. WP RECEPTACLES SHALL BE GFCI TYPE WITH IN-USE COVERS. 6-30R NEMA RECEPTACLE TYPE.

**POWER EQUIPMENT AND CONNECTIONS:**

- DISTRIBUTION PANELBOARD.
- PANELBOARD.
- E ELECTRICAL CONNECTION TO EQUIPMENT. SEE ELECTRICAL EQUIPMENT SCHEDULE.
- J JUNCTION BOX. SAFETY SWITCH. MOUNT AS INDICATED. 60" TO TOP UNO.

- FUSED SAFETY SWITCH. MOUNT AS INDICATED. 60" TO TOP UNO.
- COMBINATION MOTOR STARTER. MOUNT AS INDICATED. 60" TO TOP UNO.

**FIRE ALARM:**

- FACP FIRE ALARM CONTROL PANEL.
- NAC NAC EXTENDER PANEL.
- A FIRE ALARM AUDIBLE NOTIFICATION DEVICE. CEILING MOUNT.
- AV FIRE ALARM COMBINATION AUDIBLE/VISIBLE NOTIFICATION DEVICE. CEILING MOUNT. 75cd UNO.
- (V) FIRE ALARM VISIBLE NOTIFICATION DEVICE. CEILING MOUNT. 75cd UNO.
- (S) SMOKE DETECTOR. SYSTEM DETECTOR, UNLESS MARKED '120V'.
- C CO DETECTOR. SYSTEM DETECTOR, UNLESS MARKED '120V'.
- E ELEVATOR FIRE-ALARM INTERFACE.
- H SMOKE DETECTOR. SYSTEM DETECTOR, UNLESS MARKED '120V'.
- D DUCT MOUNTED SMOKE DETECTOR. COORDINATE MOUNTING AND SAMPLING TUBE WITH MECHANICAL.
- T FIRE PROTECTION TAMPER SWITCH. COORDINATE WITH FIRE PROTECTION.
- F FIRE PROTECTION FLOW SWITCH. COORDINATE WITH FIRE PROTECTION.
- P FIRE PROTECTION PRESSURE SWITCH. COORDINATE WITH FIRE PROTECTION.
- R ADDRESSABLE INTERFACE MODULE, WITH INPUT/OUTPUT CAPABILITIES.
- P MANUAL PULL STATION.

**FIRE ALARM SUBSCRIPTS:**

- 15cd CANDELA RATING OF VISIBLE NOTIFICATION APPLIANCE.
- 120V SENSORS: 120V-POWERED SINGLE- OR MULTIPLE-STATION DEVICE.
- 120V RELAYS: 120V RELAY.
- LTG RELAY FOR OCCUPANCY SENSOR OVERRIDE. COORDINATE WITH LIGHTING CONTROLS.
- AHU AIR HANDLING UNIT SHUTDOWN RELAY. COORDINATE WITH MECHANICAL.

**TELECOMMUNICATIONS:**

- ROUGH-IN-ONLY TO. 18" AFF UNO. PROVIDE 1"C TO ABOVE ACCESSIBLE CEILING.

**TELECOMMUNICATIONS SUBSCRIPTS:**

- AC ABOVE COUNTER

**ANNOTATIONS:**

- (1) DEMOLITION SHEET NOTE.
- (1) ELECTRICAL SHEET NOTE.

**AH**

**111**

- MECHANICAL EQUIPMENT TAG.

**GENERAL SUBSCRIPTS (APPLY TO ALL CATEGORIES):**

- 2P1A** ELECTRICAL EQUIPMENT TAG.
- GCB FED FROM GFCI TYPE CIRCUIT BREAKER.
- 72" INDICATES HEIGHT OF FIXTURE, RECEPTACLE, BOX, CABINET, ETC. HEIGHT IS TO CENTERLINE UNLESS OTHERWISE INDICATED.
- EX EXISTING TO REMAIN
- WP WEATHERPROOF INSTALLATION, WITH APPROPRIATELY LISTED OR INDICATED PRODUCTS.
- A-1** ELECTRICAL HOME RUN TO PANELBOARD. UNDERLINED LABEL INDICATES PANELBOARD NAME AND CIRCUIT NUMBER. UNLESS INDICATED OTHERWISE, DEFAULT WIRING IS #12 & #12G. PROVIDE CONDUCTORS AS NEEDED FOR INDICATED SWITCHED LEGS, ZONES, ETC. SEE ELECTRICAL EQUIPMENT SCHEDULE FOR SPECIFIC CIRCUIT SIZING.

**ABBREVIATIONS**

- AC ABOVE COUNTER
- AWG AMERICAN WIRE GAUGE
- BOD BASIS OF DESIGN
- C CONDUIT
- CB CIRCUIT BREAKER
- CFCI CONTRACTOR FURNISHED, CONTRACTOR INSTALLED
- CFOI CONTRACTOR FURNISHED, OWNER INSTALLED
- CKT CIRCUIT
- CMS COMBINATION MOTOR STARTER
- DIV DIVISION
- ECB ENCLOSED CIRCUIT BREAKER
- EOR ENGINEER OF RECORD
- EX EXISTING TO REMAIN
- FSS FUSED SAFETY SWITCH
- G GROUND, GROUND FAULT CIRCUIT INTERRUPTER
- GCB GFCI CIRCUIT BREAKER
- LTS LIGHTS
- MCC MOTOR CONTROL CENTER
- NAC NOTIFICATION APPLIANCE CIRCUIT
- OFCI OWNER FURNISHED, CONTRACTOR INSTALLED
- OFOI OWNER FURNISHED, OWNER INSTALLED
- PBD PANELBOARD
- PQM POWER QUALITY METER
- SPD SURGE PROTECTION DEVICE
- SLC SIGNALING LINE CIRCUIT
- SS SAFETY SWITCH
- SWBD SWITCHBOARD
- TBD TO BE DETERMINED
- TCR TELECOMMUNICATIONS ROOM
- TO TELECOMMUNICATIONS OUTLET
- TYP TYPICAL
- UF UNIVERSITY OF FLORIDA
- UFL UNIVERSITY OF FLORIDA
- UNO UNLESS NOTED OTHERWISE
- VFD VARIABLE FREQUENCY DRIVE
- WP WEATHER PROOF / WEATHER RESISTANT
- WR WEATHER PROOF / WEATHER RESISTANT
- WRT WITH RESPECT TO

**CODES AND STANDARDS**

ALL PROJECT WORK SHALL BE GOVERNED BY AND ADHERE TO THE FOLLOWING CODES AND STANDARDS.

- FLORIDA BUILDING CODE - SIXTH EDITION (2017)
- FLORIDA BUILDING CODE - SIXTH EDITION (2017) - ENERGY CONSERVATION
- FLORIDA FIRE PREVENTION CODE - SIXTH EDITION (2017)
  - FIRE CODE (NFPA 1 - 2015 FLORIDA EDITION)
  - LIFE SAFETY CODE (NFPA 101 - 2015 FLORIDA EDITION)
- NATIONAL ELECTRIC CODE (2014 NFPA 70)
- FIRE ALARM AND SIGNALING CODE (2013 NFPA 72)
- UNIVERSITY OF FLORIDA
- AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
- NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
- NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
- INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
- NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
- AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
- SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
- ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IESNA)
- TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
- ELECTRONICS INDUSTRY ALLIANCE (EIA)



PROJECT NAME:  
**THE UNIVERSITY OF FLORIDA  
JHMC COMMUNICORE AHU-5, 7, & 8 REPLACEMENT**

OWNER:  
THE UNIVERSITY OF FLORIDA  
1249 CENTER DRIVE  
GAINESVILLE, FL 32610

OWNER'S PROJECT NUMBER:  
MP05285

**MG** PROJECT  
NUMBER: 19066  
REVISIONS:  
REVISION DESCRIPTION DATE

ISSUE:  
100% CONSTRUCTION  
DOCUMENTS

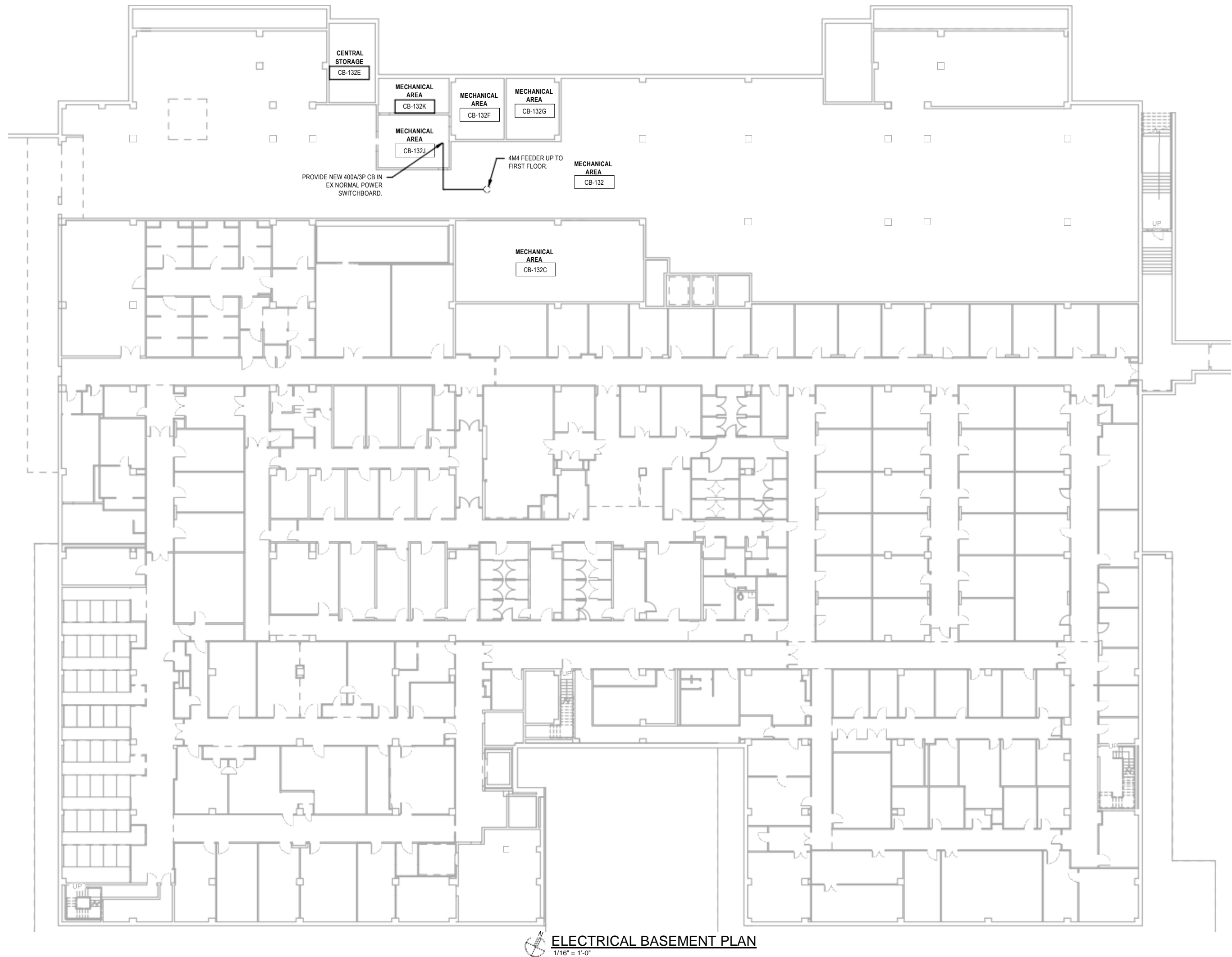
ISSUE DATE:  
DECEMBER 20, 2019

CHECKED BY:  
APM

SHEET TITLE:  
**ELECTRICAL  
BASEMENT PLAN**

SHEET NUMBER:  
317

**E010**



**ELECTRICAL BASEMENT PLAN**  
1/16" = 1'-0"



PROJECT NAME:  
**THE UNIVERSITY OF FLORIDA  
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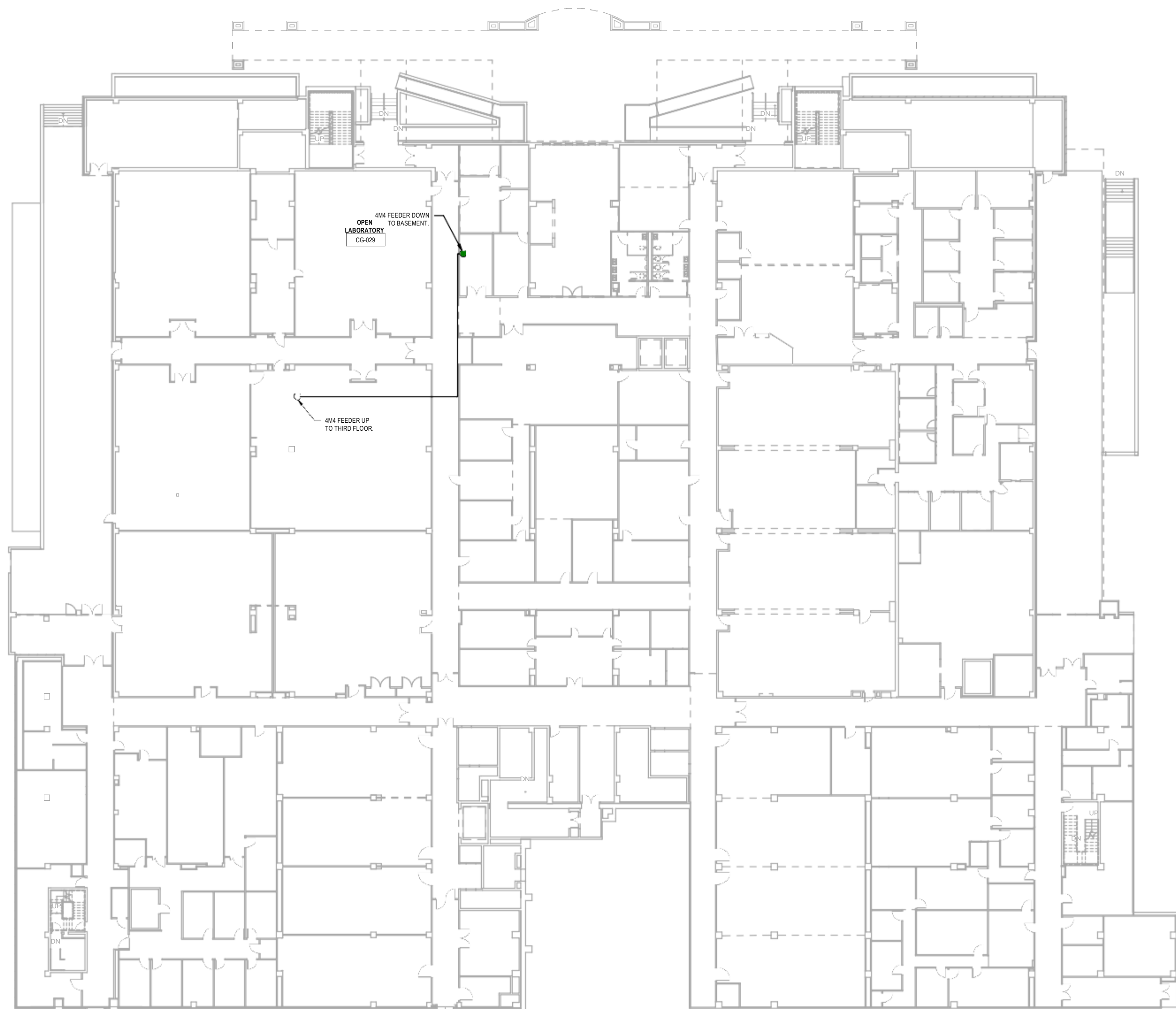
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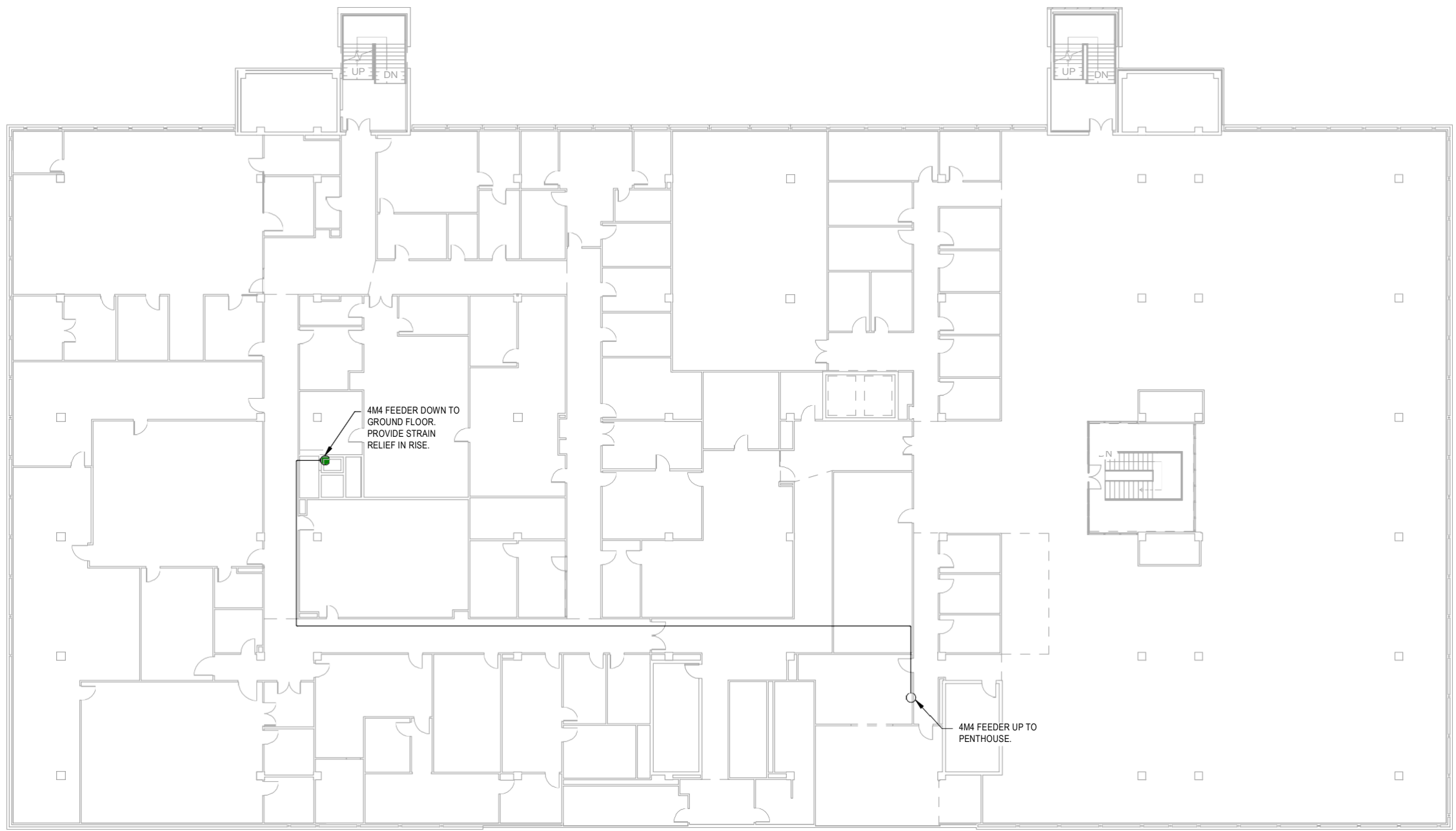
SHEET TITLE:  
**ELECTRICAL  
GROUND FLOOR  
PLAN**  
SHEET NUMBER:  
318


**E020**



**ELECTRICAL GROUND FLOOR PLAN**  
1/16" = 1'-0"





 **ELECTRICAL THIRD FLOOR PLAN**  
1/16" = 1'-0"



Andrew P. McCaddin  
PE - 83318

PROJECT NAME:  
**THE UNIVERSITY OF FLORIDA  
JHMC COMMUNICORE AHU-5, 7, & 8 REPLACEMENT**

OWNER:  
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**MG** PROJECT  
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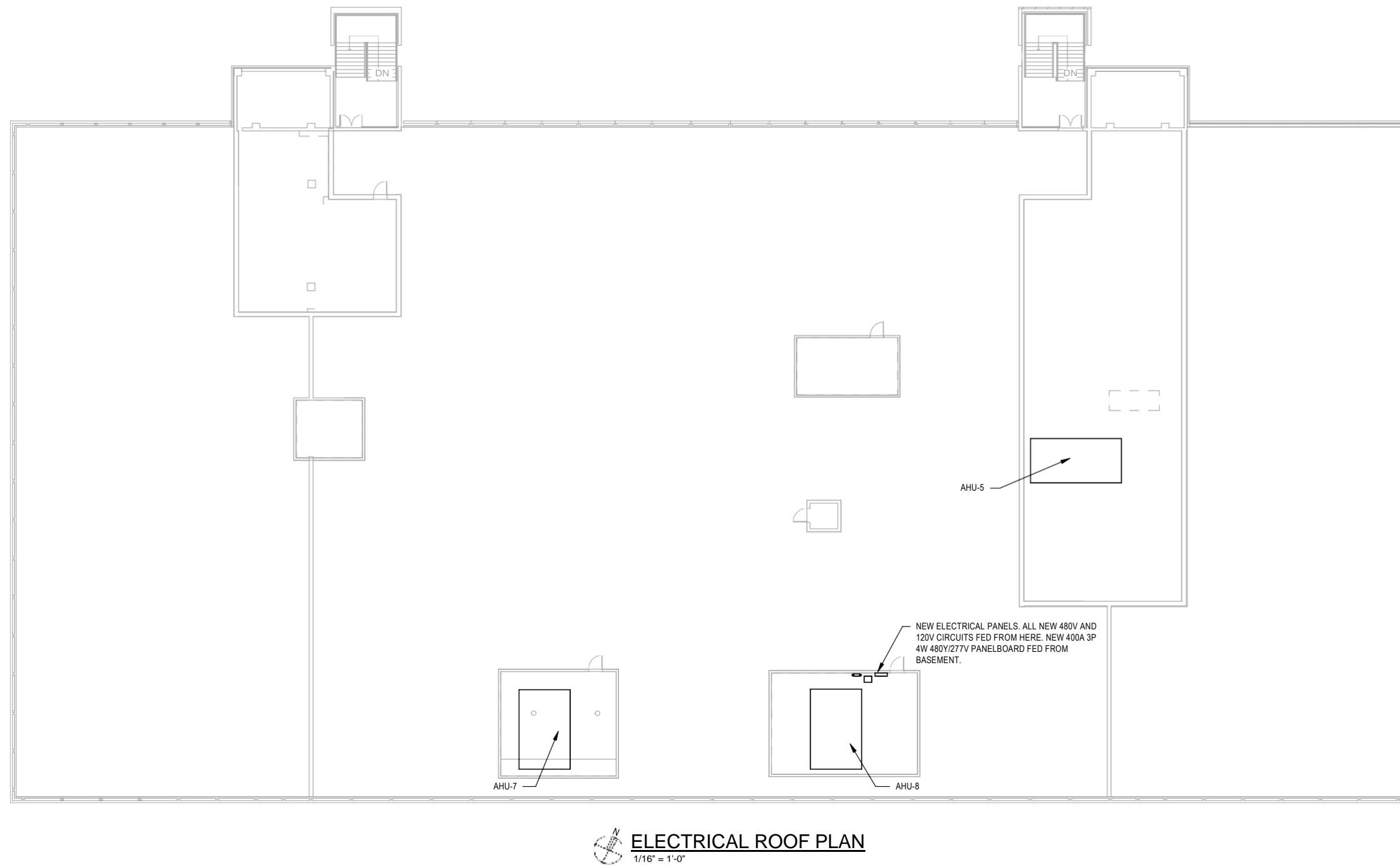
ISSUE DATE:  
DECEMBER 20, 2019

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APM

SHEET TITLE:  
**ELECTRICAL ROOF  
PLAN**

SHEET NUMBER:  
320

**E100**



 **ELECTRICAL ROOF PLAN**  
1/16" = 1'-0"



EXISTING AHU-3 AND  
AHU-4 STARTERS AND  
CIRCUITS TO REMAIN.

EX

EX

EX

DEMOLISH EXISTING CIRCUIT,  
RACEWAYS, STARTER, ETC  
FEEDING AHU-5. UPDATE  
PANELBOARD DIRECTORY.

### GENERAL DEMOLITION NOTES

- ALL CIRCUITS AND SYSTEMS OUTSIDE OF THE PROJECT AREA ARE TO REMAIN IN SERVICE AT ALL TIMES THROUGHOUT THE WORK. COORDINATE ANY NECESSARY OUTAGES WITH OWNER PRIOR TO PROCEEDING.
- DEMOLISH ALL FIXTURES AND CIRCUITS AS INDICATED. DEMOLISH ALL ASSOCIATED WIRES, RACEWAY, AND BOXES. MAINTAIN FUNCTIONALITY OF ALL REMAINING FIXTURES AND EQUIPMENT.
- DEMOLISH ANY SYSTEMS AND APPURTENANCES DISCOVERED WITHIN WALLS BEING DEMOLISHED. WHERE THESE SYSTEMS SERVE AREAS OUTSIDE OF THE PROJECT AREA, COORDINATE WITH OWNER, ARCHITECT, AND ENGINEER TO MAINTAIN EXISTING FUNCTIONALITY IN A WAY COMPATIBLE WITH THIS PROJECT.

### DEMOLITION NOTES:

- DEMOLISH ELECTRICAL AND FIRE ALARM CONNECTIONS TO AIR HANDLER. DEMOLISH ALL WIRING, CONDUIT, BOXES, AND OTHER APPURTENANCES EXCEPT WHERE REMAINING IN SERVICE FOR ANOTHER PURPOSE. REPROGRAM FIRE ALARM SYSTEM AS NEEDED.

1/4" = 1'-0"  
ELECTRICAL AHU-5 PENTHOUSE - DEMOLITION

EX

2 SUPPLY  
1

1 SVC LTS  
E

1 UV LTS  
E

1 FANS  
E

2 RETURN  
D  
1

1

1

1

2M4-1

2M4-3

2M4-5

4M4-1,3,5

VFD

3 AHU  
R

1/4" = 1'-0"  
ELECTRICAL AHU-5 PENTHOUSE



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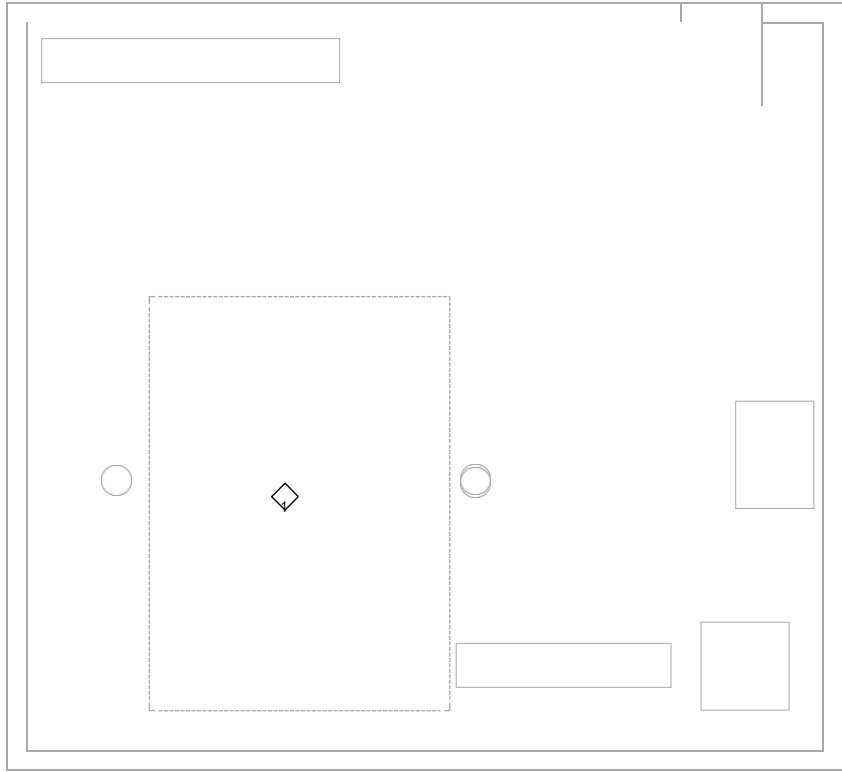
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SHEET TITLE:

ELECTRICAL AHU-7

PENTHOUSE PLANS

SHEET NUMBER:  
322

E102




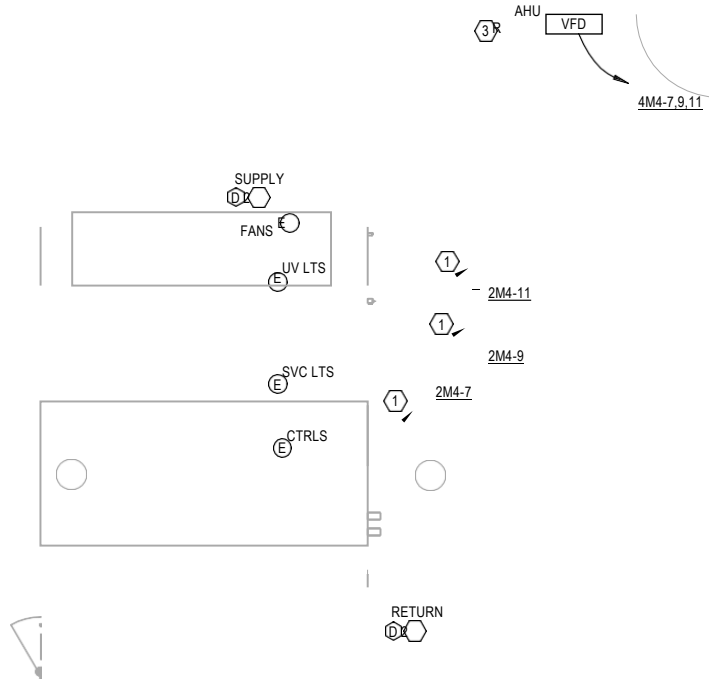
 **ELECTRICAL AHU-7 PENTHOUSE - DEMOLITION**  
1/4" = 1'-0"

### GENERAL DEMOLITION NOTES

1. ALL CIRCUITS AND SYSTEMS OUTSIDE OF THE PROJECT AREA ARE TO REMAIN IN SERVICE AT ALL TIMES THROUGHOUT THE WORK. COORDINATE ANY NECESSARY OUTAGES WITH OWNER PRIOR TO PROCEEDING.
2. DEMOLISH ALL FIXTURES AND CIRCUITS AS INDICATED. DEMOLISH ALL ASSOCIATED WIRES, RACEWAY, AND BOXES. MAINTAIN FUNCTIONALITY OF ALL REMAINING FIXTURES AND EQUIPMENT.
3. DEMOLISH ANY SYSTEMS AND APPURTENANCES DISCOVERED WITHIN WALLS BEING DEMOLISHED. WHERE THESE SYSTEMS SERVE AREAS OUTSIDE OF THE PROJECT AREA, COORDINATE WITH OWNER, ARCHITECT, AND ENGINEER TO MAINTAIN EXISTING FUNCTIONALITY IN A WAY COMPATIBLE WITH THIS PROJECT.

### DEMOLITION NOTES:

-  DEMOLISH ELECTRICAL AND FIRE ALARM CONNECTIONS TO AIR HANDLER. DEMOLISH ALL WIRING, CONDUIT, BOXES, AND OTHER APPURTENANCES EXCEPT WHERE REMAINING IN SERVICE FOR ANOTHER PURPOSE. REPROGRAM FIRE ALARM SYSTEM AS NEEDED.



 **ELECTRICAL AHU-7 PENTHOUSE**  
1/4" = 1'-0"

### SHEET NOTES:

1. CONNECT AHU LINE VOLTAGE LOADS AS REQUIRED. AHUS WILL BE FIELD ASSEMBLED AND WILL REQUIRE ELECTRICAL CONNECTIONS TO LIGHTS, SWITCHES, ETC. COORDINATE WITH MECHANICAL.
2. PROVIDE NEW DUCT SMOKE DETECTORS ON ADDRESSABLE SIMPLEX FIRE ALARM SYSTEM. PROGRAM PER EXISTING FIRE ALARM SEQUENCE.
3. PROVIDE NEW FIRE ALARM RELAY ON ADDRESSABLE SIMPLEX FIRE ALARM SYSTEM. CONFIGURE RELAY TO SHUT DOWN UNIT UPON ACTIVATION OF ALL DUCT SMOKE DETECTORS CORRESPONDING TO THIS AIR HALDING UNIT.



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GAINESVILLE, FL 32610

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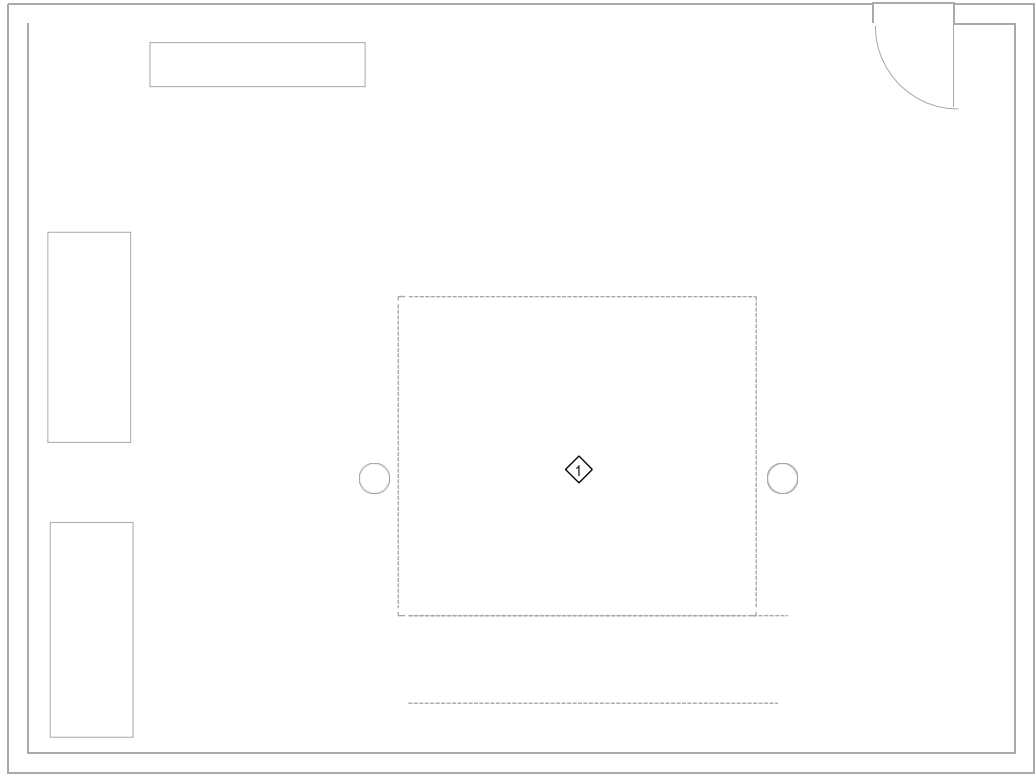
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APM  
SHEET TITLE:

ELECTRICAL AHU-8

PENTHOUSE PLANS

SHEET NUMBER:  
323

E103



### GENERAL DEMOLITION NOTES

- ALL CIRCUITS AND SYSTEMS OUTSIDE OF THE PROJECT AREA ARE TO REMAIN IN SERVICE AT ALL TIMES THROUGHOUT THE WORK. COORDINATE ANY NECESSARY OUTAGES WITH OWNER PRIOR TO PROCEEDING.
- DEMOLISH ALL FIXTURES AND CIRCUITS AS INDICATED. DEMOLISH ALL ASSOCIATED WIRES, RACEWAY, AND BOXES. MAINTAIN FUNCTIONALITY OF ALL REMAINING FIXTURES AND EQUIPMENT.
- DEMOLISH ANY SYSTEMS AND APPURTENANCES DISCOVERED WITHIN WALLS BEING DEMOLISHED. WHERE THESE SYSTEMS SERVE AREAS OUTSIDE OF THE PROJECT AREA, COORDINATE WITH OWNER, ARCHITECT, AND ENGINEER TO MAINTAIN EXISTING FUNCTIONALITY IN A WAY COMPATIBLE WITH THIS PROJECT.

### DEMOLITION NOTES:

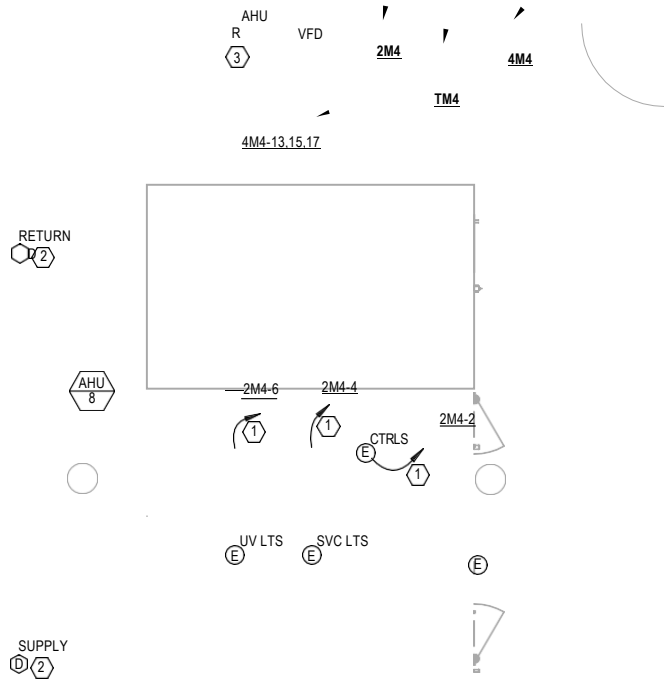
- DEMOLISH ELECTRICAL AND FIRE ALARM CONNECTIONS TO AIR HANDLER. DEMOLISH ALL WIRING, CONDUIT, BOXES, AND OTHER APPURTENANCES EXCEPT WHERE REMAINING IN SERVICE FOR ANOTHER PURPOSE. REPROGRAM FIRE ALARM SYSTEM AS NEEDED.

### ELECTRICAL AHU-8 PENTHOUSE - DEMOLITION

1/4" = 1'-0"

### ELECTRICAL AHU-8 PENTHOUSE

1/4" = 1'-0"



PROVIDE NEW PANELBOARD, FED FROM SWITCHBOARD IN BASEMENT. MOUNT PANEL ON STRUTS IN FRONT OF EXISTING COPPER PIPE. RE-WORK OVERHEAD COPPER PIPE TO PROVIDE CODE-REQUIRED DEDICATED SPACE. RELOCATE HVAC CONTROLS CABINET TO BESIDE EXISTING VFDs.

PROVIDE NEW TRANSFORMER AND LISTED WALL STAND. WALL MOUNT NEW TRANSFORMER OVERHEAD ABOVE PANELBOARDS.

PROVIDE NEW PANELBOARD, FED FROM SWITCHBOARD IN BASEMENT. MOUNT PANEL ON STRUTS IN FRONT OF EXISTING COPPER PIPE. RE-WORK OVERHEAD COPPER PIPE TO PROVIDE CODE-REQUIRED DEDICATED SPACE.

### SHEET NOTES:

- CONNECT AHU LINE VOLTAGE LOADS AS REQUIRED. AHUS WILL BE FIELD ASSEMBLED AND WILL REQUIRE ELECTRICAL CONNECTIONS TO LIGHTS, SWITCHES, ETC. COORDINATE WITH MECHANICAL.
- PROVIDE NEW DUCT SMOKE DETECTORS ON ADDRESSABLE SIMPLEX FIRE ALARM SYSTEM. PROGRAM PER EXISTING FIRE ALARM SEQUENCE.
- PROVIDE NEW FIRE ALARM RELAY ON ADDRESSABLE SIMPLEX FIRE ALARM SYSTEM. CONFIGURE RELAY TO SHUT DOWN UNIT UPON ACTIVATION OF ALL DUCT SMOKE DETECTORS CORRESPONDING TO THIS AIR HANDLING UNIT.



Branch Panel: 4M4

Location:  
Supply From:  
Mounting: Surface  
Enclosure: Type 1  
Basis of Design: I-LINE  
Service Rated: NO

Volts: 480/277 Wye  
Phases: 3  
Wires: 4  
A.I.C. Rating: 18,000  
SPD: NO  
PQM: NO

Phase Bus Rating: 400 A  
MCB Rating: MLO  
Neutral Rating: 100%  
Feeder Ampacity: 400 A  
Feeder Phase Conductor: 3#4/0  
Feeder Neutral Conductor: 1#4/0  
Feeder Ground Conductor: 1#2  
Feeder Conduit: 2-1/2"  
Number of Parallel Runs: 2

Notes:

PROVIDE NEW FEEDER FROM BASEMENT SWITCHBOARD.

CKT	Circuit Description	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Circuit Description	CKT
1	AHU-5	80 A	3	1108S...	1108S...		18013...	18013...		3	100 A	SPACE ONLY (FUTURE AHU-3)	2
3						1108S...		18013...					4
5						1108S...		18013...					6
7				18013...	18013...		18013...		18013...				8
9	AHU-7	100 A	3		18013...			18013...		3	100 A	SPACE ONLY (FUTURE AHU-4)	10
11					18013...			18013...					12
13				18013...			2500 VA		18013...				14
15					18013...			2500 VA					16
17	AHU-8	100 A	3			18013...			2500 VA	3	50 A	PANEL 2M4 VIA XFMR TM4	18
19					0 VA		0 VA						20
21					0 VA			0 VA					22
23						0 VA			0 VA				24
25	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	26
27	SPACE ONLY	--	--		0 VA				0 VA	--	--	SPACE ONLY	28
29	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	30
31	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	32
33	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	34
35	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	36
37	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	38
39	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	40
41	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	42
Total Load:				85638 VA			85638 VA						
Total Amps:				309 A			309 A						

Branch Panel: 2M4

Location:  
Supply From: TM4  
Mounting: Recessed  
Enclosure: Type 1  
Basis of Design: NQ  
Service Rated: YES

Volts: 120/208 Wye  
Phases: 3  
Wires: 4  
A.I.C. Rating: 10,000  
SPD: NO  
PQM: NO

Phase Bus Rating: 100 A  
MCB Rating: 100 A  
Neutral Rating: 100%  
Feeder Ampacity: 100 A  
Feeder Phase Conductor: 3#3  
Feeder Neutral Conductor: 1#3  
Feeder SSBJ: #8  
Feeder Conduit: 1-1/4"  
Number of Parallel Runs: 1

Notes:

CKT	Circuit Description	Trip	Poles	A	B	C	A	B	C	Poles	Trip	Circuit Description	CKT
1	AHU-5 CONTROLS	20 A	1	500 VA			500 VA			1	20 A	AHU-8 CONTROLS	2
3	AHU-5 SVC LTS	20 A	1		500 VA			500 VA		1	20 A	AHU-8 SVC LTS	4
5	AHU-5 UV LTS	20 A	1			500 VA			500 VA	1	20 A	AHU-8 UV LTS	6
7	AHU-7 CONTROLS	20 A	1	500 VA				500 VA		1	20 A	SPARE (FUTURE AHU-3 CONTROLS)	8
9	AHU-7 SVC LTS	20 A	1		500 VA				500 VA	1	20 A	SPARE (FUTURE AHU-3 SVC LTS)	10
11	AHU-7 UV LTS	20 A	1			500 VA				1	20 A	SPARE (FUTURE AHU-3 UV LTS)	12
13	SPARE	20 A	1	0 VA			500 VA			1	20 A	SPARE (FUTURE AHU-4 CONTROLS)	14
15	SPARE	20 A	1		0 VA			500 VA		1	20 A	SPARE (FUTURE AHU-4 SVC LTS)	16
17	SPARE	20 A	1			0 VA			500 VA	1	20 A	SPARE (FUTURE AHU-4 UV LTS)	18
19	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	20
21	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	22
23	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	24
25	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	26
27	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	28
29	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	30
31	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	32
33	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	34
35	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	36
37	SPACE ONLY	--	--	0 VA			0 VA			--	--	SPACE ONLY	38
39	SPACE ONLY	--	--		0 VA			0 VA		--	--	SPACE ONLY	40
41	SPACE ONLY	--	--			0 VA			0 VA	--	--	SPACE ONLY	42
Total Load:				2500 VA			2500 VA						
Total Amps:				21 A			21 A						

ELECTRICAL EQUIPMENT SCHEDULE

MARK	EQUIPMENT DESCRIPTION	VOLTAGE (V)	PHASES	WIRES	LOAD	MEANS OF DISCONNECT	FED FROM	OCP (A)	MCA (A)	# RUNS	CIRCUIT INFORMATION						NOTES
											PHASE	NEUTRAL	GROUND	CONDUIT	RATING	AMPACITY	
AHU-5	AIR HANDLING UNIT 5	480	3	4	30hp	VFD	4M4	80	50	1	6	6	8	3/4"	60°C	55	
	UV LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	SERVICE LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	CONTROLS	120	1	2	500VA	INTEGRAL	2M4	20	20	1	12	12	12	1/2"	60°C	20	
AHU-7	AIR HANDLING UNIT 7	480	3	4	50hp	VFD	4M4	100	81	1	3	3	8	1-1/4"	60°C	85	
	UV LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	SERVICE LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	CONTROLS	120	1	2	500VA	INTEGRAL	2M4	20	20	1	12	12	12	1/2"	60°C	20	
AHU-8	AIR HANDLING UNIT 8	480	3	4	50hp	VFD	4M4	100	81	1	3	3	8	1-1/4"	60°C	85	
	UV LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	SERVICE LIGHTS	120	1	2	500VA	N1 TS 20/1	2M4	20	20	1	12	12	12	1/2"	60°C	20	
	CONTROLS	120	1	2	500VA	INTEGRAL	2M4	20	20	1	12	12	12	1/2"	60°C	20	

TRANSFORMER SCHEDULE

TRANSFORMER SCHEDULE																							
MARK	PRIMARY CONFIGURATION	SECONDARY CONFIGURATION	RATING (kVA)	WINDING MATERIAL	ENCLOSURE TYPE	INSULATION CLASS (C)	TEMPERATURE RISE (C)	PRIMARY OCPD (AMPS)	PRIMARY FEEDER CIRCUIT INFORMATION						SECONDARY OCPD(AMPS)	SECONDARY FEEDER CIRCUIT INFORMATION							NOTES
									# RUNS	PHASE	GROUND	CONDUIT	RATING	AMPACITY		# RUNS	PHASE	NEUTRAL	SSBJ	CONDUIT	RATING	AMPACITY	
T1	480V DELTA	120/208 GROUNDED WYE	30	Cu	NEMA 2	220	150	50	1	8	10	1"	75°C	50	100	1	3	3	8	1-1/4"	75°C	100	
NOTES:																							