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/

UF UNIVERSITY of FLORIDA

INVITATION TO BID

Construction

Acknowledgment Form

Page 1 of 1242 pages	BID WILL BE OPENED: **January 22, 2021 at 3:00 PM** local time and may not be withdrawn within 90 days after such date and time. Mandatory Pre-bid: **January 5, 2021 at 9:00 AM** local time.	BID NO.: **ITB21KO-123**
DATE: 12/18/2020	PROCUREMENT AGENT: **KO/jh**	BID TITLE: **UF-640 IFAS Blueberry Research Facility**

VENDOR NAME	
VENDOR MAILING ADDRESS	REASON FOR NOT SUBMITTING BID
CITY - STATE - ZIP CODE	**POSTING OF BID TABULATIONS** Bid tabulations with intended award(s) will be posted electronically for review by interested parties at https://procurement.ufl.edu/ 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 reprocurement 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

NOTE: ANY AND ALL SPECIAL CONDITIONS AND SPECIFICATIONS ATTACHED HERETO WHICH VARY FROM THE GENERAL CONDITIONS SHALL HAVE PRECEDENCE.

Bid Number: ITB21KO-123

Title: IFAS Blueberry Research Facility

UF Project Number: UF-640

UF | UNIVERSITY of FLORIDA

AUTHORIZED REPRESENTATIVES AND CONTACT INFO:

UF PROCUREMENT SERVICES

Karen Olitsky
971 Elmore Drive / PO Box 115250
Gainesville, FL 32611-5250
(352) 294-1163
kolitsk@ufl.edu

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VII. Technical Specifications

Technical Specifications (1136 Pages)

VIII. Drawings

Drawings (94 pages)

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: UF-640 IFAS Blueberry Research Facility

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

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 AcknowledgmentForm.

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 January 22, 2021 at 3:00PM, 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 Karen Olitsky, Procurement Agent III, 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 their bid, either personally or by written request, at any time prior to the scheduled time for opening bids.

B. No bidder may withdraw their bid for a period of 90 calendar days after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

1.7 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 more than $10,000. See Section 00430 - Subcontractor Listing.

B. Each subcontractor performing work more than $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.

1.8 PERFORMANCE AND PAYMENT BONDS

See General Terms & Conditions, Article 20.

1.9 BID DEPOSIT

Not required.

1.10 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, 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. Alternates, if any, may be accepted in any order or not at all. Acceptance or rejection of any bid will be at the owner's sole discretion.

1.11 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 held remotely, by Zoom, and is open to pre-qualified bidders, prospective subcontractors, and any other interested parties. This conference will be held **January 5, 2021 at 9:00AM, local time. Please click HERE to long into the meeting.**

1.12 EXECUTION OF AGREEMENT

A. A Purchase Order (PO) will be issued for purposes of fiscal encumbrance and payment.

B. The contract will consist of UF's "Owner-Contractor Agreement" and the PO. The terms and conditions contained in both documents are non-negotiable.

C. 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.

D. Bonds and Certificates of Insurance shall be approved by UF before the successful bidder may proceed with the Work.

1.13 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 **January 8, 2020 at 5:00PM**, local time, to Karen Olitsky, Procurement Agent III at kolitsk@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.

1.14 TIME OF COMPLETION:

A. Date of beginning, rate of progress and time for completion of Work for this Project are ESSENTIAL CONDITIONS of Contract. Successful Bidder hereby agrees that Work required by this Contract shall be commenced within ten (10) calendar days after issuance date of written Notice to Proceed; 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 insure Substantial Completion of entire Project within ten (10) months after receipt of Notice to Proceed, and shall be finally completed within 30 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 **ITB21KO-123 UF-640 IFAS Blueberry Research Facility** 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:

_____Dollars

Figures: $_____

ADDITIVE ALTERNATE #1:

_____Dollars

Figures: $_____

ADDITIVE ALTERNATE #1:

_____Dollars

Figures: $_____

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_____, 2019.

_____
(Signature of Bidder)

_____ _____
(Print Name) (Title)

WITNESS:

_____
(Signature of Witness)

_____
(Print Name)

Address: _____

_____
(City) (State) (Zip Code)

END OF SECTION

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 affect shall be furnished with the bid.

D. See Section 00100 - Instruction to Bidders regarding subcontractor licensure requirements.

END OF SECTION

IFAS Blueberry Research Facility

Building # 0906

Project UF-640

100% Bid Documents
Project Manual
December 18, 2020

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Authorized representatives and contact information:

OWNER

Representative:	David Wayne Woods
Address:	UF Planning Design & Construction
	245 Gale Lemerand Drive, P.O. Box 115050
City, State, Zip:	Gainesville, FL 32611-5050
Telephone/Fax:	(352) 273-4440; (352) 273-4034
Web and E-mail:	www.facilities.ufl.edu;
	davidwwoods@ufl.edu

DESIGN PROFESSIONAL (*Architect)*

Name:	Rowe Architects Incorporated
	Angela Hendershot, AIA LEED AP
Address:	100 E Madison Street, Suite 200
City, State, Zip:	Tampa, Florida 33602
Telephone:	813-221-8771
Web and E-mail:	www.rowearchitects.com ;
	a.hendershot@rowearchitects.com

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01 81 13 Sustainable Design Requirements – FGBC Version 3

V. Forms, Applications, and Illustrations

The following forms or documents can be found on the Planning Design & Construction website at www.facilities.ufl.edu:

Agreement for Construction Management Services
Application and Certificate for Partial Payment
Builder Application and Certificate of Partial Payment
Change Order Form and COP Justification Form
Utility Outage Request
UF Project Construction Sign
Construction Administration and Substantial Completion Guide
Roads/Sidewalks/Parking Restriction Notification
Assignment of Antitrust Claims
Certificate of Non-Segregated Facilities
Owner Direct Purchase P.O. Requisition
Waste Reporting Log
Inspection Requests and Checklists
Project Management Guides

The following form can be found on Physical Plant Division Operations Engineering website at www.ppd.ufl.edu/operations-dig.html:

- Dig Permit

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

- EH&S Inspection Request Form

VI. Technical Specifications

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03 10 00 Concrete Forming and Accessories
03 20 00 Concrete Reinforcing
03 30 00 Cast-In-Place Concrete

Division 04 Masonry
04 20 00 Unit Masonry
04 22 13 Structural Reinforced Concrete Unit Masonry
04 72 00 Cast Stone Masonry

Division 05 Metals
05 12 00 Structural Steel Framing
05 21 00 Steel Joist Framing
05 31 23 Steel Roof Decking
05 50 00 Metal Fabrications
05 52 13 Pipe and Tube Railings

Division 06 Wood, Plastics, and Composites
06 10 53 Miscellaneous Rough Carpentry
06 41 16 Plastic-Laminate-Clad Architectural Cabinets

Division 07 Thermal and Moisture Protection
07 11 13 Bituminous Dampproofing
07 21 00 Thermal Insulation
07 52 16 SBS Modified Bituminous Membrane Roofing
07 71 00 Roof Specialties
07 72 00 Roof Accessories
07 92 00 Joint Sealants
07 92 19 Acoustical Joint Sealants

Division 08 Openings
08 11 13 Hollow Metal Doors and Frames
08 12 16 Aluminum Frames
08 14 16 Flush Wood Doors
08 31 13 Access Doors and Frames
08 41 13 Aluminum-Framed Entrances and Storefronts
08 71 00 Door Hardware
08 80 00 Glazing
08 91 19 Fixed Louvers

Division 09 Finishes
09 22 16 Non-Structural Metal Framing
09 24 00 Cement Plastering
09 29 00 Gypsum Board
09 30 13 Ceramic Tiling
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09 65 13 Resilient Base and Accessories
09 65 19 Resilient Tile Flooring
09 68 13 Tile Carpeting
09 91 00 Painting

Division 10 Specialties
10 11 00 Visual Display Units
10 14 23 Room Signage
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10 26 00 Wall Protection
10 28 00 Toilet and Bath Accessories
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10 44 13 Fire Protection Cabinets
10 73 26 Walkway Covers

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Division 12 Furnishings
12 24 13 Roller Window Shades
12 36 53 Laboratory Countertops
12 36 61 Solid Surfacing Countertops
12 56 53 Laboratory Furniture

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21 00 00 Fire Protection General
21 00 10 Codes and Standards
21 05 00 Fire Protection Related Work
21 05 05 Excavation and Backfill
21 05 19 Piping Specialties
21 05 20 Meters and Gauges
21 05 23 Valves
21 05 29 Supports, Anchors, and Seals
21 05 53 Fire Protection Identification
21 11 00 Pipes and Pipe Fittings
21 11 11 Site Fire Water Systems
21 11 13 Testing & Cleaning of Fire Protection Systems
21 11 14 Building Sprinkler and Standpipe Systems
21 30 00 Hydraulic Calculations
21 99 15 Access Doors

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22 11 16 Potable Water System
22 11 23 Plumbing Pumps
22 11 24 Gas System
22 13 13 Facility Sanitary Sewers
22 13 16 Soil, Waste and Vent System
22 40 00 Plumbing Fixtures, Equipment, Trim & Schedule
22 67 13 DI Water System
22 99 15 Access Doors
22 99 16 Testing, Cleaning, and Sterilization of Piping Systems

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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

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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 require 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). 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).

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.

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.

SECTION 00 81 00 - VENDOR DIVERSITY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Terms and Conditions and other sections in Division 1 of these Specifications.

1.2 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.

1.3 The Builder shall use good faith efforts to ensure opportunities are available to small, woman-owned, and minority-owned businesses on the Project.

1.4 Contact the UF Division of Small Business and Vendor Diversity Relations for more information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 81 00

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SECTION 00 84 20 - SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Conditions, the Supplementary Conditions, and other Sections in Division 1 of these Specifications.

1.2 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.

E. Hazardous Substances

1. Refer to the General Terms & Conditions.

1.3 Trench Safety Act

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

END OF SECTION 00 84 20

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SECTION 00 90 20 - PUBLIC ENTITY CRIMES

PART 1 - GENERAL

1.1 RELATED SECTIONS:

A. Documents affecting the work of this Section include, but are not necessarily limited to, the General Conditions, the Supplementary Conditions, and other Sections in Division 1 of these Specifications.

1.2 PUBLIC ENTITY CRIMES:

A. 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 00 90 20

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SECTION 00 90 30 - ASBESTOS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

Documents affecting the work of this Section include, but are not necessarily limited to, the General Conditions, the Supplementary Conditions, and other Sections in Division 1 of these Specifications.

1.2 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.

1.3 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.

1.4 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 00 90 30

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SECTION 01 01 40 - 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/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 01 01 60 for information regarding utility outages and dig permits.

C. Refer to Section 01 31 00 for requirements regarding the coordination of work with the University of Florida Schedule.

D. Refer to section 01 50 00 for requirements related to Temporary Facilities & Controls.

1.2 DESCRIPTION OF WORK INCLUDED

A. 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 01 50 00 for information on the maintenance of safe and accessible paths of travel in and around the job site.

B. Builder’s Vehicles:

1. Require Builder's vehicles, vehicles belonging to employees of the Builder, and all other vehicles entering upon the Owner's property in performance of the Work of the Contract, to use only agreed upon Access Route.
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 – both for offsite and approved onsite parking – 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 34th Street. See map on the “Forms & Standards” page of the Planning Design & Construction website (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. 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 Facilities Planning & Construction website (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 01 06 00.

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 Facilities Planning & Construction website (www.facilities.ufl.edu).

D. 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 Facilities Planning & Construction website (www.facilities.ufl.edu).

E. University of Florida Police Department (UPD): UPD must verify construction fencing, exterior lighting, landscaping, and other items during construction and closeout.

F. Architect / Engineer inspections – see technical sections.

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 g 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 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 .

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 updinfo@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 accessable 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.

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 .

1.10 HOME FOOTBALL GAME WEEKENDS

A. Approximately 100,000 people converge upon the campus on each of 6 to 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 34th Street Hilton by 4:00 PM Friday on such weekends and do not permit parking there again until Monday morning.

C. See 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 01 01 40

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SECTION 01 01 60 - UTILITIES 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, 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 01 31 00, 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.

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 01 01 60

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SECTION 01 06 00 - 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/Contractor 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

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).

END OF SECTION 01 06 00

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Coordination with occupants.
   4. Work performed by Owner.
   5. Owner-furnished/Contractor-installed (OFCI) products.
   6. Owner-furnished/Owner-installed (OFOI) products.
   7. Work restrictions.
   8. Specification and drawing conventions.
   9. Contractor's use of site and premises.

B. Related Requirements:
   1. Section 01 01 40 “Builder’s Use of the Premises” for access to the site and building.
   2. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: UF-640 - IFAS Blueberry Research Facility

B. Owner: The University of Florida Board of Trustees.

C. Owner's Representative: David W. Wood.

D. Architect: Rowe Architects Incorporated

E. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
   1. Civil Engineer: DRMP, Inc
   2. Structural Engineer: Walter P. Moore and Associates, Inc.
   3. Mechanical & Electrical Engineers: Moses Engineering, Inc.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and is a new standalone building on the University of Florida campus in Gainesville, Florida. The new facility will be approximately 9,355 SF and will house a variety of program spaces including a classroom, laboratories, collaboration space, offices, storage, and study rooms.

B. Type of Contract:
   1. Project will be constructed under a single prime contract.

1.5 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. Landscaping.

1.6 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. The Owner will furnish, and the Contractor will install products indicated.

1. Furnish Building Services (Phone: 352-846-1622) with the required number of each type of unit and they will be supplied to the project at no cost.

B. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Paper Towel Dispensers.
2. Soap Dispensers.
3. Toilet Paper Dispensers.
4. Fire extinguishers.
   a. At the conclusion of the project, call the UF Fire Equipment Services Unit to install fire extinguishers throughout the project.
5. Walk-In Coolers

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Automated External Defibrillators (AEDs)
2. Projection screens.
3. Video projectors, including hanging system, controls, and cabling.
4. Televisions, including wall mounting bracket, controls, and cabling.
5. Autoclaves (hoods are CPCI)
6. Deionized water systems.
7. Residential appliances.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. Unrestricted Use of Site: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Refer to Section 01 01 40 “Builder's Use of The Premises.”

C. Existing Utility Interruptions: Refer to Section 01 01 60 “Utility Outages and Dig Permits.”

D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

E. Employee Identification: Refer to Section 01 01 40 “Builder’s Use of the Premises.”

F. Employee Screening: Refer to Section 01 01 40 “Builder’s Use of the Premises.”

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

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SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other Work of the Contract.

C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. One (1): Cast Stone.

1. Base Bid: Cement Plaster, full height. Located at the North and West facades of the Mechanical / Electrical room.
2. Alternate: Cast Stone, full height. Located at the North and West facades of the Mechanical / Electrical room.

B. Alternate No. Two (2): Sound absorbing panels.

1. Base Bid: Do not provide sound absorbing panels, as indicated on sheet A402, Teaching Lab #132 and on sheet A403, Classroom #131.
2. Alternate: Provide sound absorbing panels, as indicated on sheet A402, Teaching Lab #132 and on sheet A403, Classroom #131.

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 23 00 "Alternates" for products selected under an alternate.
2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
    b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. Certificates and qualification data, where applicable or requested.
    g. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
    h. Research reports evidencing compliance with building code in effect for Project.
    i. Florida Product Approval documentation, where applicable.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.

k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.

l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results, as approved by the Architect.

b. Substitution request is fully documented and properly submitted.

c. Requested substitution will not adversely affect Contractor's construction schedule.

d. Requested substitution has received necessary approvals of authorities having jurisdiction.

e. Requested substitution is compatible with other portions of the Work.

f. Requested substitution has been coordinated with other portions of the Work.

g. Requested substitution provides specified warranty.

h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed, unless approved by Architect prior to Bid.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 31 00 - 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, 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 01 01 60, Utility Outages, for related requirements regarding the pre-planning of utility outages.

C. Comply with pertinent provisions of Section 01 33 00 – Submittal Procedures.

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 01 01 40 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.

G. Project-specific schedule requirements: NONE

END OF SECTION 01 31 00

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Division 1 Section "Construction Schedules" for submitting schedules and reports, including Contractor's construction schedule.
2. Division 1 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Division 1 Section "Project Closeout" for submitting operation and maintenance manuals.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. General: Submit submittals with Submittal Transmittal in Adobe Portable Document Format (PDF) to Architect for review.

B. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in Autodesk Revit.

c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement or the Agreement included at the end of this section.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
   b. Submit color selection data as a single package. Color selections will be made at the same time. Architect will return color selections on a schedule a copy of which is included at the end of this section.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
   a. Division 22 sections.
   b. Division 26 sections.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Electronic PDF submittal files shall be named utilizing the specification number followed by a sequential number for the submittal made under the given specification number followed by “r#” if it is a resubmittal, and then followed by a brief description of the submitted item.
   a. The description shall indicate the actual item submitted, shall not be general in nature, and does not have to be that of the specification section heading.

b. Using the example, “15135-4r2 Differential Pressure Gauge”; 15135 – Meters and Gauges is the relevant specification, the “4” shows it was the fourth submittal for specification section 15135, “r2” shows it was the second resubmittal of that particular submittal, and the description indicates what item is submitted.

c. Each specification item shall be submitted in a separate PDF file. PDF files with multiple specification items will be returned without review.

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

4. Transmittal Form for Electronic Submittals: Use electronic form, containing the following information:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Names of subcontractor, manufacturer, and supplier.
   g. Category and type of submittal.
   h. Submittal purpose and description.
   i. Specification Section number and title.
   j. Specification paragraph number or drawing designation and generic name for each of multiple items.
   k. Drawing number and detail references, as appropriate.
   l. Location(s) where product is to be installed, as appropriate.
   m. Related physical samples submitted directly.
   n. Indication of full or partial submittal.
   o. Other necessary identification.
   p. Remarks.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

1. Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals via e-mail as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data in the following format:
      a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 by 36 inches.
   3. Submit Shop Drawings in the following format:
      a. PDF electronic file.

4. BIM File Incorporation: The design documents were developed with Autodesk Revit software. Sub-contractor and manufacturers are encouraged to develop their Shop Drawing files with Autodesk Revit, so the shop drawings can be added to the final close-out documents.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
   e. Specification paragraph number and generic name of each item.
3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will use the samples to develop a “color board” for the Owner. Samples will not be returned.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit two sets of Samples. Architect will retain both Sample sets.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least two sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

F. Contractor's Construction Schedule: Comply with requirements specified in Section 01310 "Construction Schedules."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section01400 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01700 "Project Closeout."

I. Maintenance Data: Comply with requirements specified in Section 01700 " Project Closeout."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and one paper copy of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Autodesk Revit

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01700 "Project Closeout."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect or The Contractor.

C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by the Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

I. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. State of Florida Product Approval: For each type of exterior product and/or system provide the following:

1. Proof that the system/product complies with Florida Product Approval Rule 9B-72.
2. Installation instructions showing how each exterior product and system is to be installed.

B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Reports: Prepare and submit certified written reports and documents as specified.

D. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

E. Submittal Format: Submit written reports and documentation in electronic (PDF) format.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
   5. Allow seven days for initial review and each re-review of each mockup.
   6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   7. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

A. Contractor Responsibilities: Unless otherwise indicated, provide quality-control services specified and required by authorities having jurisdiction.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not sub-contract testing to the Installer of the work tested.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Retesting / Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect, Contractor, and Installer promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
   4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
   5. Do not perform any duties of Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. “Day”: Calendar day.

G. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

I. "Provide": The term “provide” means to furnish and install.

J. “Installer”: The term "installer" is defined as the entity (person or firm) engaged by Contractor, or its subcontractor or sub-subcontractor for performance of a particular unit of work at project site including installation, erection, application and similar required operations. It is a general requirement that such entities (Installers) be expert in operations they are engaged to perform.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.

1. For standards listed in the “Referenced Standards” chapter in each volume of the Florida Building Code, use the publication dates referenced in the Florida Building Code.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 45 29 – STRUCTURAL TESTING AND INSPECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for quality assurance and quality control to be completed by the Testing Laboratory, Contractor, and/or the Geotechnical Engineer for the following structural items:

1. Concrete Reinforcing.
2. Cast-in-Place Concrete.
3. Masonry.
4. Structural Steel.
5. Steel Joists.
6. Steel Decking.
7. Earthwork.

1.2 PRICE AND PAYMENT PROCEDURES

A. Unit Prices:

1. Cost Proposal: The Testing Laboratory's proposal to the Owner shall contain unit price stipulations for specified tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

B. Measurement and Payment

1. Payment of the Testing Laboratory: The Owner will pay for the initial Laboratory services for inspection and testing of materials for compliance with the requirements of the Contract Documents.
2. Payment for Substitution Testing: The Contractor shall arrange for and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.
3. Payment for Retesting: When initial tests indicate work does not comply with the requirements of the Contract Documents, the Contractor shall be liable to the Owner for the cost for any additional inspections, sampling, testing, and retesting done by the Testing Laboratory.
4. Payment by Contractor: The Contractor shall furnish and pay for the following items if required:

    a. Soil survey of the location of borrow soil materials, samples of existing soil materials, and delivery to the Contractor's Testing Laboratory.
    b. Samples of concrete aggregates and delivery to the Contractor's Testing Laboratory.
    c. Concrete mix designs as prepared by his concrete supplier.
    d. Site-situated storage boxes for concrete cylinders
    e. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.
    f. Certification of reinforcing steel mill order.
    g. Certification of structural steel mill order.
    h. Certification of portland cement, lime, fly ash.
    i. Certification of welders and preparation of Welding Procedure Specifications.

j. Tests, samples, and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner, Architect or Engineer to establish equality with specified items.

k. The making and testing of concrete cylinders for the purpose of evaluating strength at time of form stripping or the time spent evaluating the in situ strength of concrete using the Maturity Method.

l. Any other tests when such costs are required by the Contract Documents to be paid by the Contractor.

5. Payment for Tests of Suspected Deficient Work: If, in the opinion of the Building Official, Owner, Architect, or Engineer, any of the work of the Contractor is not satisfactory, the Contractor shall furnish and pay for all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction. The Owner shall pay all costs if the tests prove the questioned work to be satisfactory.

1.3 OWNER RESPONSIBILITIES

A. The Owner shall engage a Geotechnical Engineer to provide inspection services for the foundations as outlined below in Article 3.8.

B. The Owner shall provide a copy of the project plans and specifications to the Testing Laboratory prior to the start of construction and prior to any preinstallation meetings.

1.4 CONTRACTOR RESPONSIBILITIES

A. The Contractor shall not engage the same Testing Laboratory for construction services as the Owner has for Structural Testing Laboratory Services as defined herein unless agreed to by the Owner.

B. Furnishing Samples and Certificates: The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

C. Furnishing Casual Labor, Equipment and Facilities: The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

1.5 TESTING LABORATORY RESPONSIBILITIES

A. The Testing Laboratory shall sample and test materials as they are being installed for compliance with specified acceptance criteria. The Testing Laboratory will report and interpret the test results. The Laboratory shall monitor and report on the installation of construction work and shall perform tests on the completed construction as required to indicate Contractor’s compliance with the various material specifications governing this work.

B. The Testing Laboratory shall provide inspections on the following items:

1. Welding of reinforcing steel.
2. Inspection of structural steel, bolting, and welding material.
3. Welding of structural steel.
4. Compacted earth fill.

C. Inspections Required by Government Agencies: The Testing Laboratory shall perform inspections and submit reports and certifications as required by government agencies having jurisdiction over the aspects of the project covered by this specification.

D. Notification of Deficiencies in the Work: The Testing Laboratory shall notify the Architect, Engineer, and Contractor within 24 hours of discovery of observed irregularities and deficiencies of the Work and other conditions not in compliance with the requirements of the Contract Documents. Notification shall be by telephone or e-mail and then in writing.

E. Accounting: The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and costs attributed to the Contractor.

F. Monitoring Product and Material Certifications: The Testing Laboratory shall be responsible for monitoring the submittals of product and material certifications from manufacturers and suppliers as specified in the Specifications and shall report to the Owner, Architect, and Engineer when those submittals are not made in a timely manner.

G. Limitations of Authority: The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. The Testing Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.
2. The Contractor shall cooperate with Testing Laboratory personnel and provide access to the work and to manufacturers' operations.
3. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

B. Preinstallation Meetings: The Testing Laboratory shall attend preinstallation meetings with the Architect, Engineer, Contractor, and material suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule and shall participate in such meetings throughout the course of the project.

C. Scheduling:

1. Advance Notice: The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests. Failure to sufficiently notify may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.

1.7 SUBMITTALS

A. Quality Control Reports:

1. Information on Reports: The Testing Laboratory shall submit copies of reports of inspections and tests promptly. The reports shall contain at least the following information:

    a. Project name.
    b. Date report issued.
    c. Testing Laboratory name and address.
    d. Name and signature of inspector/technician.
    e. Date of inspection and/or sampling.
    f. Date of test.
    g. Identification of product and Specification section.
    h. Location in the project.
    i. Identification of inspection or test.
    j. Record of weather conditions and temperature (if applicable).
    k. Results of test regarding compliance with Contract Documents.
2. Copies: The Laboratory shall send signed copies of test and inspection reports to the following parties:

a. Two copies to the Owner or his/her representative.
b. Two copies to the General Contractor.
c. One copy to the Architect.
d. One copy to the Engineer of Record.

B. Discrepancy Log: The Testing Laboratory shall create and maintain a log of all discrepancies throughout the duration of the project.
1. Information on Log: This log shall include, but is not limited to:

a. Discrepancy date.
b. Description of discrepancy.
c. Drawing and/or detail reference.
d. Description of as-built condition.
e. Description of any remedial work performed.
f. Status of discrepancy.

2. Submission Schedule: This log shall be submitted to the Architect/Engineer on a periodic basis for review and comment. Upon completion of the Project, this log shall be submitted in its entirety as an attachment to the final signed report described below under Certifications.

C. Certification: Upon completion of the job, the Laboratory shall furnish to the Owner, Architect, and Engineer of Record, a statement signed by a licensed professional engineer that, to the best of their knowledge, required tests and inspections were made in accordance with the requirements of the Contract Documents.

1.8 QUALITY ASSURANCE

A. Qualifications of Testing Laboratory:
1. The Testing Laboratory shall meet the basic requirements of ASTM E 329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASHTO Accreditation Program or the “NIST” National Voluntary Laboratory Accreditation Program.
2. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.
3. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.
4. Qualifications of Welding Inspectors

a. Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.
b. Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.

B. The Contractor shall not engage the same testing laboratory for construction services as the Owner has for quality assurance testing, unless agreed to by the Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

A. The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and as determined in meetings with the Owner, Architect, and Engineer.

3.2 CONCRETE REINFORCING

A. Quality Assurance:
   1. Review the Welding Procedure Specification (WPS) submitted by the contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and AWS.
   2. Review welder qualifications by certification or verify by retesting. Obtain welder certificates.

3.3 CAST-IN-PLACE CONCRETE

A. Quality Assurance:
   1. Concrete Mix Designs: The Testing Laboratory shall review the submitted mix designs for conformance to the specifications and for suitability for use in the project.
   2. Preinstallation Meetings: The Testing Laboratory shall attend the preinstallation meetings as noted in Specification 033000 “Cast-in-Place Concrete.”

B. Field Testing: The following tests shall be completed by the Testing Laboratory:
   1. During Concrete Placement:
      a. Record the amount of water added and note if it exceeds the amount allowed to be added shown in the approved mix design.
      b. Mold concrete test cylinders as specified below in Paragraph 3.a.
      c. Perform tests to determine slump, concrete temperature, unit weight, and air entrainment as specified below.
      d. Record information for concrete test reports as specified below.
      e. Pick up and transport to Laboratory cylinders cast the previous day.
   2. After Concrete Placement:
      a. In-situ Concrete Strength Verification for Form Stripping: The Testing Laboratory shall perform the tests necessary to determine the concrete strength prior to form stripping:
         1) If concrete strength for form stripping is to be determined using field-cured cylinders, the cylinder shall be broken at the time of form removal as directed by the Contractor.
         2) If concrete strength for form stripping is to be determined using the Maturity Method, the Testing Laboratory shall verify that the requirements of ASTM C 1074 are being followed and that the proper criteria for determining concrete strength by this method has been established and is being followed.
      b. Investigation of Low Strength Concrete Test Results:
         1) Cost of Investigations for Low Strength Concrete: The Contractor shall reimburse the Owner for the costs of investigations of low strength concrete, as defined in Part I above.

2) Scope of Investigations: See Specification Section 033000 “Cast-In-Place Concrete” for the investigations that may be required by the Engineer. The Testing Laboratory will conduct these investigations if required.

c. Post-Installed Anchors in Concrete:
   1) Verify maximum anchor tightening torque for all applicable post-installed anchors.
   2) Verify that all drilled holes for adhesive anchors are within six degrees of perpendicular to the surface of the concrete member.
   3) Provide pull tests on individual anchors as specified in the ICC Evaluation Services Report, on the drawings, or as directed by the Engineer-of-Record.

d. Floor Flatness and Levelness Measuring: Perform tests as defined below.

e. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering: Perform tests as defined below.

f. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:
   1) Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
   2) Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

3. Standards for Concrete Tests:

a. Concrete Test Cylinders: Mold and test concrete cylinders as described below:
   1) Cylinder Molding and Testing: Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Cylinders may be either 6” in diameter by 12” or 4” in diameter by 8”, however, the diameter of the cylinder shall be at least three times the nominal maximum size of the coarse aggregate in the mix tested. All of the cylinders for each class of concrete shall be of the same dimension for all sets of that class.
   2) Field Samples: Field samples for strength tests shall be taken in accordance with ASTM C 172 at the point of placement.
   3) Quantity of Cylinders: Each set of test cylinders shall consist of a minimum of four standard test cylinders. If concrete strength for form stripping is to be determined using field-cured cylinders, one additional cylinder per set will be required for formed slab and pan-formed beam floors for the purpose of evaluating the concrete strength at the time of form stripping. This cylinder shall be stored on the floor where form removal is to occur under the same exposure conditions as the floor concrete. The cylinder shall be cured under field conditions in accordance with ASTM C 31. Field-cured test cylinders shall be molded at the same time and from the same samples as laboratory-cured test specimens. The Contractor shall reimburse the Owner for the cost of making and testing these cylinders.
   4) Frequency of Testing: A set of test cylinders shall be made according to the following minimum frequency guidelines:

      a) One set for each class of concrete taken not less than once a day.

b) Mat Foundation: One set for each 150 cubic yards or fraction thereof.
c) Spread Footings: One set for each 50 cubic yards or fraction thereof.
d) Floors: One set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of floor area.
e) All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof but not less than one set for each 5,000 square foot of area for walls.
f) No more than one set of cylinders at a time shall be made from any single truck.
g) If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
h) The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

5) The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded.
6) For concrete specified on the drawings to reach the required strength at 28 days, break one cylinder of the set at seven days, two 6” by 12” cylinders or three 4” by 8” cylinders at 28 days, and keep one in reserve for testing at the Engineer’s direction.
7) For concrete specified on the drawings to reach the required strength at 56 days, break one cylinder of the set at seven days, one cylinder at 28 days, two 6” by 12” cylinders or three 4” by 8” cylinders at 56 days, and one kept in reserve for testing at the Engineer’s direction.
8) Cylinder Storage Box: The Contractor shall be responsible for providing a protected concrete cylinder wooden storage box at a point on the job site mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory. The box shall be constructed and equipped to maintain the environment specified for initial curing in ASTM C 31.
9) Transporting Cylinders: The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders including loss of moisture, freezing temperatures or jarring.
10) Information on Concrete Test Reports: The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

a) Truck number and ticket number.
b) Concrete Batch Plant.
c) Mix design number.
d) Accurate location of pour in the structure.
e) Strength requirement.
f) Date cylinders made and broken.
g) Technician making cylinders.
h) Concrete temperature at placing.
i) Air temperature at point of placement in the structure.
j) Amount of water added to the truck at the batch plant and at the site and whether or not it exceeds the amount allowed by the mix design.
k) Slump.
l) Unit weight.
m) Air content.

n) Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be brought to the attention of the Architect and Engineer in writing if either cylinder fails to meet specification requirements.

b. Slump Tests: Slump Tests (ASTM C 143) shall be completed at the beginning of concrete placement for each batch plant and for each set of test cylinders made. The slump test shall be made from concrete taken from the end of the concrete truck chute. The concrete shall be considered acceptable if the slump is within the slump tolerance noted on the mix design submittal form for that class of concrete.

c. Air Entrainment: Air entrainment tests (ASTM C 231 or C 173, C 173 only for lightweight concrete) shall be made at the same time slump tests are made as cited above. Samples for air entrainment tests shall be taken at the point of placement.

d. Concrete Temperature: Concrete temperature at placement shall be measured (ASTM C 1064) at the same time slump tests are made as cited above.

e. Unit Weight Test: ASTM C 138.

f. Floor Flatness and Levelness Measuring:

1) The Testing Laboratory shall measure the floor for flatness and levelness according to ASTM E 1155.

2) Measurement of the finished concrete surface profile for any test section shall be made when requested by the Representative at his option. Notwithstanding, measurements shall be made within 24 hours after completion of finishing operations. For structural elevated floors measurement shall also be made prior to removal of forms and shores. The Contractor shall be notified immediately after the measurements of any section are complete and a written report of the floor measurement results shall be submitted within 72 hours after finishing operations are complete.

3) The concrete surface profile shall be measured using equipment manufactured for the purpose such as a Dipstick Floor Profiler as manufactured by the Edward W. Face Company in Norfolk, Virginia, F-Meters manufactured by Allen Face & Company in Norfolk, Virginia, optical, or laser means or other method specified in ASTM E 1155.

4) Each floor test section and the overall floor area shall conform to the two-tiered measurement standard as specified herein.

a) Minimum Local Value (MLV). The minimum local F_F/F_L values represent the absolute minimum surface profile that will be acceptable in any one floor test section.

b) Specified Overall Value (SOV). The specified overall F_F/F_L values represent the minimum values acceptable for all combined floor test sections representing the overall floor.

5) For purposes of this specification a floor test section is defined as the smaller of the following areas:

a) The area bounded by column and/or wall lines.
b) The area bounded by construction and/or control joint lines.
c) Any combination of column lines and/or control joint lines.
d) Test sample measurement lines within each test section shall be multidirectional along two orthogonal lines as defined by ASTM E 1155.

e) The precise layout of each test section shall be determined by the Testing Laboratory and shall be submitted for Architect/Engineer review and approval.

g. Testing of Concrete Floor Slabs for Acceptability to Receive an Adhesive-Applied, Low-Permeable Floor Covering:

1) The following tests shall be performed by the Testing Laboratory as a part of quality assurance testing to insure that the proper moisture condition and alkalinity of the substrate has been achieved prior to installing adhesive-applied, low-permeability floor coverings such as vinyl composition tile (VCT), linoleum, sheet vinyl, vinyl-backed carpet, rubber, athletic flooring, synthetic turf, wood, acrylic terrazzo, thin-set tile, epoxy overlays and adhesives, waterproofing, et.al.
2) Moisture Vapor Emission Rate: Perform testing according to ASTM F 1869 to determine if the moisture emission rate from the floor is below the flooring manufacturer's maximum recommended value but not greater than five pounds per 1,000 square feet per 24 hours.
3) Relative Humidity Determination Test: As an alternate to the Moisture Vapor Emission Rate Test, and if agreed to by the Contractor, Architect and Owner, perform testing according to ASTM F 2170 to determine if the relative humidity of the concrete slab is below the flooring manufacturer's maximum recommended value but not greater than 75%.
4) Alkalinity Testing: Perform testing in accordance with ASTM F 710, Paragraph 5.3, to determine if the pH level of the concrete slab surface is below the flooring manufacturer's maximum recommended value but not greater than 10. Perform one test per 1,000 square feet with a minimum of three tests within the total area being tested.

4. Evaluation and Acceptance of Concrete:

a. Strength Test: A strength test shall be defined as the average strength of two six inch cylinder breaks or three four inch cylinder breaks from each set of cylinders tested at the time indicated above.

b. Quality Control Charts and Logs: The Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:

1) Number of strength tests made to date.
2) Strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
3) Number of tests under specified strength.
4) A histogram plotting the number of strength test cylinders versus compressive strength.
5) Quality control chart plotting compressive strength test results for each test.
6) Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
7) Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

c. Acceptance Criteria: The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

1) The average of all sets of three consecutive strength tests equal or exceed the required f'c.

2) No individual strength test falls below the required f'c by more than the greater of 10% of f'c or 500 PSI.

d. If either of the above Acceptance Criteria requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

C. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).
2. Environmental Conditions: Environmental condition limits shall be as follows unless appropriate provisions in concreting practices have been made for cold or hot weather:

a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for 3 consecutive days unless the temperature rose above 50°F for at least one-half of any of those 24 hour periods.
b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 lb./sq. ft./hr. or less as determined by Figure 2.1.5 in ACI 305R-91.

Concrete may be placed at other environmental condition ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F shall not be placed in the structure.
4. Air contents outside the limits specified in the mix designs.
5. Slumps outside the limits specified.
6. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

D. Concrete Batch Trip Tickets: Concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

3.4 MASONRY

A. Quality Assurance:

1. Concrete Masonry Unit: For each type of concrete masonry unit indicated, verify compliance with ASTM C 90 and the strength required by design. Verification may be by reviewing certification from unit producer showing compliance.
2. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

B. Field Testing:

1. Masonry Strength Testing:

a. Verification Testing Frequency: Verification of masonry strength (f'm) will be performed at the beginning of masonry construction and during construction for each 5,000 square feet of wall area or portion thereof.
b. Mortar:

1) Throughout construction, verify the proportions of the site-prepared mortar mix comply with the requirements of ASTM C 270 for the type specified.

2) Verify the proportions of materials in premixed or preblended mortar comply with the requirements of ASTM C 270 for the type specified as delivered to the site.

c. Grout:
1) Prior to grouting, verify the proportions of site-prepared grout mix comply with the requirements of ASTM C 476 for each type of grout used.
2) Verify the proportions of materials in premixed or preblended grout comply with the requirements of ASTM C 476 as delivered to the site.
3) For grout pre-mixed at a batch plant or otherwise not prepared on site, grout shall be sampled and tested in accordance with ASTM C 1019. Prepare one set of grout samples for testing at seven days and two sets for testing at 28 days.

d. For each type of wall construction indicated for testing, test representative masonry prisms by methods of sampling and testing of ASTM C 1314, and as follows:
1) Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.
2) For concrete masonry prisms adhere to requirements as specified under preconstruction testing. Build prisms on job using same materials and methods as for wall construction. Store prisms in air at temperature not less than 65°F in a facility supplied by the contractor where they will be undisturbed for seven (7) days. After seven (7) days, transport to laboratory in a manner which will not disturb mortar bond.
3) Cap each prism with suitable material to provide bearing surfaces on each end.

a) Plane within 0.003 inch.
b) Approximately perpendicular to the axis of the prism.

4) The preparation of prisms shall be observed by the testing agency that will test the prisms.

e. Report test results in writing and in form specified under each test method, to Architect and Contractor, on same day tests are made.
f. Retests: Where prism tests indicate non-compliance with specified requirements, additional testing shall be performed at the frequency of two additional tests for each unsatisfactory test. The cost of such additional testing shall be the responsibility of the Contractor. Where retesting fails to indicate conformance with specified requirements, any masonry construction represented by unsatisfactory tests shall be removed and replaced with acceptable masonry construction.

2. Testing of Non-Shrink Grout for Base Plates and Bearing Plates:

a. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
b. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

C. Field Inspection:
1. Anchors:

a. Verify maximum anchor tightening torque for all post-installed anchors.
b. Provide pull tests on individual anchors as specified on the drawings or as directed by the Engineer-of-Record.

2. Welding of Reinforcing Bars: Observe the welding of reinforcing bars.

3.5 STRUCTURAL STEEL

A. Scope of Work:

1. Contract Obligations:

a. Owner Responsibility: The Owner shall pay for initial shop and field inspections and tests as required during the fabrication and erection of the structural steel.
b. Testing Laboratory Responsibility: The inspection by the Testing Laboratory of the Fabricator's work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years of experience in structural steel testing and inspection. Refer to Paragraph 1.8A.4 for special requirements for welding inspectors. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. Weld inspection reports shall be signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI). In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.
c. Rejection of Material or Workmanship: The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Quality Assurance:

1. Verify the fabrication shop's certification from AISC.
2. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

C. Source Testing: The Testing Laboratory shall provide the following tests at the designated fabrication shops:

1. Test welds completed in the shop according to Paragraph H "Weld Testing" below.
2. Test bolted connections completed in the shop according to Paragraph I "High-Strength Bolt Testing."

D. Source Inspection: The Testing Laboratory shall provide the following inspections at the designated fabrication shops:

1. An initial shop inspection prior to the start of any fabricating work shall be made to accomplish the following:

a. Perform tasks outlined in Paragraphs G.1, G.2 and G.3 of welding inspection duties described below in Paragraph G “Weld Inspection and Process Monitoring” when shop welding is to be performed.
b. Perform tasks outlined in paragraph **Error! Reference source not found.** of bolt inspection duties described below in Paragraph **Error! Reference source not found.** “High-Strength Bolt Inspection and Process Monitoring” when shop bolting involves joints that are designated on the plans as Pretensioned or Slip-Critical.

2. Process Monitoring:

a. Provide continuous or periodic monitoring of welding as described below in Paragraph G “Weld Inspection and Process Monitoring.”
b. Provide continuous or periodic monitoring of bolting as described below in Paragraph **Error! Reference source not found.** “High-Strength Bolt Inspection and Process Monitoring” of high-strength bolt installation in pre-tensioned or slip-critical joints using turn-of-the-nut without matchmarking or calibrated wrench method of bolt installation.
c. Provide periodic verification of specified camber of steel beams.

E. Field Testing: The Testing Laboratory shall provide the following tests in the field:
1. Test welds completed in the field according to Paragraph H “Weld Testing:” below.
2. Test bolted connections completed in the field according to Paragraph I “High-Strength Bolt Testing.”
3. Testing of Non-Shrink Grout for Base Plates, Bearing Plates, and Precast Wall Panels:

a. Compressive Strength Tests: Compressive strength of grout shall be determined by testing grout cubes according to the requirements of ASTM C 109 - Modified. Test one set of three cubes at one day, and one set of three cubes at 28 days.
b. Frequency of Testing: One set of cubes (6 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

F. Field Inspection: The Testing Laboratory shall provide the following inspections in the field:
1. Inspect galvanized HSS and other cold-worked structural steel members for cracking or other damage resulting from galvanizing process. Endeavor to complete inspections prior to erection of these members. Immediately notify Contractor and Architect/Engineer of any irregularities discovered.
2. Provide continuous or periodic monitoring of field welding as described below in Paragraph G “Weld Inspection and Process Monitoring.”
3. Inspect welded or bolted connections that were completed, but not inspected, in the shop. Perform inspections according to Paragraph G “Weld Inspection and Process Monitoring” and/or Paragraph **Error! Reference source not found.** “High-Strength Bolt Inspection and Process Monitoring” as appropriate.
4. Obtain the planned erection procedure, and review with the Erector’s supervisory personnel.
5. Check the installation of base plates for proper leveling, grout type, and grout application.
6. Check structural steel as received in the field for possible shipping damage, workmanship, and identification marking to conform to AISC 360 for structural steel and specified ASTM standards for other steel.
7. Verify that surveys are occurring as specified to check plumbness and frame alignment as erection progresses. Review the submitted survey report.

8. Periodically inspect the steel frame for such items as bracing and stiffening details, member locations, and joint details at each connection for compliance with approved construction documents.
9. Inspect 100% of the column compression and base joints for verification that gaps in contact bearing do not exceed 1/16 inch. Gaps greater than 1/16 inch but less than 1/4 inch shall be reported to the Owner and Engineer for assessment. All gaps greater than 1/4 inch shall be shimmed according to Specification 051200 “Structural Steel Framing.”
10. Endeavor to guard the Owner against the Contractor cutting, grinding, reaming, or making any other field modification to structural steel without the prior approval of the Engineer. Report any noted unauthorized modifications to the Owner and Engineer.

G. Weld Inspection and Process Monitoring: The Testing Laboratory shall make the following inspections of the welds and welding processes. Welds performed in the fabricating shop may be inspected in the field unless continuous monitoring of the welding process is herein specified or if access in the field due to other work or shop finishes makes field inspection impractical:
1. Approve Welding Procedure Specifications submitted by the Contractor. Approve any changes submitted by the Contractor to any WPS that has already been approved. Obtain the Welding Procedure Qualification Record (WPQR) for each successful WPS qualification.
2. Periodically verify welding electrodes to be used and other welding consumables as the job progresses.
3. Periodically observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders with sufficient frequency to assure compliance with code and contract document requirements. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
4. Continuously observe joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.
5. Periodically provide visual inspection of the root pass of partial and complete joint penetration welds.
6. Visually inspect 100 % of welds for proper size, length, location, and weld quality in accordance with AWS D1.1 requirements. Unless specifically noted otherwise, all welding shall be considered statically loaded nontubular connections.
7. Visually inspect 100% of completed shear connectors on each beam.
8. Visually inspect 100% of the welds of anchors to embedded plates that are to be cast into concrete elements.
9. In addition to the inspections above, perform the following:
    a. Continuously monitor and observe joint preparation, assembly practice, welding techniques including preheating and sequence, and the performance of welders for 100% of complete and partial joint penetration welds, plug and slot welds, multiple-pass fillet welds, and single-pass fillet welds greater than 5/16 inch. Check preheating to assure conformance with AWS D1.1, Section 5.6. Verify procedure for control of distortion and shrinkage stresses.
    b. Periodically monitor welding of single-pass fillet welds that are less than or equal to 5/16 inch.
    c. Periodically monitor the welding of anchors to embedded plates that are to be cast into concrete elements.

H. Weld Testing:
1. Perform nondestructive examination services using a qualified technician with the necessary equipment to perform the following:

a. Nondestructive examination conducted in accordance with the specific requirements for the item being examined including radiographic (RT), ultrasonic (UT), magnetic particle (MT), or dye-penetrant inspection (PT). Nondestructive inspection procedures shall conform to AWS D1.1.
b. Interpret, record, and report results of the nondestructive tests.
c. Mark for repair, any area not meeting Specification requirements. Correction of rejected welds shall be made in accordance with AWS D1.1.
d. Re-examine repair areas and interpret, record, and report the results of examinations of repair welds.
e. Verify that quality of welds meet the requirements of AWS D1.1.

2. Fillet Welds: Provide the following:

a. MT test a minimum of 10% of the length of each fillet weld exceeding 5/16".
b. Periodic MT testing of representative fillet welds 5/16" and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

3. Partial Joint Penetration (PJP) Welds, including Flare-Bevel Groove Welds: Provide the following:

a. MT test a minimum of 25% of the length of each PJP weld exceeding 5/16" effective throat.
b. Periodic MT testing of representative PJP welds 5/16” and less but need not exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

4. Complete Joint Penetration (CJP) Welds: Provide the following:

a. All CJP welds exceeding 5/16" thickness shall be 100% UT tested per AWS D1.1 Clause 6 Part F. The Testing Laboratory shall review the CJP joints to determine where geometry or accessibility precludes the use of standard scanning patterns per AWS D1.1 Clause 6 Part F. At these locations the testing laboratory shall develop and submit for approval a written testing procedure in accordance with AWS D1.1 Annex S.
b. Periodic MT testing of representative CJP welds 5/16” and less not to exceed 10% of all such welds, except as required for high rejection rates as indicated in the following paragraph.
c. Increase MT testing rate for welders having a high rejection rate as required to ensure acceptable welds.

5. Acceptance Criteria:

a. Visual, MT, PT shall be per AWS D1.1 Table 6.1.
b. UT testing shall be per AWS D1.1 6.13.1 and Table 6.2.

6. Base metal thicker than 1.5 inches, where subjected to through-thickness weld shrinkage strains, shall be UT tested for discontinuities behind and adjacent to such welds. UT testing shall occur no sooner than 24 hours after the weld has cooled to ambient temperatures. Any material discontinuities shall be recorded on the basis of ASTM A 435 or ASTM A 898 (Level 1 criteria) and reported for Engineer disposition.
7. Welds of Anchors to Embedded Plates:

a. Headed Studs: Perform field bend tests according to AWS D1.1 on 2% of the studs welded to plates, but not less than one stud per plate.
b. Deformed Bar Anchors: Perform MT testing on 10% of deformed bar anchors larger than 5/8” diameter.

8. The costs of repairing defective welds and the costs of retesting by the Testing Laboratory providing services for the Owner shall be borne by the Contractor. If removal of a backing strip is required by the Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

3.6 STEEL JOISTS

A. Scope of Work: The Testing Laboratory shall perform inspection of steel joists as described herein.

B. Quality Assurance:
1. Verify that the fabricator maintains detailed quality control procedures that provide a basis for inspection control of workmanship and of the ability to conform to approved construction documents and industry standards. Verify that these procedures are complete and adequate relative to code requirements for fabricator’s scope of work.
2. Verify welding procedures, welder qualifications and weld material prior to the start of work.
3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

C. Source Testing:

D. Source Inspection:
1. Provide periodic inspection of the welding work in progress.
2. Visually inspect 100% of welds prior to shipment of shop welded assemblies.
3. Verify camber requirements.

E. Field Testing:
1. Perform Magnetic Particle testing (MT) on representative field welds not to exceed 10% of such welds unless rejection rates become high, in which case, frequency of inspection shall be increased to ensure acceptable welding.

F. Field Inspection: The duties of the Testing Laboratory shall be as follows:
1. Inspect joists for damage during shipment.
2. Visually inspect 100% of welded chord splices for compliance with SJI and project specifications.
3. Confirm bolting of joists to supports at column lines as required by OSHA requirements.

3.7 STEEL DECKING

A. Field Inspection:
1. Check steel deck as received in the field for possible shipping damage, workmanship, and identification marking to conform to specified ASTM standards for steel deck.
2. Periodically monitor the method of attaching the steel floor and roof decking to the structural frame.
3. Visually inspect 100% of the welding or other attachment method of steel deck to the structure and at sidelaps.

3.8 EARTHWORK

A. Quality Assurance:

1. Welder Qualifications: Verify welder qualifications either by certification and/or by retesting. Obtain welder certificates.

B. Field Testing:

1. Compacted Fill:

a. Verification of Fill Material: Perform classification and testing to verify that the fill material to be used complies with the project specifications.

b. Field Density Testing: Perform field density testing as described below:

1) Field density tests shall be run according to ASTM D 2937 or ASTM D 6938 as applicable.

2) Acceptance Criteria: The results of field density tests by the Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not less than the required density with no single test falling more than 2 percent below the required density and the moisture content conforms to the requirements of the specification.

3) Test Frequency for Paved Areas and Building Slab Subgrade:

a) Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests.

b) In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab or paved area but in no case less than three tests.

4) Test Frequency for Foundation Wall Backfill: Make at least one field density test for each 200 lineal feet of wall with a minimum of 4 tests for the basement walls around the perimeter of each building and a minimum of one test for every other type of foundation wall on the site. Tests shall be performed in random lifts along each wall.

5) Test Frequency for Compacted Fill beneath Column and Wall Footings and Mat Foundations: Make at least one field density test in each compacted fill layer or lift for each column footing, one for each twenty-five lineal feet of wall and one for each 2,500 square feet of mat foundation area or fraction thereof.

c. Report Copies: Moisture-density curves and results of field density tests shall be submitted to the parties specified earlier in this section.

d. Additional Testing: If reports by the Laboratory indicate field densities lower than specified, additional tests will be run by the Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be liable to the Owner for repayment by the Contractor.

2. Spread (Excavated) Footings

a. Concrete Cylinders: Make and test concrete cylinders as specified for Cast-in-Place Concrete.

C. Field Inspection by the Testing Laboratory:

1. The Testing Laboratory shall provide inspection of materials used in foundation elements as described below.

2. Compacted Fill:

a. Subgrade below Compacted Fill: Observe and verify that the subgrade below compacted fill has been properly prepared before compact fill construction begins.

b. During placement and compaction of fill, determine that the material being used and the maximum lift thickness comply with the specifications.

D. Foundation Inspection by the Geotechnical Engineer: The Geotechnical Engineer of Record shall provide inspection service for the following items before and during foundation installation as appropriate for the foundation type. The Geotechnical Engineer shall submit written field inspection reports promptly after inspection to the parties listed above and report his findings after each inspection by telephone or e-mail to the Engineer.

1. Spread (Excavated) Footing:

a. Subgrade: Verify that foundation bearing conditions are consistent with soil report tests and that the footing is being installed in the proper soil strata at the proper elevation. Make recommendations regarding adjustment to subgrade or bearing elevation if subgrade is not adequate to support footing.

END OF SECTION 01 45 29

SECTION 01 50 00 - 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/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 01 01 60. 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

A. 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 01500-3 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 www.ppd.ufl.edu/currentrates.htm.
2. For use of University-owned utilities, the Builder shall establish a work order with billing account information, with 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 and installed by PPD Utility Services, which shall also energize service. 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 (UFIT) or the local utility for temporary phone, fax lines, and/or Internet service lines.

E. SANITARY FACILITIES

1. Provide temporary sanitary facilities, if required, for use by all personnel.

2. The Builder shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees 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 or vendors.

2.2 PERMANENT (BUILDING) UTILITIES

1. Once permanent power, chilled water, and other permanent metered utilities are established, the cost of such utilities shall be borne by the Builder as a cost of the Work.

2. Utility services will not be provided until new meters are installed and certified to be operating properly by PPD Utility Services.

2.3 FIELD OFFICES AND SHEDS

A. TRAILERS – Office and Storage

1. Provide stairs and railings as required by OSHA.

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. The University of Florida Police Department (UFPD) requires the following anti-harassment notification be posted on each leg of the construction fence:
“In case of harassment from anyone at this construction site, telephone 392-1111 to notify the University of Florida Police Department.”

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

A. 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 01 50 00

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SECTION 01 50 50 - 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/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. Comply with the sustainability requirements in Specification Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

C. See the Physical Plant Division Solid Waste Management website at www.ppd.ufl.edu/grounds-refuse.html.

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. Evaluation, on-site storage, transportation, disposal and other aspects of Hazardous Waste Management shall comply with applicable Federal, State, and local laws.

C. Refer to the General Terms & Conditions for requirements related to the discovery of environmental contamination, including, but not limited to, Hazardous Substances.

1.3 CONSTRUCTION WASTE MANAGEMENT

A. In support of Florida Statute 403.7032 and the University’s Zero-Waste Goal, the University of Florida requires that its builders maximize the diversion of construction and demolition (C&D) material from landfills. Faculty and students from the UF School of Building Construction and the College of Design, Construction, and Planning may interact with the Builder to facilitate, coordinate, and document such efforts and/or to conduct research.

B. Beyond the provisions for such work in either the basic scope of work or bid alternates, the builder shall salvage materials for reuse, resale, or recycling to the maximum extent possible. Typical designated waste streams include land clearing debris, concrete and masonry, metals and appliances, dimensional wood & lumber, wooden pallets, gypsum wallboard (unpainted), paper and cardboard, packaging, and asphalt roofing shingles. Depending on the project, other large volume wastes may be included (e.g., bricks, asphalt, carpeting and pad, plastic, glass, beverage containers).

C. For projects seeking a 3rd -party sustainable building certification, Florida Green Building Coalition, the Builder shall establish and adhere to program-specific waste diversion and recycling goals.

D. Prior to mobilization, the Builder shall submit a project-specific Solid Waste Management Plan to the University Project Manager for review by the University Solid Waste Coordinator and Sustainable Building Coordinator. This plan shall include the following elements:

1. An explanation of how C&D waste will be recycled or reused – by source separation, time-based separation, or commingled for delivery to an offsite separation facility.

2. A list of materials targeted for recycling and reuse, their estimated quantities, and the predicted end use of the recycled materials, along with a separate list of recyclable or otherwise recoverable materials that must be landfilled.
3. The overall diversion goal (percentage of waste to be diverted from landfilling or incineration).
4. The facilities to be used, both landfills and recycling facilities, indicating which of the targeted wastes are to be received, projected quantities, facility addresses and phone numbers, and documentation of the facilities' permit status.

E. Builder shall designate an onsite representative to distribute and implement the approved plan, instruct workers, and provide instruction and supervision on separation, handling, and recovery methods. The onsite representative shall also ensure proper labeling of waste collection receptacles and otherwise monitor compliance with the project-specific Solid Waste Management Plan.

F. Reporting

1. Submit monthly progress reports using Owner's form (see sample Waste Reporting Log at the end of this specification) to quantify the total amount of collected waste and the percentage recycled.
2. Maintain accurate records of the final destination of all waste, including manifests, weight tickets, and receipts. Manifests shall be from recycling and disposal site operators who can legally accept the materials for the purpose of reuse, recycling, or disposal. Submit all such records at the end of construction or upon request.

END OF SECTION 01 50 50

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:

1. State of Florida Rule 9B-72 for approval of products and systems, which comprise the building envelope and structural frame:
2. Section 01 42 00 "References" for applicable industry standards for products specified.
3. Section 01 70 00 "Closeout Procedures" for submitting warranties for contract closeout.
4. Divisions 2 through 26 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporation into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design" or "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
    1. Each trade contractor is responsible for providing products and construction methods compatible with products and construction methods of other trade contractors.
    2. If a dispute arises between trade contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Florida Product Approval: Products used on the exterior of the building shall comply with the Product Approval requirements of the Florida Building Code.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
    1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
    2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
    3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
    4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
    1. Store materials in a manner that will not endanger Project structure.
    2. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
    3. Store cementitious products and materials on elevated platforms.
    4. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product. Only the Architect shall make the determination weather or not the unnamed product is equal to the specified product.
    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:
1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Sole product may be indicated by the phrase: "Subject to compliance with requirements, provide the following: …"
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Sole manufacturer/source may be indicated by the phrase: "Subject to compliance with requirements, provide products by the following: …"

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    a. Limited list of products may be indicated by the phrase: "Subject to compliance with requirements, provide one of the following: …"
4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
    1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
    2. Evidence that proposed product provides specified warranty.
    3. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
    4. Samples, if requested.
B. Submittal Requirements: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 70 00 - PROJECT CLOSEOUT

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/Construction Manager 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

A. Prior to occupancy of a new building, the Division of Environmental Health & Safety (EH&S) shall issue a Certificate of Occupancy. The certificate of occupancy 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. The State Fire Marshal and other University entities must inspect and certify the building is substantially complete prior to occupancy of the structure.

1.3 SUBSTANTIAL COMPLETION

A. 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 Facilities Planning & Construction website (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

A. 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

A. 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, as outlined in the technical specifications, shall be completed prior to Substantial Completion, at which point the Owner assumes the responsibility for operation and maintenance.

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

A. Coordination of the physical storage location of “attic stock” items shall be made with the building operation & maintenance 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

A. 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 Final Completion, including a Table of Contents for each discreet manual. Provide these to UF and the A/E on CD-ROM or through a file-sharing platform (e.g., Sharepoint), assembled and organized in electronic folders as follows:

01 00 00 – General Requirements *(with subfolders for pre-concealment photos and other general information such as a complete list of subcontractors with contact information, a list/inventory of attic stock, and a final list/inventory of all colors & finishes)*

03 00 00 – Concrete

04 00 00 – Masonry

05 00 00 – Metals

06 00 00 – Wood and Plastics

07 00 00 – Thermal and Moisture Protection (including roofing)

08 00 00 – Doors and Windows

09 00 00 – Finishes

10 00 00 – Specialties (e.g., lockers, window treatment, acoustic wall panels, operable partitions, toilet accessories, fire extinguisher cabinets, mobile storage systems, etc.)

11 00 00 – Equipment

12 00 00 – Furnishings (e.g., fixed tables/seating, lab casework, marker boards, foot grilles, etc.)

21 00 00 – Fire Protection

22 00 00 – Plumbing

23 00 00 – HVAC

25 00 00 – Building Automation System and Controls

26 00 00 – Electrical

27 00 00 – Communications
28 00 00 – Electronic Safety & Security
31 00 00 – Earthwork
32 00 00 – Exterior Improvements
33 00 00 – Utilities

B. Other than 01 00 00, 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
      {NOTE: IOM = Installation Operations & Maintenance}
   2. Shop Drawings
   3. Training (*including training agendas, sign-in sheets, and videos*)
   4. Warranty Documents
   5. Other *(e.g., test reports, underground utility videos, Master UL labels, meter data sheets, 3rd party certifications or inspections)*

1.11 PROJECT-SPECIFIC CLOSEOUT REQUIREMENTS:

A. See Section 01 78 10 - Project Record Documents

END OF SECTION 01 70 00

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SECTION 01 73 00 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Installation of the Work.
   2. Progress cleaning.
   3. Protection of installed construction.

B. Related Sections:
   1. Section 01 01 40 “Builder's Use of the Premises" for limits on use of Project site.
   2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
   3. Section 01 70 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

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

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 QUALITY ASSURANCE

A. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.
   1. Utilize products on the building exterior that have Florida Product Approval.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    a. Description of the Work.
    b. List of detrimental conditions, including substrates.
    c. List of unacceptable installation tolerances.
    d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine walls and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to.

C. Surface and Substrate Preparation: Comply with manufacturer's recommendations for preparation of substrates to receive subsequent work.

3.3 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

1. Do NOT use asbestos containing materials.

3.4 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
   a. Utilize containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01505 "Construction Waste Management."

F. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

G. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

H. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

3.6 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 01 77 00 "Project Closeout" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Initial Submittal:
         1) Submit PDF electronic files of scanned record prints and one of file prints.
         2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
      b. Final Submittal:
         1) Submit PDF electronic files of scanned record prints.
         2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.

c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
4. Refer instances of uncertainty to Architect for resolution.
5. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.
   a. See Section 01 31 00 "Project Management and Coordination" for requirements related to use of Architect's digital data files.
   b. Architect will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Format: Annotated PDF electronic file with comment function enabled.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect and Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, record Specifications, and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 78 39

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SECTION 01 81 13 - SUSTAINABLE DESIGN REQUIREMENTS – FGBC Version 3

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements and procedures for compliance with Florida Green Building Coalition (FGBC) prerequisites and credits needed for Project to obtain FGBC **Gold** certification based on FGBC's "Florida Green Commercial Building Standard, Version 3."

1. Other FGBC prerequisites and credits needed to obtain FGBC certification depend on product selections that may not be specifically identified as FGBC requirements. Compliance with requirements needed to obtain FGBC prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
2. A copy of FGBC Project checklist is attached at end of this Section for information only.
    a. Some FGBC prerequisites and credits needed to obtain indicated FGBC certification depend on Architect's design and other aspects of Project that are not part of the Work of the Contract.

1.3 DEFINITIONS

A. Chain-of-Custody Certificates: Certificates signed by manufacturers certifying that wood used to make products was obtained from forests certified by Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI) or Community Supported Agriculture (CSA).

B. FGBC: Florida Green Building Coalition. A Florida non-profit corporation with open membership whose primary mission is to develop and maintain Green Designation Standards for Florida and to promote cost-effective, sustainable improvements in the built environment.

1. Florida Green Commercial Building Standard, Version 3." Definitions that are part of this document apply to this Section.

C. Green Commercial Building - A commercial building that incorporates multiple environmental, ecological and sustainability features that reduce the environmental degradation throughout its life cycle considerably more than a commercial building that just minimally meets state and local regulations.

D. Rapidly Renewable: Agriculturally sourced building materials with a 10-year or shorter growth cycle. If only a fraction of a product or material is comprised of rapidly renewable components, then only that percentage (by weight) shall contribute to the rapidly renewable value.

E. Local Manufacturing: Building materials and products that are manufactured within a 700 mile radius of the project site. Manufacturing refers to the final assembly of components, that may come from other location regardless of the distance from the project site, into a building product that is installed in the building.

F. Local Raw Materials Extraction: Materials that have been extracted, harvested, or recovered, within 700 miles of Project site.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at **Project site**. Review FGBC requirements and action plans for compliance with requirements.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Respond to questions and requests from Architect about FGBC's prerequisites and credits that are Contractor's responsibility, that depend on product selection or product qualities, or that depend on Contractor's procedures, until USGBC has made its determination on Project's FGBC certification application.

1.6 ACTION SUBMITTALS

A. General: Submit sustainable design submittals required by other Sections.

B. Sustainable design submittals are in addition to other submittals.

1. If submitted item is identical to that proposed to comply with other requirements, include additional copy with other submittal as record of compliance with indicated FGBC requirements instead of separate sustainable design submittal. Mark additional copy "Sustainable Design Submittal."

C. Qualification Data: For FGBC coordinator.

D. Project Materials Cost Data: Provide statement indicating total cost for materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:

1. Plumbing.
2. Mechanical.
3. Electrical.
4. Specialty items such as elevators and equipment.
5. Wood-based construction materials.

E. Sustainable Design Action Plans: Provide preliminary submittals within **30** days of date established for **the Notice to Proceed** indicating how the following requirements will be met:

1. Prerequisite S1: Storm water pollution prevention plan (SWPPP)
2. Credit S3.02: Minimize Site Disturbance
3. Prerequisite H02: Indoor Air Quality Management Plan, During Construction
4. Credit H1.07: Radon Mitigation
5. Credit H1.08: Pre Occupancy IAQ Testing
6. Credit H2.01; Adhesives & Sealants
7. Credit H2.02: Paints & Coatings
8. Credit H2.03; Carpet Systems
9. Credit H2.04: Healthy Floors
10. Credit H2.05: Composite Wood and Agrifiber
11. Credit H2.06: Insulation
12. Credit M1.02: Recycled Content
13. Credit M1.04: Certified Wood
14. Credit M2.01: Construction Waste Recycling
15. Credit M2.03: Recyclable Materials
16. Credit M3.01: Local Manufacturing-
17. Credit M3.02: Local Raw Material Extraction
18. Credit DM2.01: Termite Prevention
19. Credit DM2.02: Physical Termite Barrier

F. Sustainable Design Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with sustainable design action plans.

PART 2 - CREDIT CATEGORIES

2.1 CATEGORY 4: SITE

A. Prerequisite S1: Storm water pollution prevention plan (SWPPP).

1. Requirement: Keep copy of SWPPP & FDEP National Pollutant Discharge Elimination System (NPDES) Notice of Intent (NOI) onsite for Contractor to implement and maintain SWPPP Best Management Practices (BMP) as designed by Civil Engineer or SWPPP designer. For projects less than 1 acre, implement SWPPP on site as designed by the project Civil Engineer.

B. CREDIT S01: FDEP PROFESSIONAL

1. Requirement: The General Contractor has on staff or contracts with a FDEP Certified Erosion and Sedimentation Control Professional (Tier 2).

2.2 CATEGORY 5: HEALTH

A. Prerequisite H1: Environmental Tobacco Smoke (ETS) Control

1. Requirement: No smoking allowed **on the site or** in the building.

B. Prerequisite H2: Indoor Air Quality Management Plan, During Construction

1. Requirement: Indoor Environmental Quality shall be protected during construction according to SMACNA guidelines.
   a. Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building as follows:
   b. During construction meet or exceed the minimum requirements recommended in Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995.
   c. Protect stored on-site or installed absorptive materials from moisture damage.
   d. Replace all filtration media immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13, as determined by ASHRAE 52.2-1999 for media installed at the end of construction, and a MERV of 8, for media used to protect HVAC at each return air grill during construction.

C. Credit H1.07: Radon Mitigation

1. Requirement: Install a passive or active system as needed for your building location to mitigate for radon.

D. Credit H1.08: Pre Occupancy IAQ Testing

1. Requirement: Perform IAQ testing over a minimum 4-hour period for a minimum of at least one (1) test per 25,000 s.f. within the breathing zone, which is between 3’0” and 6’0” above the finished floor. Test and remediate building prior to occupancy using procedure consistent with the United States Environmental Protection Agency’s current Protocol for Environmental Requirements, Baseline IAQ and Materials, for the Research Triangle Park Campus, Section 01445.
2. Test for the following contaminants and maximum concentration:

	Contaminant	Maximum Concentration
a.	Formaldehyde	50 parts per billion
b.	Particulates (PM10)	50 micrograms per cubic meter
c.	Total Volatile Organic Compounds (TVOC)	500 micrograms per cubic meter
d.	*4-Phenylcyclohexene (4-PCH)	6.5 micrograms per cubic meter
e.	Carbon Monoxide(CO)	9 part per million and no greater than 2 parts per million above outdoor levels.

*This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

E. Credit H2.01: Adhesives & Sealants

1. Requirement: Adhesives and Sealants shall be low Volatile Organic Compound (VOC) and meet the VOC limits below which were established by the South Coast Air Quality Management District (SCAQMD) Rule 1168 AND all sealants used as fillers must meet or exceed the requirements of the Bay Area Air Quality Management District Regulation 8, Rule 51.

2. VOCLimit,LessWaterandLessExemptCompoundsinGramsperLiter

	Architectural Applications	VOC Limit
a.	IndoorCarpetAdhesives	50
b.	Carpet Pad Adhesives	50
c.	Outdoor Carpet Adhesives	150
d.	Wood Flooring Adhesive	100
e.	Rubber Floor Adhesives	60
f.	Subfloor Adhesives	50
g.	Ceramic Tile Adhesives	65
h.	VCT and Asphalt Tile Adhesives	50
i.	Dry Wall and Panel Adhesives	50
j.	Cove Base Adhesives	50
k.	Multipurpose Construction Adhesives	70
l.	Structural Glazing Adhesives	100
m.	Single Ply Roof Membrane Adhesives	250

F. Credit H2.02: Paints and Coatings

1. Requirement: VOC shall be less than or equal to the values listed below:

a. InteriorCoatings Gram / LiterNon-Flat 150

2) Flat 50

b. Exterior Coatings Gram / Liter

1) Non-Flat 200

2) Flat 100

G. Credit H2.03: Carpet Systems

1. Requirement: Carpet and carpet products shall meet the Carpet and Rug Institute's Green Label Plus Program certification.

H. Credit H2.04: Healthy Floors

1. Requirement: 80% of a minimum of the flooring installed shall be classified as hard or resilient and comply with GreenGuard or similar health related certification.

I. Credit H2.05: Composite Wood and Agrifiber

1. Requirement: Composite wood and agrifiber products shall not contain urea-formaldehyde resin.

J. Credit H2.06: Insulation

1. Requirement: Insulation products shall be free of formaldehyde.

2.3 CATEGORY 6: MATERIALS

A. Credit M1.02: Recycled Content

1. Requirement: Incorporate recycled materials (based on materials cost). Use materials with recycled content such that post-consumer and/or post-industrial recycled content constitutes a minimum of **20%** of the total project cost. The value of the recycled content portion of a material or furnishing shall be determined by dividing the weight of recycled content in the item by the total weight of all material in the item, then multiplying the resulting percentage by the total value of the item.
   a. Mechanical and electrical components shall not be included in this calculation.
   b. Recycled content materials shall be defined in accordance with the Federal Trade Commission document, Guide for the Use of Environmental Marketing Claims, 15 CFR 260.7 (e), available at www.ftc.gov/bcp/grnrule/guides980427.htm.

B. Credit M1.03: Rapidly Renewable Materials

1. Requirement: Incorporate rapidly renewable (plant to harvest cycle less than 10 years) **for 3% [5%} [7%]** of the total value of all building materials and products used in the project. Materials such as bamboo flooring, wool carpets, straw board, cotton batt insulation, linoleum flooring, poplar OSB, and sunflower seed board and wheatgrass cabinetry qualify for this credit.

C. Credit M1.04: Certified Wood

1. Requirement: Wood products are FSC, SFI or CSA certified. Use a minimum of **40% [60%] [80%]** certified of wood-based materials and products, for wood building components including, but not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

D. Credit M1.05: Biobased Materials

1. Requirement: Use a minimum of 5%, based on cost, bio based materials such as solid wood, engineered wood, bamboo, wool, cotton, cork, agricultural fibers, or other bio based materials with at least 50% bio based content.

E. Credit M2.01: Construction Waste Recycling

1. Requirement: Develop and implement a waste management plan, quantifying material diversion goals. Recycle and/or salvage a minimum of **75% [90%]** of construction, demolition and land clearing waste. Calculations can be done by weight or volume but must be consistent throughout.

F. Credit M2.05: Durable Materials, Exterior Finish Materials

1. Requirement: Use finishes systems and materials capable of withstanding the moisture and heat impacts of the local climate for a period of 30 years on 100% of the exposed exterior surfaces. Exterior surface products must have a minimum of a 30 year warranty.

G. Credit M3.01: Local Manufacturing

1. Requirement: Use a minimum of **15% [20%] [25%]** (by cost) based on project cost (div 2-10) of building materials and products that are manufactured (final assembly of components into the building product) within a 700 mile radius of the project site.

H. Credit M3.02: Local Raw Material Extraction

1. Requirement: A minimum of **15% [20%]** of the project materials are made from raw materials that are harvested, extracted, or recovered within a 700-mile radius from project site.

I. Credit M3.03: Resource Reuse

1. Requirement: Use salvaged, refurbished, or reused materials, products, and furnishings for at least **10%** of building materials (based on cost).

2.4 CATEGORY 7: DISASTER MITIGATION

A. Credit DM2.01: Termite Prevention

1. Requirement: The building uses an alternative to traditional soil poison for termite treatment. Systems may include the use of borate or Alkaline Copper Quaternary (ACQ) treated lumber or termite bait systems. To achieve this credit any and all plants, turf and irrigation lines must be a minimum of 3 feet from the foundation. Additionally, any foam insulation must terminate above ground. The exterior cladding of the building must also terminate a least 8 inches above grade. Rainwater from the roof must also be dispersed a minimum of 3feet from the building foundation (by the use of downspouts or scuppers and extensions or splashblocks). All AC condensate lines must also discharge a minimum of 3 feet from the building.

B. Credit DM2.02: Physical Termite Barrier

1. Requirement: Physical barriers must be used in addition to or in lieu or traditional termite treatments. Physical barriers include stainless steel mesh, elastomeric plumbing boots, or other means of physically sealing the slab penetrations.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 81 13

SECTION 03 10 00 – CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes formwork, shoring, reshoring, backshoring, falsework, bracing, and other temporary supports required to form and support all cast-in-place concrete shown on the drawings.

B. Related Requirements:

1. Specification 014529 “Structural Testing and Inspections” for inspection requirements associated with forming and accessories.
2. Specification 032000 “Concrete Reinforcing” for reinforcement associated with cast-in-place concrete.
3. Specification 033000 “Cast-in-Place Concrete” for cast-in-place concrete and related products.

1.2 REFERENCES

A. Definitions:

1. Formwork: The total system of support for freshly placed concrete, including the mold or sheathing that contacts the concrete and all supporting members, hardware, and necessary bracing.
2. Professional Engineer: A professional engineer who is licensed to practice engineering in the state where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with concrete formwork that are similar to that indicated for this Project in material.

B. Reference Standards:

1. Comply with the provision of the following codes, specifications, and standards except where more stringent requirements are shown or specified:
   a. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
   b. ACI 301, "Specifications for Structural Concrete for Buildings."
   c. ACI 318, "Building Code Requirements for Structural Concrete."
   d. ACI 347, “Guide to Formwork for Concrete.”
   e. CRSI, "Manual of Standard Practice."

1.3 RESPONSIBILITY

A. The design, construction, and safety of all formwork shall be the responsibility of the Contractor. All forms, shores, reshores, backshores, falsework, bracing, and other temporary supports shall be engineered to support all loads imposed including the wet weight of concrete, construction equipment, live loads, lateral loads due to wind and wet concrete imbalance. The Contractor shall also be responsible for determining when temporary supports, shores, reshores, backshores, and other bracing may be safely removed.

1.4 SUBMITTALS

A. Product Data: Submit technical data and brochures for carton forms.

B. Shop Drawings:

1. Formwork Drawings: Formwork drawings, prepared under the supervision and sealed by the formwork design engineer, shall be submitted for Owner’s record and shall be

reviewed by the Engineer for conformance to structural layout only. Such shop drawings shall indicate all dimensions and types of materials, sizes, lengths, connection details, design allowance for construction loads, anchors, form ties, shores, braces, construction joints, reveals, camber, openings, formwork coatings, and all other pertinent information.

C. Temporary Structure Design Submittals: Submit the following items for the Owner's records:

1. Design Calculations: Submit, for record purposes, calculations of all concrete formwork sealed by the formwork design engineer.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Licensed Professionals: The formwork design engineer retained by the Contractor shall be a professional engineer registered in the state where the project is located and shall be experienced in the design of concrete formwork.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Unless otherwise specified, formwork for exposed concrete surfaces as defined by the Surface Finish Class noted on the drawings, shall consist of plywood, metal, metal framed plywood, or other acceptable surface. Formwork shall provide a continuous straight and smooth surface conforming to the joint system as specified on the Architect's drawings. Form material shall have sufficient thickness to withstand pressure of concrete without bow or deflection. Plywood shall be exterior grade plywood panels, suitable for concrete forms, complying with U.S. Product Standard PS-1, each piece bearing a legible inspection trademark, and as follows:

1. Phenolic Surface Film Overlay over Hardwood Face, Class 1 or better.
2. High Density Overlay (100/30 min. rating) on Hardwood Face, Class 1or better.
3. High Density Overlay (100/30 min. rating) on Softwood Face, Class 1 or better.
4. Medium Density Overlay on Hardwood Face, Class 1 or better, mill-release agent treated and edge sealed.
5. Medium Density Overlay on Softwood Face, Class 1 or better, mill-release agent treated and edge sealed.
6. Structural 1, B-B, or better, mill oiled and edged sealed.
7. "B-B (Concrete Form) Plywood", Class 1, or better, mill-oiled and edge sealed.

B. Non-specific formed concrete: Unless otherwise specified, the default finish for formed surfaces shall be rough-form finish constructed with plywood, lumber, metal, or other acceptable material. Lumber shall be dressed on at least two edges and one side for tight fit. The minimum grade shall be B-C, exterior grade.

C. Textured-form finished concrete: For exposed surfaces as noted on the drawings provide units of form face design, size, arrangement and configuration that matches Architect's control sample. Provide solid backing and form supports to ensure stability of textured form liners. See Architect's drawings, specifications and control sample for special form textured finish concrete.

2.2 FORMWORK COATINGS

A. Formwork coatings shall be of a commercial formulation that will not bond with, stain, nor adversely affect concrete surfaces or impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede curing with water or curing compounds. Provide a product that has a maximum VOC (Volatile Organic Compounds) of 50 g/l but not greater than

that permitted by the local government agency having jurisdiction in the area where the project is located.

B. Products: Subject to compliance with requirements, provide one of the following:
   1. Dayton Superior; Bio-Release EF.
   2. Unitex; Farm Fresh.
   3. Universal Form Clamp; Bio-Form.
   4. US Spec; Aqua Blue.

2.3 NAILS AND FASTENERS

A. Use only galvanized nails and fasteners for securing formwork in structures exposed to weather or unconditioned spaces such as garages, canopies, and porte-cocheres.

2.4 FORM TIES

A. Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to minimize spalling of concrete on removal.
   1. Exposed Surfaces: For surfaces designated with Surface Finish Class SF-2.x or SF-3.x, furnish units that will leave no portion of the tie closer than 3/4 inch to the plane of the concrete surface and that will leave holes not larger than one inch in diameter in concrete surface when the ends or end-fasteners have been removed.
   2. Dampproofed Surfaces: Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
   3. Exposed to Weather or Unconditioned Space: Provide removable, glass-fiber-reinforced plastic, stainless steel, or galvanized form ties that will leave no corrodible metal closer than 1 1/2 inches in surfaces that will be exposed to weather or in an unconditioned space in the final structure. The ties shall leave holes no larger than one inch in diameter in concrete surfaces when the ends or end-fasteners are removed.

2.5 CHAMFER STRIPS

A. Provide wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

PART 3 - EXECUTION

3.1 FABRICATION AND CONSTRUCTION

A. Design, erect, support, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic construction loads that might be applied until the concrete structure can support such loads.
   1. The formwork design engineer shall design the concrete formwork, formwork removal, shoring, reshoring, and backshoring.

B. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of concrete mortar.

C. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood

inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

D. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and patch forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as indicated, using specified chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

3.2 CLEANING AND TIGHTENING

A. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and all other debris just prior to concrete placement. Retighten forms and bracing prior to concrete placement as required to prevent concrete mortar leaks and maintain proper alignment.

3.3 CLEANING AND RE-USE OF FORMS

A. Forms reused in the work shall be repaired and cleaned. Split, frayed, delaminated, or otherwise damaged facing material will not be acceptable for exposed surfaces. Forms intended for successive concrete placement shall have surfaces cleaned, fins and laitance removed, and joints tightened to avoid surface offsets. New form coating compound shall be applied to reused forms. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.4 TOLERANCES

A. Unless specified otherwise, all tolerances for concrete formwork shall conform to ACI Standard 117, "Standard Tolerances for Concrete Construction and Materials". Before concrete placement the Contractor shall check lines and levels of erected formwork and make any corrections and adjustments as required to ensure proper size and location of concrete members and stability of forming systems. During concrete placement the Contractor shall check formwork and supports to ensure that forms have not displaced and that completed work will be within specified tolerances.

B. Construct forms so as to limit the offset between adjacent pieces of formwork facing material in accordance with the surface tolerance class as defined in ACI 117 corresponding to the Surface Finish Class noted on the drawings. The offset limits shall apply to both abrupt and gradual variations in the surface.

C. Prior to each concrete pour, the Contractor shall engage a qualified surveyor to verify that work is within specified tolerances. The surveyor shall report in writing to the Architect, Engineer and Contractor certifying that the work is acceptable or indicating any deviations from allowable tolerances.

D. The Owner shall hire an independent qualified surveyor to verify the proper form, line, position, and elevation of the finished concrete work. The results of each survey shall be sent to the Owner, Architect/Engineer, and Contractor and shall identify any deviation from specified tolerances. All work not in conformance with specified tolerances shall be removed at the Contractor's sole expense if so specified by the Owner.

3.5 SHORES AND SUPPORTS

A. Comply with requirements of ACI 301 for shoring, reshoring and backshoring in concrete construction and as herein specified where more stringent.

B. Design: Shores and reshores or backshores must be designed to carry all loads transmitted to them. A rational analysis should be used to determine the number of floors to be shored, reshored, or backshored, subject to the minimums stated in the following paragraph, and to determine the loads transmitted to the floors, shores and reshores or backshores as a result of the construction sequence. The analysis should consider, but should not necessarily be limited to, the following:

1. Structural design load of the slab or member including live load, partition loads, and other loads for which the engineer designed the slab. The live load reduction method for the design of certain members is shown on the structural drawings. The reduced live load and an allowance for construction loads shall be taken into consideration when performing the analysis.
2. Dead load weight of the concrete and formwork.
3. Construction live loads, such as placing crews and equipment or stored materials.
4. Design strength of concrete specified.
5. Cycle time between placement of successive floors.
6. Strength of concrete at time it is required to support shoring loads from above.
7. Minimum age of concrete where appropriate.
8. Alignment of shores: Where possible, shores for any floor shall be placed directly above previously placed shores so that load will be transferred directly to such shores. Where shores are not vertically aligned, calculations shall include verification that the structure can support the reaction.

3.6 REMOVAL OF FORMS AND SUPPORTS

A. Determination by Contractor's Registered Engineer: The Contractor's registered professional engineer shall determine and submit for Owner's record the time and sequence of formwork and shore removal subject to the criteria as specified below. The submittal shall clearly distinguish between reshoring and backshoring procedures.

B. Determining in situ Strength of Concrete: The General Contractor shall be responsible for making and curing concrete cylinders, cured under field conditions, for the purpose of determining concrete strength at time of form and shore removal. Such cylinders shall be made by the Contractor and tested by his testing laboratory. Alternatively, the in situ strength of concrete may be determined by the Maturity Method following the requirements of ASTM C 1074. An acceptable system for this method is the “intelliRock” system manufactured and supplied by Engius Constructive Intelligence of Stillwater, OK.

C. Records of Weather Conditions: The Contractor shall be responsible for keeping records of weather conditions to be used in the decision on when to remove forms.

D. Formwork Not Supporting Concrete: Formwork not supporting concrete, such as sides of beams, walls, columns and similar parts of the structure, may be removed after cumulatively (not necessarily consecutively) curing at not less than 50°F for 12 hours after placing concrete, provided the concrete is sufficiently hard so as not to be damaged by form removal operations and provided curing and protection operations are maintained. If ambient air temperatures

remain below 50°F, if retarding agents are used, or if Type II and Type V Portland cement is used, then this specified minimum period shall be increased as required to safely remove the forms without damage to the concrete. Where such forms also support formwork for slab or beam soffits, the removal times of the latter shall govern.

E. Formwork Supporting Weight of Concrete: Formwork supporting weight of concrete such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained at least the following percentages of the design compressive strength:

1. Joists, Beam Bottoms: 70%, but not less than 2,800 psi.
2. Slabs: 70%, but not less than 2,800 psi.

3.7 FIELD QUALITY CONTROL

A. Field Inspection: Refer to Specification 01 45 29 “Structural Testing and Inspections” for inspection requirements associated with forming and accessories.

END OF SECTION 03 10 00

SECTION 03 20 00 – CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes labor, materials, hardware, equipment, transportation and services required to fabricate and place all reinforcement for cast-in-place concrete including bars, welded wire reinforcement, ties and supports shown on the drawings and as specified. Prestressing reinforcement is specified in Post-Tensioned Concrete and/or Precast Concrete sections of the specifications.

B. Related Requirements:

1. Specification 014529 “Structural Testing and Inspections” for testing and inspection requirements associated with concrete reinforcing.
2. Specification 031000 “Concrete Forming and Accessories” for forming associated with cast-in-place concrete.
3. Specification 033000 “Cast-in-Place Concrete” for cast-in-place concrete and related products.

1.2 PRICE AND PAYMENT PROCEDURES

A. Alternates:

1. Products Requiring International Code Council (ICC) Evaluation Service Reports:

a. For those products listed in Part 2 as requiring Evaluation Service Reports (ESRs), alternate products that do not have ESRs will be considered by the Engineer only if valid research reports or test data from an independent and approved agency is provided and use of the product receives prior approval from the Building Official.

1.3 REFERENCES

A. Reference Standards:

1. Comply with all provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified:

a. ACI 117, “Specifications for Tolerances for Concrete Construction and Materials."
b. ACI 301, "Specifications for Structural Concrete for Buildings."
c. ANSI/AWS D1.4, “Structural Welding Code – Reinforcing Steel.”
d. CRSI, "Manual of Standard Practice."

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Quality Control: The Contractor is responsible for quality control, including workmanship and materials furnished by subcontractors and suppliers.
2. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.

B. Preinstallation Meetings: The Reinforcing-Placing subcontractor shall attend the Pre-Concrete Conference conducted by the Concrete Contractor as described in Specification 033000 “Cast-in-Place Concrete.”

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s product data with application and installation instructions for proprietary materials and items including mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement, dowel bar replacement systems, and dowel bar sleeves. For fiber reinforcement, submit manufacturer’s product data, including application rate and mixing instructions.

B. Shop Drawings:

1. Submit shop drawings for all reinforcing steel and related accessories for the Engineer's approval. Shop drawings shall show arrangement and layout, bending and assembly diagrams, bar schedules, stirrup spacing, splicing and laps of bars and shall be prepared in accordance with CRSI Standards.
2. Submit shop drawings indicating which members will use fusion welding process for assembly. Shop drawings shall show complete structural details indicating the size of stirrups, the size of holding wires, and welding requirements.

C. Certificates:

1. Submit, for record, mill certificates and/or test results signed by Producer, for all reinforcement.
2. Provide certification from fiber reinforcement manufacturer that fiber reinforcement complies with specified requirements.

D. Test and Evaluation Reports:

1. Submit International Code Council (ICC) Evaluation Service Reports indicating approval from ICC Evaluation Service, Inc. for mechanical splices, hooked anchorage systems, large-headed stud punching shear reinforcement and dowel bar replacement systems.
2. Submit test results for deformed bar material not identifiable as outlined in Part 2 below.

E. Special Procedure Submittals: Submit shop welding program for fusion welding including the type of the specific fusion welding machine and the quality control/inspection protocol for the shop welding.

F. Qualification Statements: Submit welding certificates.

1.6 QUALITY ASSURANCE

A. Testing Laboratory Requirements: The Owner’s Testing Laboratory shall:

1. Review the Welding Procedure Specification (WPS) submitted by the Contractor for any reinforcing steel other than ASTM A 706 that is proposed to be welded for consistency with acceptable welding practices and AWS.
2. Review the welder qualifications by certification or verify by retesting and shall obtain the welder certificates.

B. Welder Qualifications: Qualify procedures and personnel according to ANSI/AWS D1.4.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Reinforcement:

1. Reinforcing materials shall be delivered from the mill in bundles that are identified as to heat number and manufacturer and accompanied with mill and analysis test reports and an affidavit from the supplier stating that the material conforms to the requirements of the governing ASTM specification listed herein.
2. Use reinforcing steel made from 90% recycled material, two-thirds of which shall be post-consumer material. A minimum of 50% of the material in the reinforcement must have been extracted, harvested, or recovered as well as manufactured, within 500 miles of the project site.
3. Deformed bar material that is not identifiable according to the criteria listed above shall be tested for tensile strength and bend tests according to ASTM A 615 on a sample of two bars for each ten tons or fraction thereof of unidentified material for each bar size. The bars shall be a minimum of 24 inches long. Bend tests are not required for #14 and #18 bars. Submit the results of such tests for record.
4. Reinforcing Bars: Reinforcing bars shall conform to ASTM A 615, Grade 60 or Grade 75 as noted on the drawings.
5. Reinforcing Steel: Reinforcing steel used as transverse reinforcing or as spiral reinforcing as noted on the drawings shall conform to ASTM A 1035.
6. Weldable Reinforcing Bars: All reinforcing bars noted on the drawings as being required to be welded shall conform to ASTM A 706, Grade 60.
7. Deformed Bar Anchors: 3/8” to 5/8” diameter AWS Type C studs manufactured in conformance with ASTM A 1064 with a minimum yield strength of 70,000 psi and a tensile strength of 80,000 PSI. 3/4" or larger diameter, ASTM A 706 bars of equal size with welds to steel substrate that develop the full strength of the anchor. ASTM A 615 reinforcing bars may not be substituted for deformed bar anchors. Reinforcement shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    a. Nelson Stud Welding, Inc.; Nelson D2L Deformed Bar Anchor Studs (ESR-2907).
    b. Tru-Weld Division, TFP Corporation; Deformed Bar Anchors (ESR-2823).
8. Plain Steel Welded Wire Reinforcement: ASTM A 1064 with a yield strength of 65,000 PSI. Provide in flat sheets only.
9. Deformed-Steel Welded Wire Reinforcement: ASTM A 1064 with a yield strength of 70,000 PSI. Provide in flat sheets only.
10. Wire: Smooth wire for spiral reinforcement shall conform to ASTM A 82 with a minimum yield strength of 70,000 PSI.

2.2 SPLICES

A. Dowel Bar Replacement: All grade 60 reinforcing steel dowel bars shown on the drawings crossing concrete construction joint surfaces with inserts cast flush against the form and having reinforcing bars connected to the insert in a subsequent concrete pour shall conform to the following:

1. Splice connection to the insert shall develop the 1.25 times the specified yield strength and the full tensile strength of the spliced bar.
2. Splices shall be approved by the ICC Evaluation Service, Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
3. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:

    a. Dextra Manufacturing Co., Ltd.; Bartec Mechanical Splice System for Steel Reinforcing Bars in Concrete (ESR-1705).
    b. nVent Electric, plc.; Lenton Form Saver (ER-3967).

B. Hooked Anchorage Replacement: Reinforcing bar terminations shall be manufactured out of ASTM A 576, ASTM A 615, or A 706 material and shall develop the full tensile strength of the bar when installed at the manufacturer's recommended depth.

1. The anchorage shall be approved by the ICC Evaluation Service Inc. as expressed in an ICC Evaluation Service Report which shall be submitted for review.
2. The following are acceptable products (for use only with grade 60 bars), provided that their Evaluation Service Reports are still valid at the time of intended use on the project:

    a. Dextra Manufacturing Co., Ltd; Bartec Mechanical Anchorages for Steel Reinforcing Bars in Concrete (ESR-2166).
    b. Headed Reinforcement Corporation; HRC 555 Headed Reinforcing Bars (ESR-2935).
    c. nVent Electric plc.; Lenton Terminator (ER-3967).

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: Smooth bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 615, Grade 40 or ASTM A 36, plain-steel bars. Cut bars true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: Smooth epoxy-coated bars used to dowel across slab-on-grade construction joints shall conform to ASTM A 775 with ASTM A 615, Grade 40 or ASTM A 36 plain-steel bars. Cut bars true to length with ends square and free of burrs.

C. Dowel Bar Sleeves: Plastic or gage metal (26 gauge minimum) sleeves with an inside diameter of 1/16 inch greater than the dowel bar that it encases, that have the strength, durability, and design to provide free movement of the dowel relative to the concrete slab and that are specifically manufactured for this purpose.

D. Alternate Slab-on-Grade Joint Load Transfer Systems: A system that consists of flat, ASTM A 36 plate that is saw cut into a square or rectangular shape and is embedded into or encased by a plastic sleeve that allows movement in both lateral directions but not in the vertical direction. Acceptable systems are manufactured by PNA Construction Technologies with products known by the names "Diamond Dowel System" and "PD^3 Basket" and Greenstreak Group Inc. with products known as "Speed Plate' and "Double-Tapered Basket".

E. Tie Wire: Tie wire shall be annealed steel tie wire, minimum 16 gauge.

    a. Tie wire in architecturally exposed concrete shall be plastic coated or stainless steel.
    b. Tie wire for epoxy-coated reinforcement shall be epoxy-coated.
    c. Tie wire for galvanized reinforcement shall be galvanized.

F. Holding Wire: Holding wire shall conform to ASTM A 82 or ASTM A 1064.

G. Coating Repair Materials: Repair damaged areas of epoxy-coated or galvanized reinforcement using the following products.

1. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating compatible with epoxy coating on reinforcement and complying with ASTM A 775.
2. Zinc Repair Material: ASTM A 780, zinc-based solder, paint containing zinc dust, or sprayed zinc shall be used to repair damaged areas of galvanized reinforcement.

H. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Use wire bar type supports complying with CRSI recommendations.

1. Slabs-on-Grade: Use precast concrete bar supports (dobies) or supports with sand plates or horizontal runners designed for use on ground.
2. Spread Footing Bottom Reinforcement: Use precast concrete bar supports (dobies) or chairs designed for soil-supported slabs.
3. Exposed to View Concrete: Provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

PART 3 - EXECUTION

3.1 FABRICATION AND DELIVERY

A. Bending and Forming: Fabricate bars of indicated sizes and accurately form to shapes and lengths indicated and required, by methods not injurious to materials. Do not heat reinforcement for bending. Bars shall be free from injurious defects, have a workman-like finish with no excessive rust and/or pitting, and have no unusual kinks or bends.

B. Marking and Shipping: Bundle reinforcement and tag in accordance with Section 7.4.5 of the CRSI “Manual of Standard Practice.” Transport and store at site so as not to damage material. Keep sufficient supply of tested, approved, and proper reinforcement at the site to avoid delays. Maintain reinforcing bars free of mud, dirt, grease, or other coating.

C. Repair of Epoxy-Coated Reinforcing: Repair cut and damaged epoxy coatings on fabricated reinforcing before delivery with epoxy repair coating according to ASTM D 3963

3.2 PLACING REINFORCEMENT

A. Comply with CRSI recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports and as herein specified.

B. Before placing reinforcement and again before concrete is placed, clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers, and hangers as required. Exercise particular care to maintain proper distance and clearance between parallel bars and between bars and forms. Provide spreaders and spacers to hold steel in position. Support steel at proper height upon approved chairs.

D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set tie wires so ends are directed into concrete, not toward exposed concrete surfaces.

E. Support of Spread Footing Reinforcing Steel:

1. Bottom Steel: Support bottom reinforcing mat to provide the specified clearance to the bars. Spacing between supports shall not exceed 4'-0" centers each way.
2. Top Steel: Support top reinforcing on steel angle frames braced in both directions or on special standee support bars. Spacing between supports shall not exceed 4'-0" centers each way. The depth of the supports shall provide the specified clearance from the bars to the top of the concrete. The design of the support steel shall be the responsibility of the Contractor.

F. Install welded wire reinforcement in as long lengths as practicable. Provide lap splice for wires of adjoining pieces per ACI 318 Chapter 25.5.3 or 25.5.4 and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

G. Coordinate with other trades and expedite materials and labor to avoid omissions and delay.

H. Install waterproof membrane or vapor retarder as specified prior to placing steel for concrete slabs-on-grade.

I. Extend reinforcement continuous through construction joints unless otherwise shown on the drawings.

J. Slab-on-Grade Joint Dowel Bars: Support slab-on-grade joint dowel bars independently of support for slab reinforcement on soil supported slab bolsters or specially manufactured cradles such that dowel bar remains parallel to slab surface and at right angles to joint during concreting operations. Lightly coat the exposed end of the dowel with a paraffin-base lubricant, asphalt emulsion, form oil, or grease or use a dowel bar sleeve.

K. Alternate Slab-on-Grade Joint Load Transfer Systems: Install the alternate load transfer system in accordance with the manufacturer's instructions such that the largest plane of the flat plate is parallel to the plane of the subgrade on which the slab is bearing.

L. Provide and place additional reinforcing steel at all sleeves and openings in beams, slabs, and walls as specified on the drawings. Where sleeves or openings not shown on the drawings interrupt the reinforcement, consult with Engineer for instructions for placing and splicing of bars. Provide required additional reinforcing steel at no additional cost to the Owner.

M. Do not bend reinforcement that is embedded partially in concrete except in locations noted on the drawings or approved by the Engineer.

3.3 SPLICING REINFORCING STEEL

A. Provide splices as indicated on the drawings. Splice reinforcing bars only at locations shown on the structural drawings and approved shop drawings. Unauthorized or unscheduled splices not approved by the Engineer in writing will not be accepted.

B. All lap splices in reinforcing steel shall be contact lap splices unless detailed otherwise on the drawings.

C. Maintain proper cover and spacing between reinforcing bars at splices.

D. Lap unscheduled reinforcing bars not otherwise specified with a Class B lap splice. Lap welded wire reinforcement per ACI 318 Chapter 25.5.3 or 25.5.4.

3.4 WELDING REINFORCING STEEL

A. Welding reinforcing steel is permitted only where specifically shown on the drawings. All welding shall conform to AWS D1.4. Only weldable reinforcing steel conforming to ASTM A 706 or deformed bar anchors conforming to ASTM A 1064 shall be permitted. ASTM A 615 bars may not be welded for structural use.

B. Tack welding of reinforcement shall not be permitted.

3.5 SHRINKAGE AND TEMPERATURE REINFORCEMENT

A. Provide shrinkage and temperature reinforcement as indicated on the drawings at right angles to main top and bottom bars for all structural slabs unless detailed otherwise on the drawings.

3.6 PLACEMENT OF WELDED WIRE REINFORCEMENT

A. Wherever welded wire reinforcement is specified as reinforcement in pan-formed beams or slabs, it shall be continuous and properly lapped per ACI 318 Chapter 25.5.3 or 25.5.4 across the entire concrete surface and not interrupted by beam or girders.

3.7 REINFORCEMENT IN TOPPING SLABS

A. Provide welded smooth wire reinforcement minimum 6 x 6 W1.4 x W1.4 in all topping slabs unless specified otherwise on the drawings.

3.8 REINFORCEMENT IN HOUSEKEEPING PADS

A. Provide welded smooth wire reinforcement 6 x 6 W2.9 x W2.9 minimum in all housekeeping pads supporting mechanical equipment unless detailed otherwise on the drawings.

3.9 MECHANICAL AND PLUMBING REQUIREMENTS

A. Refer to Mechanical and Plumbing Drawings for concrete requiring reinforcing steel. Such reinforcement shall be furnished as part of the work of this section.

3.10 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Refer to Specification 01 45 29 “Structural Testing and Inspections” for testing and inspection requirements associated with concrete reinforcing.

END OF SECTION 03 20 00

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SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes all labor, materials, services, equipment, and hardware required in conjunction with or related to the forming, delivery, and pouring of all cast-in-place concrete work. Concrete paving and walks are specified in Division 32.

B. Related Requirements:

1. Specification 014529 “Structural Testing and Inspections” for inspection requirements associated with cast-in-place concrete.
2. Specification 031000 “Concrete Forming and Accessories” for forming associated with cast-in-place concrete.
3. Specification 032000 “Concrete Reinforcing” for reinforcement for cast-in-place concrete.

1.2 REFERENCES

A. Reference Standards:

1. Codes and Standards: Comply with provisions of following codes, specifications and standards, except where more stringent requirements are shown or specified:
   a. AASHTO, "LRFD Bridge Design Specifications."
   b. AISC 360, "Specification for Structural Steel Buildings."
   c. ACI 117, “Specifications for Tolerances for Concrete Construction and Materials.”
   d. ACI 301, “Specifications for Structural Concrete.”
   e. ACI 305.1, “Specification for Hot Weather Concreting.”
   f. ACI 318, “Building Code Requirements for Structural Concrete.”
   g. ACI 355.4, “Qualification of Post-Installed Adhesive Anchors in Concrete.”
   h. CRSI, “Manual of Standard Practice.”

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Quality Control: The Contractor is responsible for quality control, including workmanship and materials furnished by subcontractors and suppliers.
2. Document Conflict and Precedence: In case of conflict among documents, including architectural and structural drawings and specifications, notify the Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.
3. Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work.
   a. The Contractor shall provide adequate notification to the Owner’s Testing Agency of construction operations including the project schedule to allow the Testing Agency to schedule inspections. Failure to notify sufficiently may result in additional costs incurred by the Testing Laboratory that may be back-charged to the Contractor by the Owner.
   b. The Contractor shall cooperate with laboratory personnel, provide access to the work, and provide access to manufacturer's operations.
   c. The Contractor shall make adequate arrangement with the Owner’s Testing Agency for inspection of material stockpiles and facilities.

d. The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

e. The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the laboratory and otherwise facilitate the required inspections and tests.

f. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Tests not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See Structural Testing and Inspections section of the Specifications.

4. Responsibility for Selection and Use of Concrete Admixtures and Chemical Treatments: The Contractor shall be responsible for selecting admixtures and surface treatments that are compatible with the intended use of the concrete including all final surface treatments called for within this or other specifications or on the structural or architectural drawings. The Contractor is responsible for following the manufacturer's instructions for the use of their product including abiding by any limitations placed by the manufacturer on the use of any of its products.

B. Preinstallation Meetings:

1. Design Mixture Conference: At least 30 days prior to submittal of design concrete mixtures, the Contractor shall hold a meeting or telephone conference to review the detailed requirements for preparing the design concrete mixtures. Participants shall include representatives from the Contractor, Owner's Testing Laboratory, Concrete Supplier, Architect, and Engineer.

2. Pre-Concrete Conference:

a. At least seven days prior to beginning concrete work, the Contractor shall conduct a meeting to review the proposed design mixtures and to discuss required methods and procedures to produce concrete construction of the required quality. Also, review requirements for submittals, status of coordinating work and availability of materials. Establish work progress schedule and procedures for materials inspection, testing, and certifications. The contractor shall send a pre-concrete conference agenda to all attendees seven days prior to the scheduled date of the conference.

b. The Contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1) Contractor's Superintendent.
2) Laboratory responsible for the concrete design mix.
3) Laboratory responsible for field quality control.
4) Concrete Subcontractor.
5) Ready-Mix Concrete Producer.
6) Admixture Supplier.
7) Concrete Pumping Contractor.
8) Owner's and Architect's/Engineer's Representative.

c. Minutes of the meeting shall be recorded, typed and printed by the Contractor and distributed by him to all parties concerned within five days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:

1) Owner's Representative.
2) Architect.
3) Engineer-of-Record.

d. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least seven days prior to the scheduled date of the conference.

C. Sequencing:

1. Provide for installation of inserts, hangers, metal ties, anchors, bolts, angle guards, dowels, thimbles, slots, nailing strips, blocking, grounds, and other fastening devices required for attachment of work. Properly locate in cooperation with other trades and secure in position before concrete is poured. Do not install sleeves in any concrete slabs, beams, or columns except where shown on the drawings or upon written approval of the Architect/Engineer.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including admixtures, patching compounds, epoxies, grouts, waterstops, joint systems, curing compounds, dry-shake finish materials, hardeners, sealers, joint fillers, and others as requested by Architect/Engineer.

B. Shop Drawings:

1. Construction Joints: Submit drawings of proposed construction joint locations in concrete for slab-on-grade, mat foundations, structural floors, roofs and walls. Submit any additional or changed reinforcing that is required at construction joints that differs from that shown on the drawings.
2. Openings, Sleeves, and Cores: Submit drawings of all openings to be formed, sleeved, cored, or sawcut in cast-in-place elements. Drawings shall indicate size and location of openings, sleeves, or cores.
3. Penetrations in Beams and Joists: Submit drawings locating all horizontal and vertical penetrations in beams and joists. Drawings shall indicate location, size, orientation, and type of penetrations.
4. Embedded Items: Submit drawings showing all items to be embedded in concrete elements, including plates, angles, bolts, and any non-structural items, such as conduit. Drawings shall indicate location, size, orientation, and type of embedded item.
5. Anchor Rods: Submit drawings showing layout and details for steel templates used for placing anchor rods.

C. Samples: Submit samples of materials specified if requested by Architect/Engineer, including names, sources, and descriptions.

D. Certificates:

1. Material and Mill Certificates:
   a. Provide material and mill certificates as specified herein and in the Testing Laboratory section of the Specifications. The Manufacturer and Contractor shall sign the material and mill certificates certifying that each material item complies with specified requirements.
   b. Provide certification from admixture manufacturers that chloride ion content complies with specified requirements.

E. Design Mixtures: Submit for each concrete mixture as specified herein.

F. Field Quality Control Submittals:

1. Surveys: Submit report certifying that all anchor rods and reinforcing dowels into columns above are in their proper location prior to placing of concrete.

G. Qualification Statements: Submit certifications for adhesive anchor installers.

H. Minutes of Preinstallation Meetings: Submit for review.

1.5 QUALITY ASSURANCE

A. Testing Laboratory Requirements: The Owner's Testing Laboratory shall:

1. Concrete Design Mixtures: Review the submitted design mixtures for conformance to the specifications and for suitability for use in the project.
2. Preinstallation Meetings: Attend the preinstallation meetings referenced above.
3. Review adhesive anchor installer qualifications by certification. Obtain qualification certificates.

B. Qualifications:

1. Concrete Supplier: The concrete supplier shall have a minimum of five years of experience in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment. The supplier must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
2. Concrete Contractor: The concrete contractor shall have a minimum of five years of experience with installation of concrete similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful service performance.
3. Adhesive Anchor Installers: The individuals performing the installation of adhesive anchors that are horizontally or upwardly inclined shall be certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification program.

C. Survey for Anchor Rods and Reinforcing Steel Dowels: The Contractor shall use a qualified licensed professional engineer or licensed land surveyor to lay out the proper location of all embedded anchor rods and reinforcing steel dowels for columns above before they are encased in concrete. The surveyed locations of such elements shall be submitted to the Architect/Engineer for record, if requested.

D. Manufacturer Representative Presence:

1. Post-installed anchors: The manufacturer's representative for each post-installed anchor product (adhesive, expansion, undercut, screw, or insert anchor) shall be present during the first day's installation of the product to provide instruction for the correct installation of each type of any to be installed in accordance with the manufacturer's recommendation and the current ICC-ES Evaluation Report.

E. Mockups: Provide mock-ups as required.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Refer to the drawings for classes and strengths of concrete required.

B. Hydraulic Cement:

1. Use ASTM C 150, ASTM C 1157, or ASTM C 595 (excluding Type IS) unless otherwise specified. Do not use Type III cement in slabs-on-grade unless approved in advance by the Engineer.
2. Concrete Exposed to Sulfates in Soil or Water:
   a. Exposure Class S1: For concrete designated on the drawings as Exposure Class S1, use ASTM C 150, Type II or ASTM C 1157, Type MS.
   b. Exposure Class S2: For concrete designated on the drawings as Exposure Class S2, use ASTM C 150, Type V or ASTM C 1157, Type HS.
   c. Alternate Cement Types for Exposure Classes S1 and S2: ASTM C 150, Type I or III cement may be used for concrete designated as Exposure Class S1 or S2 if the tricalcium aluminate (C_3A) content is less than eight percent for Exposure Class S1 or five percent for Exposure Class S2. ASTM C 150, Type I or III cement may be used for exposure to seawater if the tricalcium aluminate content does not exceed

10 percent and the water/cementitious material ratio of the concrete mix does not exceed 0.40.

d. Exposure Class S3: For concrete designated on the drawings as Exposure Class S3, use ASTM C 150, Type V plus pozzolan or slag or ASTM C 1157, Type HS plus pozzolan or slag or ASTM C 595, Type IP (HS) or Type IS (HS). The amount of pozzolan or slag added or in a blended mix shall be such that has been determined by service record to improve sulfate resistance when used with Type V cement or the amount that when tested according to ASTM C 1012 meets the criteria of Table 26.4.2.2(c) in ACI 318-14.

3. Use one brand of cement, for each class of concrete, throughout the project, unless approved otherwise by the Architect/Engineer and the Owner's Testing Laboratory. Submit mill certificates certifying conformance to this specification for each brand and type of cement.

4. Testing of cement in lieu of mill certificate submittal will be required if:
   a. The cement has been in storage at the mixing site for over 30 days.
   b. It is suspected by the Owner, Architect, Engineer, or Owner's Testing Laboratory that the cement has been damaged in storage or in transit or is in any way defective.

C. Low-alkali cement: Cement that has the additional requirement that equivalent alkalis (Na_2O + $0.658K_2O$) do not exceed 0.60% according to ASTM C 150-00, Table 2.

D. Expansive Cement: ASTM C 845, Type [**G or K**] [**G, K, M, or S**].

E. Fly Ash: ASTM C 618, Class C or F.

F. Silica Fume: ASTM C 1240, Amorphous Silica.

G. Slag Cement: ASTM C 989, Grade 100 or 120 or ASTM C 595, Type IS or Type S.

H. Normalweight Aggregates: ASTM C 33, and as herein specified. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

1. For concrete identified on the drawings as exposed to Exposure Classes C1 and C2, submit certification that aggregate does not contain any deleterious materials that react with alkalis in the concrete mix to cause excessive expansion of the concrete for concrete that is exposed to wetting, has extended exposure to humid atmosphere, or is in contact with moist ground unless low-alkali cement is used.

I. Lightweight Aggregates: ASTM C 330. Submit material certificates from aggregate supplier or test results from an independent testing agency certifying conformance to this specification for each source of aggregate.

J. Water: Comply with the requirements of ASTM C 1602.

K. Cementitious materials, aggregate, and water must be extracted or recovered as well as manufactured within 500 miles of the project site.

2.2 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
   a. GCP Applied Technologies; Darex or Daravair series.
   b. BASF Corporation; MasterAir VR 10, MasterAir AE 90, MasterAir AE 200.
   c. Sika Corporation; Sika AER.
   d. The Euclid Chemical Company; Air Mix, AEA-92, Eucon Air 30 or Eucon Air 40.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

B. Water-Reducing Admixture: ASTM C 494, Type A. See maximum permissible chloride ion content in concrete specified below.
   1. Subject to compliance with requirements, provide one of the following products and manufacturers:
      a. BASF Corporation; MasterPozzolith Series.
      b. Sika Corporation; Plastocrete 161.
      c. The Euclid Chemical Company; Eucon WR-75, Eucon WR-91, Eucon NW or Eucon LW.
      d. GCP Applied Technologies; WRDA series, Zyla Series.
   2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

C. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A and Type F. See maximum permissible chloride ion content in concrete specified below.
   1. Subject to compliance with requirements, provide one of the following products and manufacturers:
      a. BASF Corporation; MasterPolyheed Series.
      b. The Euclid Chemical Company; Eucon MR, Eucon X-15 or Eucon X-20.
      c. Sika Corporation; Sikament HP.
      d. GCP Applied Technologies; Daracem or Mira series.
   2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

D. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C 494, Type F or Type G. See maximum permissible chloride ion content in concrete specified below.
   1. Subject to compliance with requirements, provide one of the following products and manufacturers:
      a. GCP Applied Technologies; ADVA or Daracem Series.
      b. BASF Corporation; MasterRheobuild 1000; MasterGlenium Series, PS 1466.
      c. Sika Corporation; Sikament.
      d. The Euclid Chemical Company; Eucon 37/1037, Plastol series, Eucon SP or Eucon RD2.
   2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

E. Water-Reducing, Accelerator Admixture (Non-Corrosive, Non-Chloride): ASTM C 494, Type C or E. See maximum permissible chloride ion content in concrete specified below.
   1. Subject to compliance with requirements, provide one of the following products and manufacturers:
      a. GCP Applied Technologies; Polarset, Lubricon NCA, Daraset 400, or DCI.
      b. BASF Corporation; MasterSet FP 20, MasterSet AC 534.
      c. The Euclid Chemical Company; Accelguard 80/90, Accelguard NCA, or Accelguard AcN.
      d. Sika Corporation; Plastocrete 161FL.
   2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

F. Water-Reducing, Retarding Admixture: ASTM C 494, Type D. See maximum permissible chloride ion content in concrete specified below.

1. Subject to compliance with requirements, provide one of the following products and manufacturers:
    a. GCP Applied Technologies; Daratard series, or Zyla R.
    b. BASF Corporation; MasterPozzolith R series, or MasterSet DELVO series.
    c. Sika Corporation; Plastiment.
    d. The Euclid Chemical Company; Eucon Retarder series.
2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all other admixtures to be used.

G. Viscosity Modifying Admixture: Used to enhance plastic concrete properties such as workability, pumpability, and stability for “Self-Consolidating Concrete”.
1. BASF Corporation; MasterMatrix VMA series.
2. The Euclid Chemical Company; Eucon SL or Visctrol.
3. Sika Corporation; VisoCrete series.
4. GCP Applied Technologies; VMAR series.

H. Shrinkage Reducing Admixture.
1. Subject to compliance with requirements, provide one of the following products and manufacturers:
    a. For Air-Entrained Concrete:
        1) GCP Applied Technologies; Eclipse 4500.
        2) The Euclid Chemical Company; Eucon SRA.
        3) BASF Corporation; MasterLife CRA 007.
    b. For Non Air-Entrained Concrete
        1) GCP Applied Technologies; Eclipse Floor 200.
        2) BASF Corporation; MasterLife SRA 20

I. Corrosion Inhibitor: 30% calcium nitrite:
1. Products: Subject to compliance with requirements, provide the following at dosage rates per Engineer from manufacturer’s recommendation based on design life, application, clear cover and other products in concrete mix:
    a. The Euclid Chemical Company; Eucon CIA or Eucon BcN.
    b. GCP Applied Technologies; DCI or DCI-S.
    c. BASF Corporation; MasterLife CI 30.
    d. Sika Corporation; Sika CNI.

J. Corrosion Inhibitor: Amine-Ester type:
1. Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:
    a. BASF Corporation; MasterLife CI 222.

K. Crystalline-Forming Waterproofing Admixture: A powder admixture capable of producing concrete that is water tight under hydrostatic pressure up to seven atmospheres when tested in accordance with Corps of Engineers test CRD-C48 and capable of sealing cracks up to 0.4 mm.
1. Products: Subject to compliance with requirements, provide the following at dosage rates per manufacturer’s recommendation:
    a. ICS/Penetron International/Ltd; Penetron Admix.
    b. Kryton International, Inc.; Krystol Internal Membrane (ESR-1515).
    c. Xypex Chemical Corporation; Xypex Admix C1000 or C500.
    d. Sika Corporation; Sika WT-215P
    e. BASF Corporation; MasterLife 300D
    f. The Euclid Chemical Company; Eucon Vandex AM-10

L. Moisture Vapor Reduction Admixture: Acceptable products include:
1. Barrier One, Inc.; Barrier-1.
2. USC Technologies, Inc.; Aridus.
3. GCP Applied Technologies; Eclipse Floor 200.
4. Concure Systems; Concure Systems Admixture.
5. Specialty Products Group; Vapor Lock VL 20/20.
6. ISE Logik Industries; MVRA 900.

M. Calcium Chloride: Calcium chloride is not permitted.

N. Certification: Written conformance to all the above-mentioned requirements and the chloride ion content of the admixture as tested by an accredited laboratory will be required from the admixture manufacturer at the time of design mixture review by the Engineer.

2.3 WATERSTOPS

A. Provide waterstops at all construction joints and other joints in all foundation walls below grade and where shown on the drawings. Size to suit joints.
1. Products:
a. Swell Hydrophilic Waterstops:
1) Manufacturers: GCP Applied Technologies; ADCOR ES.
b. Polyvinyl Chloride (PVC) Waterstops: Comply with Corps of Engineers CRD-C 572. Provide flat, dumbbell type or centerbulb type as noted on the drawings.
c. Rubber Waterstops: Comply with Corps of Engineers CRD-C 513. Provide flat, dumbbell type or centerbulb type as noted on the drawings.
d. Preformed Plastic Waterstops: Comply with Federal Specifications SS-S-210A "Sealing Compound for Expansion Joints".
1) Manufacturers: Henry Corporation; Synko-Flex Waterstop
e. Bentonite Waterstops:
1) Manufacturers: CETCO; Bentonite Waterstop-RX.

2.4 VAPOR RETARDERS

A. Provide vapor retarder cover chosen from products specified below over prepared base material where indicated. Vapor retarders shall be a complete system, including all materials and accessories as recommended by the manufacturer for specific installation and assembly.
1. Plastic Vapor Retarder under slabs-on-grade: Provide a flexible, preformed sheet membrane conforming to ASTM E 1745 with the following properties:
a. Class A material.
b. Minimum of 15 mils thick.
c. Maximum water vapor permeance rating of 0.01 perms after mandatory conditioning as tested by ASTM E 96 or ASTM F 1249.
d. Manufacturer’s recommended penetration boots, joint tape and mastic.
e. Acceptable products include the following:
1) Stego Industries, LLC; Stego Wrap Vapor Barrier (15 mil).
2) Epro Waterproofing Systems; Ecoshield-E (15 mil).
3) Insulation Solutions; Viper Vapor Check II (15 mil).
4) Raven Industries; VAPORBLOCK VBLP15 (15 mil).
5) W.R. Meadows, Inc; Perminator (15 mil)
6) Tex-Trude, LP, Xtreme (15 mil)

2. Bituminous Vapor Retarders: Provide a pre-molded membrane consisting of reinforced core and carrier sheet with fortified bitumen layers, protective weather coating, and plastic anti-stick sheet conforming to ASTM E 1993 with the following properties:
   a. Maximum water vapor permeance rating of 0.002 perms after mandatory conditioning as tested by ASTM E 1745.
   b. Manufacturer's recommended tape and mastic.
   c. Acceptable products include the following:
      1) W.R. Meadows, Inc; Premoulded Membrane Vapor Seal with Plasmatic Core (PMPC).
3. Plastic Vapor retarder under structural slabs on carton forms: Provide a flexible, preformed sheet membrane that adheres to concrete and conforms to ASTM E 1745 with the following properties.
   a. Class A Material.
   b. Minimum of 15 mils thick.
   c. Maximum water vapor permeance rating of 0.01 perms after mandatory conditioning as tested by ASTM E 96 or ASTM F1249.
   d. Manufacturer's recommended penetration boots, joint tape and mastic.
   e. Acceptable products include the following:
      1) Barrier Bac; BarrierBac VBC-350 (31 mil).
      2) GCP Applied Technologies; Florprufe 120 (21 mil).
4. Tape for Plastic Vapor Retarders: High-density polyethylene tape with pressure sensitive adhesive having a minimum width of 3.75" having a maximum water vapor transmission rate of 0.3 perms.

2.5 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate or Aluminum Granule Finish: Provide fused aluminum-oxide granules, or crushed emery, as abrasive aggregate for slip-resistive finish. The emery aggregate shall contain not less than 50% aluminum oxide and not less than 20% ferric oxide. The aluminum aggregate material shall contain not less than 95% fused aluminum-oxide granules. Use material that is factory-graded, packaged, rustproof, and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
   1. Subject to compliance with requirements, provide one of the following:
      a. Dayton-Superior Corporation, Inc; Emery Non-Slip.
      b. L&M Construction Chemicals, Inc.; Grip-It or Grip-It AO.
      c. BASF Corporation; MasterTop 120SR

B. Colored, Mineral Aggregate, Dry Shake Surface Hardener: Packaged, dry, combination of materials, consisting of portland cement, graded quartz aggregate, coloring pigments (if required) and plasticizing admixtures. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color, as selected by Architect, unless otherwise indicated.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. The Euclid Chemical Company; Surflex.
      b. L&M Construction Chemicals, Inc.; QuartzPlateFF.
      c. L.M. Scofield Company; Lithochrome.
      d. BASF Corporation; MasterTop 100.
      e. Dayton-Superior Corporation, Inc; Quartz-Tuff.
      f. US Mix Co.; US Spec Dense Top.
      g. SpecChem, LLC; Quartz Floor Hardener.
   2. Submit manufacturer's certification that product conforms to the requirements specified.

C. Metallic Aggregate Hardener Finish: Packaged dry, combination of materials consisting of Portland Cement, specially processed and graded iron aggregate, coloring pigments (if required) and plasticizing admixtures. The hardener shall be formulated, processed, and packaged under stringent quality control. Use coloring pigments that are finely ground, non-fading mineral oxides inter-ground with cement. Color as selected by Architect unless otherwise indicated.

1. The Euclid Chemical Company; Euco-Plate HD.
2. BASF Corporation; MasterTop 200.
3. Dayton-Superior Corporation, Inc; Ferro Tuff.

D. Non-Oxidizing Metallic Floor Hardener: Packaged dry, combination of materials consisting of portland cement, non-rusting aggregate and plasticizing admixtures.

1. The Euclid Chemical Company; Diamond-Plate.
2. BASF Corporation; MasterTop 210COR.

2.6 CURING MATERIALS

A. Liquid Membrane-Forming Curing and Curing and Sealing Compounds:

1. Water-Based Dissipating Resin Type Curing Compound: Curing Compound shall be a dissipating resin type, which chemically breaks down after approximately four weeks. Membrane forming compound shall meet ASTM C 309, Types 1 or 1D, Class B with a VOC content less than 350 grams per liter.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) The Euclid Chemical Company; Kurez DR VOX.
      2) L&M Construction Chemicals; L&M Cure R.
      3) Dayton-Superior Company; Clear Resin Cure J11W.
      4) W.R. Meadows, Inc; 1100-Clear.
      5) US Mix Co.; US Spec Maxcure Resin Clear.
      6) SpecChem LLC; SpecRez.
   b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments and floor coverings.
2. High Solids, Water-Based Acrylic Curing and Sealing Compound with Moderate Yellowing Characteristics: Water-Based membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class B, classified as low odor with a VOC content less than 350 grams per liter. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile, resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.
   a. Products: Subject to compliance with above requirements, provide one of the following products or equivalent products:
      1) Dayton-Superior; Cure & Seal 1315 J22WB.
      2) The Euclid Chemical Company; Super Aqua-Cure VOX.
      3) L&M Construction Chemicals; Dress & Seal, 30 WB.
      4) BASF Corporation; Masterkure CC 1315.
      5) SpecChem LLC; Cure & Seal WB 25.
   b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.
3. High Solids, Water-Based, Non-Yellowing Curing and Sealing Compound: Water based membrane-forming curing and sealing compound, acrylic type, complying with ASTM C

1315, Type 1, Class A classified as low odor with a VOC content less than 350 grams per liter. Do not apply to surfaces that are to receive subsequent cementitious toppings, sealers, hardeners, ceramic tile resilient flooring, vinyl-backed carpet, wood, terrazzo, epoxy overlays or adhesives, or other coating or finishing products.

a. Products: Subject to compliance with requirements, provide one of the following:
   1) The Euclid Chemical Company; Super Diamond Clear VOX.
   2) L&M Construction Chemicals; Lumiseal WB Plus.
   3) BASF Corporation; MasterKure CC 1315.
   4) Dayton-Superior Corporation; Cure & Seal 1315EF
   5) W.R. Meadows, Inc; Vocomp 30.
   6) SpecChem LLC; Cure & Seal WB 30.

b. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with any covering or surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

B. Evaporation Control: Monomolecular film forming compound applied to exposed concrete slab surfaces for temporary protection from rapid moisture loss in hot, dry, or windy weather conditions.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. The Euclid Chemical Company; Eucobar.
   b. L&M Construction Chemicals; E-Con.
   c. BASF Corporation; MasterKure ER 50.
   d. Dayton-Superior Corporation; Aqua Film (J74).
   e. Sika Corporation; SikaFilm.
   f. W.R. Meadows, Inc; Sealtight Evapre.
   g. US Mix Co.; US Spec Monofilm ER.
   h. SpecChem LLC; SpecFilm RTU.
2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

C. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard, complying with AASHTO M 182, Class 2.

D. Moisture-Retaining Cover: One of the following, complying with ANSI/ASTM C 171:

1. Waterproof paper.
2. Polyethylene film.
3. Polyethylene-coated burlap.
4. Polyethylene-coated natural cellulose fabric such as Greenstreak Group, Inc.; Aquacure.
5. Cover for Industrial Slab: Provide a low permeance moisture-retaining cover that allows a moisture loss of no more than one pound per square yard in 72 hours when tested in accordance with ATSM C 156 for industrial slabs. The material shall be non-staining and meet with requirements of ASTM C 171.

2.7 LIQUID FLOOR TREATMENTS

A. Chemical Hardener: Colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than two pounds of fluosilicates per gallon.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. The Euclid Chemical Company; Surfhard.
   b. BASF CorporationMasterKure HD 300WB.

c. L&M Construction Chemicals; Fluohard.
d. SpecChem LLC; Spec-O-Lith.

2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings or surface treatments to be received. Submit any instructions that must be followed prior to any subsequent surface treatments.

B. Chemical Curing/Floor Hardener Compound: Sodium silicate based compound that reacts with concrete constituents to harden the surface, resulting in a surface having a maximum abrasion coefficient of 0.25 cubic centimeters per square centimeter when tested in accordance with ASTM C 418.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. The Euclid Chemical Company; Eucosil.
   b. BASF Corporation; MasterKure HD 100WB.
   c. Dayton-Superior Corporation; Densifier J13.
   d. L&M Construction Chemicals; Chem Hard.
   e. W.R. Meadows, Inc; Med-Cure.
   f. US Mix Co.; US Spec Permasil.
2. Submit manufacturer's certification that product conforms to the requirements specified and is compatible with all coverings and surface treatments to be applied. Submit any instructions that must be followed prior to any subsequent surface treatments.

C. Liquid Sealer/Densifier: High performance, deeply penetrating concrete densifier that is an odorless, colorless, VOC-compliant, non-yellowing siliconate-based solution containing a minimum solids content of 20%, 50% of which is siliconate.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. The Euclid Chemical Company; Euco Diamond Hard.
   b. L&M Construction Chemicals; Seal Hard.
   c. W.R. Meadows, Inc; Liqui-Hard.

D. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent based Silane or Siloxane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 90% factor when tested in accordance with NCHRP #244, Series II, 100% solids, and applied in accordance with the manufacturer's recommendation.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Corporation; MasterProtect H 1000.
   b. Lymtal International, Inc.; Iso-flex 618-100 CRS.
   c. Evonik Industries; Protectosil Chem-Trete BSM-400.
   d. SpecChem, LLC; SpecSilane 100.

E. Water and Chloride Ion Repelling Penetrating Sealer: Clear, solvent free, Silane penetrating sealer which reacts chemically with the concrete surface to function as a Chloride Ion screen with a minimum 83% factor when tested in accordance with NCHRP #244, Series II and applied in accordance with the manufacturer's recommendation.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. 40% solids:
      1) BASF Corporation; MasterProtect H 400.
      2) Lymtal International, Inc.; Iso-flex 618-40 WB.
      3) SpecChem, LLC; SpecSilane WB 40.
   b. 100% solids:
      1) Evonik Industries; Protectosil BHN.

F. Moisture Vapor Reduction Sealer: ASTM C 1315 Type 1 Class A, ASTM C 309 Type 1 Class A, penetrating product to have no less than 34% solids content, leaving no sheen. Acceptable products include:

1. Creteseal; CS2000 Spray Apply System.

2.8 RELATED MATERIALS

A. Post-Installed Anchors:

1. Qualified Products:
   a. Mechanical Anchors: Only anchors having passed Acceptance Criteria 193 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
      1) ICC Evaluation Service Report.
      2) IAPMO Uniform Evaluation Services.
   b. Adhesive Anchoring Systems: Only adhesive anchor systems that comply with the latest revision of ICC-ES Acceptance Criteria 308 for use in cracked concrete and resisting wind and seismic loads shall be approved for use. Reports from the following organizations are acceptable:
      1) ICC Evaluation Service Report.
      2) IAPMO Uniform Evaluation Services.
2. Alternate Anchor Approval: Install only anchors identified on the drawings by manufacturer and product. Substitutions using products approved by this Specification may be permitted provided complete design calculations are signed and sealed by a registered professional engineer licensed in the state where the project is located and furnished to the Engineer for review and approval prior to commencement of work. The Contractor shall request design criteria for all conditions where a product substitution is considered. Failure to obtain approval for an anchor substitution may result in the request by the Engineer to remove installed anchors and replace with the product specified on the drawings at the Contractor's expense.
3. Installation: All installation of post-installed anchors shall be in accordance with the Manufacturer's Printed Installation Instructions (MPII).
4. Interior Use: All anchors for use in interior conditioned environments free of potential moisture shall be manufactured from carbon steel zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.
5. Exterior or Exposed Use: All anchors for use in exposed or potentially wet environments or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel.
6. Nuts and Washers: Nuts and washers shall be furnished from the manufacturer and used with the anchors.
7. Anchor Types:
   a. Expansion and Undercut Anchors in Concrete:
      1) Type: All expansion and undercut anchors in concrete shall be wedge type expansion, sleeve type expansion, or undercut type anchors.
      2) Acceptable Products and Manufacturers – Normalweight and Sand-Lightweight Concrete Not on Corrugated Steel Deck:
         a) Hilti, Inc.; Kwik Bolt TZ (ESR-1917).
         b) Hilti, Inc.; HDA Undercut Anchor (ESR-1546).
         c) Hilti, Inc.; HSL-3 Heavy Duty Sleeve Anchor (ESR-1545).
         d) Simpson Strong-Tie Co., Inc.; Strong-Bolt Wedge Anchor (ESR-1771).
         e) Simpson Strong-Tie Co., Inc.; Strong-Bolt 2 Wedge Anchor (ESR-3037).

f) USP Structural Connectors; DUC Undercut Anchor (ESR-1970).
g) Dewalt; Power Stud+ SD1 Expansion Anchor (ESR-2818).
h) Dewalt; Power Stud+ SD2 Anchor (ESR-2502).
i) Dewalt; Atomic+ Undercut Anchor (ESR-3067).
j) Dewalt; Power-Bolt+ Sleeve Anchor (ESR-3260)
k) MKT Metall-Kunststoff-Technik/UCan Fastening Products; SRS TZ Anchor (ESR-2461).

3) Acceptable Products and Manufacturers – Normalweight and Sand-Lightweight Concrete on Corrugated Steel Deck:
a) Hilti, Inc.; Kwik Bolt TZ (ESR-1917).
b) Simpson Strong-Tie Co., Inc.; Strong-Bolt Wedge-Anchor (ESR-1771).
c) Dewalt; Power Stud+ SD1 Expansion Anchor (ESR-2818).
d) Dewalt; Power Stud+ SD2 Anchor (ESR-2502).

b. Screw and Insert Anchors in Concrete:

1) Acceptable Products and Manufacturers:
a) Hilti, Inc.; KWIK HUS-EZ Anchor (ESR-3027).
b) Simpson Strong-Tie Co., Inc.; Titen HD (ESR-2713).
c) Dewalt; Snake+ Anchor (ESR-2272).
d) Dewalt; Screw-Bolt+ (ESR-3889).

c. Adhesive Anchoring Systems in Concrete:

1) Chemical anchoring of anchors, rods, or reinforcing steel is not allowed for fire-rated assemblies, unless specified provided for in the drawings.
2) Consult with the manufacturer for the minimum temperature of the concrete substrate allowed.
3) Only personnel trained to install adhesive anchors and certified in accordance with the ACI/CRSI Adhesive Anchor Installer Certification Program shall install adhesive anchors, including reinforcing steel.
4) All anchors installed horizontally or upwardly inclined require continuous inspection.
5) All adhesive anchors shall be installed in concrete having a minimum age of 21 days at the time of anchor installation.
6) Acceptable Products and Manufacturers:
a) Hilti, Inc.; HIT-HY 200 (ESR-3187).
b) Hilti, Inc.: HIT-RE 500 V3 (ESR-3814)
c) ITW Red Head; EPCON G5 (ESR-1137).
d) ITW Red Head; EPCON S7 (ESR-2308).
e) Dewalt; PE 1000+ (ESR-2583).
f) Dewalt; Pure110+ (ESR-3298).
g) Dewalt; AC200+ (ESR-4027).
h) Simpson Strong-Tie; AT-XP (IAPMO ER-263).
7) These products may not be used in concrete cast over corrugated deck.
8) Threaded Rods Chemically Anchored in Concrete:
a) Type: Threaded rods installed in holes using a chemical anchoring process shall have a 45º chiseled end on the embedded end.
b) Interior Application: Meet the requirements of ASTM A 307, A 36 or A 193, grade B7.
c) Exterior Application: Meet the requirements of ASTM A 153 galvanized steel, or F 593, Group 1 or 2, condition CW stainless steel.
9) Steel Reinforcing Bars:
a) Reinforcing steel installed shall comply with ASTM A 615 or ASTM A706 unless noted otherwise in the structural drawings. The embedded portions of reinforcing bars must be straight, and free of mill

scale, rust, mud, oil and other coatings that may impair the bond with the adhesive.

b) Reinforcing bars must not be bent after installation except as permitted in the structural drawings. Heating of reinforcing bars to facilitate field bending is not permitted.

B. Bonding Compound: Polyvinyl acetate or acrylic base, for use in cosmetic and/or nonstructural repairs.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Acrylic or Styrene Butadiene:
      1) Dayton-Superior Corporation; Acrylic Bonding Agent J40.
      2) The Euclid Chemical Company; SBR Latex, Akkro-7T.
      3) GCP Applied Technologies; Daraweld C.
      4) BASF Corporation: MasterEmaco A 400
      5) Sika Corporation; SikaLatex.
      6) W.R. Meadows, Inc; Acry-Lok.
      7) US Mix Co.; US Spec Acrylcoat.
      8) SpecChem, LLC; Strong Bond Acrylic Bonder.
   b. Polyvinyl Acetate (Interior Use Only):
      1) The Euclid Chemical Company; Tammsweld.
      2) L&M Construction Chemicals; Primer One.
      3) Dayton-Superior Corporation; PVA Bonding Agent J41.
      4) SpecChem, LLC; SpecWeld.
      5) W.R. Meadows, Inc; Intralok.

C. Epoxy Products: Two-component material suitable for use on dry or damp surface, complying with ASTM C 881.

1. Products for Crack Repair:
   a. Sika Corporation; Sikadur 35 Hi Mod LV – injection type.
   b. Sika Corporation; Sikadur 52 – injection type.
   c. Sika Corporation; Sikadur 55 SLV – gravity feed.
   d. The Euclid Chemical Company; Dural Injection Gel.
   e. Dayton-Superior Corporation, Inc; Sure-Inject (J56 or J56SLV).
   f. BASF Corporation; MasterInject 1000.
   g. Simpson Strong-Tie Co., Inc.; ETI-LV or ETI-GV – injection type.
   h. Unitex; Pro-Poxy 100 or Pro-Poxy 50.
   i. Adhesives Technology; Crackbond LR 321 or Crackbond LR 321 LPL.
   j. W.R. Meadows, Inc; Rezi-Weld LV.
   k. SpecChem LLC; SpecPoxy 1000.
2. Products for Epoxy Mortar Patches:
   a. Sika Corporation; Sikadur Lo-Mod LV.
   b. Dayton-Superior Corporation; Sure Patch.
   c. BASF Corporation; MasterInject 1500.
   d. Unitex; Pro-Poxy 2500.
   e. W.R. Meadows, Inc; Rezi-Weld 1000.
   f. SpecChem, LLC; SpecPoxy Binder.
3. Products for Epoxying Steel Plates to Concrete: Conform to ASTM C 881-13, Type IV, Grade 3, Class A, B, & C except gel times.
   a. Sika Corporation; Sikadur 31 Hi-Mod Gel.
   b. Dayton-Superior Corporation, Inc; Sure Anchor J50 or Sure Bond J58
   c. BASF Corporation; MasterEmaco ADH 1420.

d. Unitex; Pro-Poxy 300.
e. The Euclid Chemical Company; Duralcrete Gel.
f. SpecChem, LLC; SpecPoxy 3000.

D. Anchor Rods:
1. All anchor rods shall conform to the ASTM designation and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:
a. ASTM F 1554, Grade 36 (1/4 inch to 4 inches in diameter).
b. ASTM F 1554, Grade 55 (1/4 inch to 4 inches in diameter), complying with Supplementary Requirement S1 of ASTM F 1554.
c. ASTM F 1554, Grade 105 (1/4 inch to 3 inches in diameter).
d. ASTM A 588 (corrosion resistant).
e. ASTM A 354 Grade BD, 130 KSI (to 2 1/2 inches in diameter).
f. ASTM A 354 Grade BD, 115 KSI (greater than 2 1/2 inches to 4 inches in diameter).
g. ASTM A 354 Grade BC, 109 KSI (to 2 1/2 inches in diameter).
h. ASTM A 354 Grade BC, 99 KSI (greater than 2 1/2 inches to 4 inches in diameter).
2. Anchor rods used with ASTM A 588 baseplates shall be threaded round stock conforming to ASTM A 588, grade 50.
3. Anchor rods used with galvanized baseplates shall be galvanized.
4. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A 563.
5. Washers: Unless noted otherwise on the drawings, washer size and thickness for all anchor rods shall conform to Table 14-2 of AISC “Steel Construction Manual” with holes 1/16” greater than the anchor rod diameter. Washers shall conform to ASTM A 36 steel.

E. Non-Shrink Grout:
1. Type: Grout for base plates, bearing plates and grouting under precast or tilt-up wall panels shall be a non-metallic, shrinkage resistant, premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents and fluidity improving compounds.
2. Specifications: Non-shrink grout shall conform to ASTM C 1107.
3. Compressive Strength: Provide the minimum strength as shown below as determined by grout cube tests at 28 days:
a. 6,000 PSI for supporting concrete 3,000 PSI and less.
b. 8,000 PSI for supporting concrete greater than 3,000 PSI and less than or equal to 4,000 PSI.
c. Unless noted otherwise on the drawings, grout strength on supporting concrete greater than 4,000 PSI shall be 8,000 PSI.
4. Products: Acceptable non-shrink grouts are listed below:
a. L&M Construction Chemicals, Inc.; Crystex.
b. BASF Corporation; Masterflow 713.
c. BASF Corporation; MasterFlow 100.
d. The Euclid Chemical Company; NS Grout.
e. Dayton Superior Corporation, Inc; 1107 Advantage Grout
f. Hilti, Inc.; Precision Grout.
g. W.R. Meadows, Inc; CG-86 Grout.
h. US Mix Co.; US Spec GP Grout.
i. SpecChem, LLC; SC Multipurpose Grout.

5. High Flow, Non-Metallic Grout: Use high-flow grout where high fluidity and/or increased placing time are required and for base plates that are larger than 10 square feet. The factory pre-mixed grout shall conform to ASTM C 1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve minimum 95% bearing under an 18" x 36" base plate. Provide one of the following:
   a. The Euclid Chemical Company; Hi-Flow Grout.
   b. BASF Corporation; Masterflow 928.
   c. BASF Corporation; MasterFlow 928.
   d. W.R. Meadows, Inc; 588-10K Grout.
   e. US Mix Co.; US Spec MP Grout.
   f. SpecChem, LLC; SC Precision Grout.
   g. Dayton Superior Corporation, Inc; Sure Grip High Performance Grout
6. Epoxy Grout: High performance, highly flowable, epoxy grout consisting of pre-packaged components on each resin, one each hardener, and pre-packaged aggregate. Epoxy grout shall be capable of achieving minimum 28 day compressive strength of 19,000 PSI in accordance with ASTM C 579, maximum linear shrinkage of 0.025% at 14 days per ASTM C 531, and maximum creep of 2.7 10-4 inches per inch at 28 days when measured at 400 PSI and 73 degrees F per ASTM C 1181. Provide one of the following, only at locations required by the structural drawings:
   a. The Euclid Chemical Company; E^3-X.
   b. Dayton-Superior Corporation; Pro-Poxy Chock

F. Contraction and Construction Joint-Filler Material for Slabs-on-Grade: Provide a two-component semi-rigid, 100% solids epoxy having a minimum Shore A Hardness of 80 when tested in accordance with ASTM D 2240. Subject to compliance with requirements, provide one of the following:
   1. The Euclid Chemical Company; Euco 700.
   2. Dayton-Superior Corporation, Inc.; Sure Fil J52
   3. BASF Corporation; MasterSeal CR 190.
   4. Metzger/McGuire Co.; MM-80.
   5. W.R. Meadows, Inc; Rezi-Weld Flex.
   6. SpecChem, LLC; SpecPoxy CJ.

G. Bondbreaker for Construction Joints in Slabs-on-Grade: A dissipating bondbreaking compound containing no silicones, resins, or waxes, and that conforms to ASTM C 309. Subject to compliance with requirements, acceptable manufacturers include the following:
   1. Dayton-Superior Corporation, Inc.; Sure-Lift J6WB.
   2. SpecChem, LLC; SpecTilt 100.

H. Joint-Filler Strips for Isolation Joints in Slabs-on-Grade: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

I. Rigid-Cellular-Polystyrene Boards use as Fill under Topping Slabs or Slabs-on-Grade: Provide rigid, expanded (EPS) or extruded (XPS) cellular polystyrene boards that conform to ASTM D 6817 or ASTM C 578 with a minimum density of 15 kilograms per cubic meter; a flame spread index of not more than 75 and a smoke-develop index of not more than 450 where tested for use in accordance with ASTM E 84 or UL 723. Subject to compliance with requirements, acceptable manufacturers include the following:
   1. Dow Chemical Company; STYROFOAM Brand.
   2. Therma Foam; Foam-Control EPS Geofoam.

3. Carpenter Co.; EPS Envirogreen Geofoam.
4. Insulfoam; Insulfoam GF (EPS Geofoam).

2.9 REPAIR MATERIALS

A. Self-Leveling Mortars, Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound. Follow manufacturer's instruction regarding the use of a bonding agent.
   1. Products: Unless specified otherwise, provide one of the following:
      a. BASF Corporation; MasterTop 110 SL.
      b. The Euclid Chemical Company; Flo-Top,Super Flo-Top.
      c. Dayton-Superior Corporation, Inc; Levelayer.
      d. US Mix Co.; US Spec Self-Leveling Underlayment.
      e. The Euclid Chemical Company; Level Magic Lightweight.
      f. SpecChem, LLC; SpecFlow.

B. Polymer Patching Mortar: Polymer and microsilica modified cementitious-based compounds.
   1. Products:
      a. Horizontal Application:
         1) The Euclid Chemical Company; Thin Top Supreme, Concrete Top Supreme.
         2) Sika Corporation; Sikatop 121 Plus or Sikatop 122 Plus.
         3) BASF Corporation; MasterEmaco T 310CI.
         4) BASF Corporation; MasterEmaco N424 or N423 RS.
         5) US Mix Co.; US Spec H2 or NuTop.
         6) The Euclid Chemical Company; Speed Crete PM.
         7) SpecChem, LLC; RepCon H.
         8) Dayton-Superior Corporation; Thin Resurfacer or Special Patch.
      b. Upwardly Inclined Application:
         1) The Euclid Chemical Company; Verticoat or Verticoat Supreme.
         2) Sika Corporation; Sikatop 123 Plus.
         3) BASF Corporation; MasterEmaco N 350CI.
         4) BASF Corporation; MasterEmaco N423 RS.
         5) US Mix Co.; US Spec V/O Patch CI.
         6) The Euclid Chemical Company; Speed Crete PM.
         7) SpecChem, LLC; RepCon V/O.
         8) Dayton-Superior Corporation; Civil/Structural VO.

C. High Strength Flowing Repair Mortar: For forming and pouring structural members, or large horizontal repairs, provide flowable one-part, high strength microsilica polymer modified repair mortar with 3/8" aggregate. The product shall achieve 9,000 PSI at 28-days at a nine inch slump.
   1. Products:
      a. BASF Corporation; MasterEmaco T 1060.
      b. US Mix Co.; US Spec STR Mortar.
      c. The Euclid Chemical Company; Eucocrete.
      d. The Euclid Chemical Company; Tamms Form and Pour.
      e. SpecChem, LLC; RepCon 928.
      f. Dayton-Superior Corporation; Civil/Structural FPX.

D. Anti-Corrosive Epoxy/Cementitious Adhesive: Water-based epoxy/cementitious compound for adhesion and corrosion protection of reinforcing members (20 hour maximum open time).
   1. Products:
      a. The Euclid Chemical Company; Duralprep A.C.

b. Sika Corporation; Sika Armatec 110 Epocem.
c. BASF Corporation: MasterEmaco P 124.
d. Dayton-Superior Corporation; Perma Prime 3C.

2.10 PROPORTIONING AND DESIGN OF CONCRETE MIXTURES

A. The Contractor shall submit design concrete mixtures for each class of concrete indicated on the structural drawings and in the Specifications for approval by the Engineer and Owner's Testing Laboratory at least 15 working days prior to the start of construction. If required, the Contractor shall engage the services of an independent Testing Laboratory to assist in preparing the design mixtures. The Contractor shall not begin work with a particular mixture until that design mixture has been approved.

B. The Contractor, acting in conjunction with his Concrete Supplier and his Testing Laboratory, shall submit in writing, with his design mixtures, the method used to select mixture proportions. Either of the following methods, as outlined in ACI 301, may be used:
1. Field Experience Method.
2. Laboratory Trial Mixture Method.

C. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings.

D. All design mixtures shall state the following information:
1. Design mixture number or code designation by which the Contractor shall order the concrete from the Supplier.
2. Identify design mixture usage (i.e., columns, shear walls, footings, slab-on-grade, etc.).
3. Wet and dry unit weights.
4. Compressive strength and associated age (28-day, 56-day, etc.).
5. Aggregate type, source, size, gradation, fineness modulus.
6. Cement type and brand.
7. Fly ash or other pozzolan type and brand (if any).
8. Admixtures including air entrainment, water reducers, high-range water reducers, accelerators, and retarders.
9. Design slump or slump/flow.
10. Proportions of each material used.
11. Water/cementitious ratio and maximum allowable water content.
12. Method by which the concrete is intended to be placed (bucket, chute, or pump).
13. Required average strength qualification calculations per ACI 301 4.2.3.3a and 4.2.3.3b. Submit separate qualification calculations for each production facility that will supply concrete to the project.
14. Documentation of Average Strength (Trial Mixture Data or Field Test Data) per ACI 301: When field test data is used to qualify average strength, submit separate documentation for each production facility that will supply concrete to the project.
15. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.

E. Low Alkali Concrete: For concrete identified on the drawings as Exposure Classes C1 and C2, the total alkali contribution from cementitious materials in the concrete mix shall not exceed 4.0 pounds per cubic yard of concrete unless the aggregate used is certified to contain no deleterious materials that react with alkalis in the concrete mix as defined in ASTM C 33. This requirement may be met by the use of low-alkali cement.

F. Supplementary Cementitious Materials: Fly ash and/or ground granulated blast-furnace slag replacement of Portland cement shall be within percentage replacement levels listed on the drawings unless noted otherwise. Every effort should be made to reduce the amount of cement to the minimum practical amount, and still achieve performance requirements contained in the Contract Documents.

1. Cement replacement shall not exceed a percentage level that has been shown by experience on other projects to exhibit satisfactory performance using materials from identical sources as proposed for this project. As an alternate, trial concrete batches can be performed to identify design mixtures that maximize cement replacement while meeting strength requirements per ACI 301 and finishability criteria.
2. The use of fly ash or slag in architecturally exposed structural concrete shall be coordinated with the Architect, Engineer, and Contractor.
3. Overall replacement percentages with combined fly ash and slag shall not exceed the maximum identified with slag or be less than the minimum identified with fly ash for each type of element. In addition, the replacement percentage of fly ash within the combined mixture shall not exceed the maximum identified with fly ash alone.
4. Replacement percentages exceeding the maximum may be permitted at the discretion of the Architect, Engineer of Record, and Contractor.
5. For concrete identified on the drawings as being subject to Exposure Class F3, the maximum amount of supplementary cementitious materials shall not exceed the limits noted in Table 4.2.2.7.b.2 “Maximum cementitious materials requirements for concrete exposed to deicing chemicals” of ACI 301.
6. Except for Mass Concrete, the Contractor may submit for approval a revised design mixture with lower supplementary cementitious material percentages than herein specified should finishability or other issues arise due to changing weather conditions.

G. Aggregate: Comply with the following special requirements:

1. For exposed concrete, provide aggregates from a single source.
2. For exposed surfaces subject to Exposure Class C1 or C2, do not use aggregates containing spalling-causing deleterious substances.
3. For slabs and other designated concrete, combined aggregate gradation shall be 8% - 18% for large top size aggregates (1 1/2 inches) or 8% - 22% for smaller top size aggregates (1 inch or 3/4 inch) retained on each sieve below the top size and above the No. 100. Deviations from this gradation may be allowed upon the approval of the Engineer subject to the following limitations:
   a. The percent retained on two adjacent sieves shall be not less than 5%.
   b. The percent retained on three adjacent sieves shall be not less than 8%.
   c. If the percent retained on two adjacent sieves is less than 8%, the total percent retained on either of those sieves and the adjacent outside sieve shall be not less than 13%.

H. Admixtures:

1. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Owner's Testing Laboratory and shall be used for the purpose intended by the manufacturer to produce concrete to meet the specified requirements.
2. Quantities of admixtures to be used shall be in strict accordance with the manufacturer’s instructions.
3. Air Content Requirements: For concrete subject to Exposure Class F1, F2 or F3 as noted on the drawings, use air-entrainment admixtures to provide concrete such that the air content at the point of placement shall conform to the requirements of ACI 301 Table 4.2.2.7.b “For Exposure Category F: Freezing and thawing exposures” within plus or

minus 1.5%. Required air content levels may be reduced by 1.0 percent for concrete strengths above 5,000 PSI.

a. Interior steel troweled surfaces shall not have more than 3% total air content.

b. Surfaces scheduled to receive hardeners shall not have more than 3% total air content.

c. Air-entraining admixtures are not permitted in industrial slabs.

I. Self-Consolidating Concrete (SCC): Proportion SCC mixture with specified admixtures to produce a concrete having properties that allow it to flow freely into all spaces of the formwork, through tight openings under its own weight and is resistant to segregation during transport and placing. Flowable spread shall be between 20 to 30 inches and shall show no evidence of segregation, mortar halo, or aggregate pile, although some slight bleeding is acceptable. Workability, pumpability, finish, and setting time of the proposed design mixture must be demonstrated by a successful trial placement onsite.

J. Lightweight Structural Concrete:

1. Comply with the requirements of ACI 301, Section 7.

2. Provide concrete with a dry unit weight of not more than 116 pounds per cubic foot and not less than 110 pounds per cubic foot. Design mixture to produce strengths as indicated on the drawings with a split cylinder strength factor $(fct/(f'c)^{0.5})$ of not less than 5.7.

K. Adjustments of Concrete Mixtures: Design mixture adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved design mixtures including changes in admixtures shall be submitted in writing to the Engineer and Owner's Testing Laboratory for approval prior to field use.

L. Shrinkage: Concrete so identified on the drawings shall be proportioned for a maximum allowable unit shrinkage as noted on the drawings, measured at 28 days after curing in lime water as determined by ASTM C 157 (using air storage). Submit results of test for each class of applicable concrete after every 500 cubic yards placed.

M. Chloride Ion Content:

1. Unless noted otherwise, the maximum water soluble chloride ion concentration in hardened concrete measured at ages from 28 to 42 days contributed from all ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed the limits specified in ACI 318-14 Table 19.3.2.1 “Requirements for concrete by exposure class” depending on to which Corrosion Exposure Class (C0, C1 or C2) the concrete is subject as noted on the drawings. Water-soluble chloride ion tests shall conform to ASTM C 1218. One test shall be run for each class of concrete before the design mixture submittal and each time a change is made to the design mixture (such as change in aggregate type or source).

2. The chloride ion content in all concrete used for prestressed or post-tensioned concrete shall not exceed 0.06 percent by weight of cement.

3. The Concrete Supplier shall certify that the chloride ion content in all concrete design mixtures used on the project does not exceed the limits stated above.

2.11 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with requirements of ANSI/ASTM C 94 and the Structural Testing and Inspections section of the specifications.

2.12 SOURCE QUALITY CONTROL

A. Source Inspection: Refer to Specification 014529 “Structural Testing and Inspections” for inspection requirements associated with cast-in-place concrete.

PART 3 - EXECUTION

3.1 SLUMP LIMIT

A. The slump, as measured in the field where concrete cylinders are taken, shall be within plus or minus 1-1/2 inches of the design slump noted in the approved Design Mixture submittal. Self-Consolidating Concrete shall have a slump/flow of plus or minus two inches of the design slump/flow noted on the approved Design Mixture submittal. Water may be added to the concrete in the field only to the extent that the prescribed water/cementitious ratio noted in the approved Design Mixture submittal is not exceeded. The responsibility for adding water to trucks at the job site shall rest only with the Contractor’s designated representative. The Contractor is responsible that all concrete placed in the field is in conformance with the Contract Documents.

3.2 VAPOR RETARDER INSTALLATION

A. Install and repair damaged vapor retarder in accordance with ASTM E 1643 and manufacturer’s instructions.

B. Lap all seams per manufacturer’s instruction (6” minimum lap) and seal all joints in the field with the specified pressure sensitive tape. Heat-welded joints done in a shop prior to delivery is an acceptable method to minimize the number of field joints.

C. Seal all pipe penetrations through the vapor retarder with a boot made from the vapor retarder material and tape or mastic.

3.3 JOINTS IN CONCRETE

A. Construction Joints: Locate and install construction joints as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer.

1. Keyways: Provide keyways with a depth of one tenth of the member thickness (1 1/2" minimum or as shown on the drawings) in construction joints only where shown on the drawings.
2. Joint Construction: Place construction joints in the center one third of suspended spans and grade beams and as shown on the drawings for slabs-on-grade and walls unless shown otherwise. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise shown on the drawings. Dowels that cross construction joints shall be supported during concreting operations so as to remain parallel with the slab or wall surface and at right angles to the joint. Submit all construction joint locations as a shop drawing submittal.
3. Waterstops: Provide waterstops in construction joints as indicated on the Architectural and Structural Drawings. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.
4. Isolation Joints in Slabs-on-Grade: Construct isolation joints (without dowels) in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces only where specifically detailed on the drawings. Install joint-filler strips at joints where indicated. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated on the drawings. Install joint-filler strips in

lengths as long as practicable. Where more than one length is required, lace or clip sections together. Provide construction joints with dowels at all locations unless isolation joints are detailed.

B. Contraction Joints in Slabs-on-Grade and Unbonded Topping Slabs: Install contraction joints at locations and spacings as indicated on the drawings or if not shown on drawings, located so as not to impair strength and appearance of the structure, as acceptable to Architect/Engineer. Maximum joint spacing shall be per the drawings and be perpendicular to the slab surface. Use one of the two following methods (sawed or formed) to create the joints. Do not use the formed joint in areas subject to vehicular traffic or in industrial slabs.

1. Sawed Joints:
   a. Primary Method: Early-Entry, dry-cut method, using Soff-Cut saws. Finisher must have documented successful experience in the use of this method prior to this project. Install cuts within one to four hours, depending on air temperature, after final finish as soon as the concrete surface is firm enough to not be torn or damaged by the blade at each saw cut location. Use 1/8 inch thick blade, cutting to a depth of one quarter of the slab thickness but not less than one inch. Cut to a depth of one third of the slab thickness for slabs reinforced with steel fibers or synthetic fibers.
   b. Optional Method (where Soff-Cut System method equipment is not available, subject to limitations): This method may not be used when there is no dowel passing through the contraction joint. Use a conventional saw to cut joints within four to 12 hours after finishing as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses become sufficient to produce cracking. Use 1/8 inch thick blade, cutting to a depth of one quarter of the slab thickness but not less than one inch. Cut to a depth of one third of the slab thickness for slabs reinforced with steel fibers.
2. Formed Joints: Form contraction joints by inserting premolded plastic hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. The depth is to be one quarter of the slab thickness, but not less than one inch. Tool slab edges round on each side of insert. After concrete has cured, remove inserts and clean groove of loose debris.
3. Joint Filler: Provide in both contraction and saw-cut construction joints when specified.
   a. Remove dirt and debris from the joint by vacuuming immediately prior to filling joint. Clean the joint of curing compounds and sealers.
   b. Filler material shall be applied to the joints when the building is under permanent temperature control, but no less than 90 days after slab construction.
   c. Follow the manufacturer's recommended procedure for installing filler material. The joint filler must be flush with the adjacent concrete. A concave profile on the top of the joint filler is unacceptable and will be grounds for removal and replacement.
4. The Contractor shall protect the joints from damage caused by wheeled traffic or other sources during construction until a joint-filler material (if specified) has been installed.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of items to be attached thereto unless directed otherwise by these specifications. Install reglets to receive top edge of foundation sheet waterproofing where specified by the Architect, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles and other conditions.

B. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work as shown on the drawings. Furnish 1/8" minimum steel templates for presetting rods and other anchors to accurate locations as shown on the drawings in keeping with the tolerances noted in ACI 117 for embedded anchor rods.

C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units sufficiently strong to support types of screed strips by use of strike-off templates or accepted compacting type screeds.

D. Do not install sleeves in any concrete member except where shown on the structural drawings or approved by the Architect and Engineer.

E. Securely fasten embedded plates, angles, anchor rods and other items to be built into the concrete to the formwork or hold in place with templates. Insertion of these items into concrete after concrete placement is prohibited.

3.5 CONCRETE PLACEMENT

A. Pre-placement Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.

B. Concrete Batch Trip Tickets: The Contractor shall collect and retain concrete batch trip tickets. Compressive strength, slump, air content, and temperature tests shall be identified by reference to a particular trip ticket. Tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mixture. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

C. Causes for Rejection of Concrete: The Contractor shall reject concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect design mixture number).
2. Environmental condition limits shall be as follows unless appropriate provisions in concrete practices have been made for cold or hot weather:
    a. Cold Weather: Air temperature must be 40°F and rising or the average daily temperature cannot have been lower than 40°F for three consecutive days unless the temperature rose about 50°F for at least one-half of any of those 24 hour periods.
    b. Hot Weather: Environmental conditions must be such that cause an evaporation rate from the concrete surface of 0.2 pounds per square foot per hour or less as determined by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1.
    c. Concrete may be placed at other environmental condition ranges only with the approval of the job inspector for the Testing Laboratory or other duly appointed representative.
3. Concrete with temperatures exceeding 95°F.
4. Air contents outside the limits specified in the design mixtures.
5. Slumps outside the limits specified.
6. Water added to the mix that exceeds the maximum allowed water-to-cementitious material ratio.
7. Excessive Age: Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes and it shall be discharged before the

drum has revolved 300 revolutions, unless approved by the Testing Laboratory job inspector or other duly appointed representative.

D. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

E. Comply with ACI 301 and as herein specified:

1. Concrete Temperature: The maximum acceptable concrete temperature at the truck discharge point shall be 95°F.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation. Spread concrete using short-handled, square-ended shovels, or come-alongs.
3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use internal vibrators of the largest size and power that can properly be used in the work.
5. Do not vibrate Self-Consolidating Concrete.
6. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to penetrate rapidly placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
7. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed. Place concrete for beams, girders, brackets, column capitals, haunches, and drop panels at the same time as concrete for slabs. Do not place concrete over columns and walls until concrete in columns and walls is no longer plastic and has been in place at least one hour.
8. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners of forms, eliminating air and stone pockets that may cause honeycombing, pitting, or planes of weakness.
9. Bring slab surfaces to correct level with straightedge and strikeoff. Use highway straightedges, bull floats, or darbies to smooth surface free of humps or hollows before excess moisture or bleedwater appears on the surface. Do not disturb slab surfaces prior to beginning finishing operations.
10. Maintain reinforcing in proper position during concrete placement operations.
11. Protect adjacent finish materials against damage and spatter during concrete placement.
12. Placing Concrete by Pump: If concrete is placed by using a pump, the grout used for pump priming must not become a part of the completed structure unless an engineered grout design mix and grout location are approved in advance by the Engineer.

3.6 FINISH OF FORMED SURFACES

A. General: Formed surfaces shall have the finishes as described below and as shown on the drawings after formwork is removed and repairs made.

B. Matching Mockup Finish: In all areas where a special finish is required or a mock-up is required below, Contractor shall prepare a 100 square foot mock-up to match the required finish. The mock-up should match the finish on a sample panel furnished to the Contractor. If a sample is not furnished, provide finish to match SF2.0 or any other finish specified for the project. Protect mock-up from damage for the duration of project. Approval of mock-up by Architect is required before proceeding with application of finish in project.

C. Classifications and Finish Requirements:
   1. Surface Finish 1.0 (SF-1.0):
      a. No formwork facing material is specified.
      b. Patch voids larger than 1-1/2 inch wide or 1/2 inch deep.
      c. Remove projections larger than 1.0 inch.
      d. Provide surface tolerance Class D as specified in ACI 117.
      e. Tie holes need not be patched.
   2. Surface Finish 1.1 (SF-1.1):
      a. No formwork facing material is specified.
      b. Patch voids larger than 1 inch wide or 1/2 inch deep.
      c. Remove projections larger than 1/2 inch.
      d. Provide surface tolerance Class C as specified in ACI 117.
      e. Tie holes need not be patched.
   3. Surface Finish 2.0 (SF-2.0):
      a. Provide specified formwork-facing material.
      b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      c. Patch tie holes.
      d. Remove projections larger than 1/4 inch.
      e. Provide surface tolerance Class B as specified in ACI 117.
      f. Provide mock-up of concrete surface appearance.
   4. Surface Finish 2.1 (SF-2.1):
      a. Provide specified formwork-facing material.
      b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      c. Patch tie holes.
      d. Remove projections larger than 1/4 inch.
      e. Provide surface tolerance Class B as specified in ACI 117.
      f. Provide specified rubbed finish after formwork removal.
      g. Provide mock-up of concrete surface appearance.
   5. Surface Finish 2.2 (SF-2.2):
      a. Provide specified formwork-facing material.
      b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      c. Patch tie holes.
      d. Remove projections larger than 1/4 inch.
      e. Provide surface tolerance Class B as specified in ACI 117.
   6. Surface Finish 2.3 (SF-2.3):
      a. No formwork-facing material is specified.
      b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
      c. Patch tie holes.
      d. Remove projections larger than 1/4 inch.
      e. Provide surface tolerance Class B as specified in ACI 117.
   7. Surface Finish 3.0 (SF-3.0):

a. Provide specified formwork facing material.
b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
c. Remove projections larger than 1/8 inch.
d. Patch tie holes.
e. Provide surface tolerance Class A as specified in ACI 117.
f. Provide mock-up of concrete surface appearance.

8. Surface Finish 3.1 (SF-3.1):
   a. Provide specified formwork-facing material.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/8 inch.
   e. Provide surface tolerance Class A as specified in ACI 117.
   f. Provide specified rubbed finish after formwork removal.
   g. Provide mock-up of concrete surface appearance.
9. Surface Finish 3.2 (SF-3.2):
   a. Provide specified formwork-facing material.
   b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
   c. Patch tie holes.
   d. Remove projections larger than 1/8 inch.
   e. Provide surface tolerance Class A as specified in ACI 117.
10. Surface Finish 3.3 (SF-3.3):
    a. No formwork-facing material is specified.
    b. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
    c. Patch tie holes.
    d. Remove projections larger than 1/8 inch.
    e. Provide surface tolerance Class A as specified in ACI 117.

D. Standard Finish: Provide SF-1.0 on all concrete surfaces not exposed to view in the final condition unless otherwise specified.

E. Exposed Finishes: Provide SF-2.0 on all concrete surfaces exposed to view in final condition unless otherwise specified.

F. Rubbed Finishes: Remove forms as early as permitted by these specifications and perform any necessary repairs and patches. Unless otherwise specified, provide one of following finishes where rubbed concrete finish is specified or scheduled:

1. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled or specified concrete surfaces where indicated, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
2. Grout Cleaned Finish: Provide grout cleaned finish to scheduled or specified concrete surfaces that have received smooth-form finish treatment.
   a. Combine one part portland cement to 1-1/2 parts sand meeting the requirements of ASTM C 144 and ASTM C 404 by volume, and 50:50 mixture of acrylic or styrene butadiene based bonding admixture and water to consistency of thick paint. Proprietary additives may be used at Contractor's option. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that final color of dry grout will closely match adjacent surfaces.

b. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

G. Self-Consolidating Concrete: Use Self-Consolidating Concrete where shown on the plans to produce a smooth and uniform finish such that upon form removal no patching, stoning, rubbing or other form of repair, except washing, is required. The surface shall match the approved jobsite mock-up.

H. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.7 MONOLITHIC SLAB FINISHES

A. Place, consolidate, strike off, and level concrete, eliminating high spots and low spots, before proceeding with any other finish operation. Do not add water to the surface of the concrete during finishing operation.

B. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, portland cement terrazzo and other bonded applied cementitious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to tolerance specified below. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

C. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using a hand float, a bladed power float equipped with float shoes, or a powered disk float, when the bleed water sheen has disappeared and the concrete surface has stiffened sufficiently to permit the operation. Check and level surface plane to a tolerance as specified below. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

D. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system. After floating, begin first trowel finish operation by hand or power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface to a tolerance as specified below. Grind smooth surface defects that would telegraph through applied floor covering system.

E. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply initial trowel finish as specified above, then immediately follow with slightly scarifying surface by fine brooming.

F. Slip-Resistive Broom Finish: Apply slip-resistive broom finish to garage floors and ramps less than 6% slope, exterior concrete platforms, steps, and ramps and elsewhere as indicated. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application. For concrete containing fibers, broom once only in one direction.

G. Roller-Bug Finish: Provide a roller-bug finish with minimum 1/4” amplitude to all ramps exceeding a 6% slope. Extend the finish as least 12 feet beyond the beginning and ending of the greater-than-6% ramp. The finish shall be imprinted on the concrete by the use of a roller-bug tamper.

H. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Apply proprietary chemical hardeners, in strict accordance with manufacturer's printed instructions. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

I. Liquid Sealer/Densifier Finish: Apply liquid sealer/densifier finish to exposed interior concrete floors where indicated. Apply after complete curing and drying of the concrete surface and in strict accordance with manufacturer's printed instructions.

J. Penetrating Sealer Finish: Apply a chloride-and-water-repelling-penetrating-sealer finish to surfaces as described below and where indicated on the drawings. Apply liquid penetrating sealer after complete curing and drying of the concrete surface. Apply proprietary sealers in strict accordance with manufacturer's printed instructions. The Contractor shall verify the compatibility of the sealer product with the paint used to stripe parking decks and coordinate the sequencing of the sealing and striping operations. Apply to the following surfaces:

1. Sloping and horizontal surfaces of parking garages.
2. Top surfaces of exposed exterior balconies.

K. Slip-Resistive Aggregate Finish: Apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as indicated on the Architect's or Structural Drawings.

1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 pounds of dampened slip-resistive aggregate per 100 square feet of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
2. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose slip-resistive aggregate.

L. Colored, Mineral Aggregate Surface Hardener: Provide colored, mineral aggregate surface hardener to monolithic slab surface indicated.

1. Apply dry shake materials for colored wear-resistant finish at rate of not less than 100 pounds per 100 square feet, unless greater amount is recommended by material manufacturer.
2. Cast a trial slab approximately 20 feet by 20 feet to determine actual application rate, color, and finish as acceptable to Architect/Engineer.
3. Immediately following first floating operation using wood floats, uniformly distribute approximately two thirds of required weight of dry shake material over concrete surface, and embed by means of power floating using float shoes or pan floats. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material at right angles to first application, and embed by power floating.
4. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

M. Non-Oxidizing Metallic Floor Hardener: Slabs in areas noted on the drawings shall receive an application of the non-oxidizing, metallic floor hardener applied at the rate of 150 pounds per 100 square feet. Immediately following the first floating operation using wood floats, uniformly distribute approximately two thirds of the required weight of the hardener over the concrete surface by mechanical spreader and embedded by means of power floating using float shoes or pan floats. The hardener shall be floated in and the second application made. The surface shall be floated again to bond properly the hardener to the base concrete slab. The surface shall then be troweled at least twice to a smooth dense finish.

N. Metallic Aggregate Floor Hardener: Slabs in areas noted on the drawings shall receive an application of the metallic aggregate floor hardener applied at the rate of 150 pounds per 100 square feet. Immediately following the first floating operation using wood floats, uniformly

distribute approximately two thirds of the required weight of the hardener over the concrete surface by mechanical spreader and embedded by means of power floating using float shoes or pan floats. The hardener shall be floated in and the second application made. The surface shall be floated again to bond properly the hardener to the base concrete slab. The surface shall then be troweled at least twice to a smooth dense finish.

O. Finish of Top of Spread Footings and/or Mat Foundations:

1. Top Surface below Finished Slab: The top of the footing or mat shall be screeded level and smooth with a flatness F-number, F_F15 (overall), F_F10 (minimum local) and a levelness F-number, F_L12 (overall), F_L10 (minimum local).
2. Top Surface as Finished Slab: The top surface of a footing or mat that is to serve as the finished slab in the building shall be leveled, cured, and surface prepared as specified for the finished floor construction appropriate to the space usage as defined in the Architectural Drawings.

3.8 CONCRETE FINISH MEASUREMENT AND TOLERANCES

A. Testing Procedure: ASTM E 1155.

B. Tolerance on Floor Elevations: Construction tolerance on absolute floor elevation from the specified elevation as shown on the drawings shall be as specified below, taken from ACI 117:

1. Slab-on-Grade Construction: ±3/4".
2. Top Surfaces of Formed Slabs Measured Prior to Removal of Supporting Shores: ±3/4".
3. Top Surfaces of All Other Slabs: ±3/4".

C. Random Traffic Floor Finish Tolerances:

1. Specified overall values for flatness (SOF_F) and levelness (SOF_L) shall conform to the values listed below for the floor surface classification noted for each slab category noted.
   a. Conventional:
      1) SOF_F: 20.
      2) SOF_L: 15.
   b. Moderately Flat:
      1) SOF_F: 25.
      2) SOF_L: 20.
   c. Flat:
      1) SOF_F: 35.
      2) SOF_L: 25.
   d. Very Flat:
      1) SOF_F: 45.
      2) SOF_L: 35.
   e. Super Flat:
      1) SOF_F: 60.
      2) SOF_L: 40.
2. Minimum local values for flatness (MLF_F) and levelness (MLF_L) shall equal 3/5 of the SOF_F and SOF_L values, respectively, unless noted otherwise. The MLF_F and MLF_L values shall apply to the minimum areas bounded by the column lines and half-column lines, or the minimum areas bounded by the construction and contraction joints, whichever are the smaller areas.
3. The SOF_L and MFL_L tolerance values shall apply only to level slabs-on-ground or to level, uncambered suspended slabs that are shored such that it cannot deflect from the time the floor is placed to the time it is measured.

4. Slabs specified to slope shall have a tolerance from the specified slope of 3/8" in 10 feet at any point.

D. Construction Requirements to Achieve Specified Floor Finish Tolerances:
   1. Forms shall be properly leveled, in good condition, and securely anchored including special attention to ends and transitions.
   2. Bearing surfaces for straightedges such as form edges or previously poured slabs shall be kept clean of laitance, sand, gravel, or other foreign elements.
   3. Screeds shall be maintained in good condition with true round rolling wheels and level cutting edges. The use of optical sighting equipment such as lasers is recommended for checking levelness and straightness. The Contractor shall promptly adjust or replace equipment when test results indicate substandard work.
   4. Highway straightedges are recommended for use in lieu of bullfloats for all slab placement and finishing operations. If mineral, non-oxidizing metallic, or metallic floor hardeners are used, the slab shall be wood bullfloated immediately after the straightedge.

E. Contractor Responsibility for Concrete Floor Finish Requirements: Floor finish requirements shown below (flatness and levelness tolerances) are minimum requirements that apply unless stricter requirements are contained in instructions for installation of applied floor products in which case the Contractor is responsible for attaining the values prescribed by the manufacturer of such products.

F. Concrete Floor Finish Tolerance for Slab-on-Grade Construction:
   1. Concrete Placement: Concrete shall be placed and screeded to predetermined marks set to elevations prescribed on the drawings.
   2. Finish Tolerances of Random Traffic Floor Surfaces:
      a. Slabs in nonpublic areas, mechanical rooms, surfaces to received raised computer flooring, surfaces to have thick-set tile or a topping, and parking structures: Conventional.
      b. Carpeted Areas: Moderately Flat.
      c. Exposed Slabs in Public Spaces, Slabs to Receive Thin-Set Flooring: Flat.
      d. Ice or Roller rinks: Very Flat.
      e. Movie or Television Studios: Super Flat.
      f. Gymnasium Floors Scheduled to Receive Wood Playing Floor: Very Flat.

G. Remedial Measures for Slab Finish Construction Not Meeting Specified Tolerances:
   1. Application of Remedial Measures. Remedial measures specified herein are required whenever either or both of the following occur:
      a. The composite overall values of F_F or F_L of the entire floor installation measure less than specified values.
      b. Any individual test section measures less than the specified absolute minimum F_F or F_L value.
   2. Modification of Existing Surface:
      a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work can be repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately undertake the approved repair method.
      b. The Contractor shall submit for review and approval a detailed work plan of the proposed repair showing areas to be repaired, method of repair, and time to affect the repair.
      c. Repair method(s), at the sole discretion of the Architect/Engineer or Owner's Representative, may include grinding (floor stoning), planing, retopping with self-

leveling underlayment compound or repair topping, or any combination of the above.

d. The Architect/Engineer or Owner's Representative maintains the right to require a test repair section using the approved method of repair for review and approval to demonstrate a satisfactory end product. If, in the opinion of the Architect/Engineer or Owner's Representative, the repair is not satisfactory an alternate method of repair shall be submitted or the defective area shall be replaced.

e. The judgment of the Architect/Engineer or Owner's Representative on the appropriateness of a repair method and its ability to achieve the desired end product shall be final.

f. All repair work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3. Removal and Replacement:

a. If, in the opinion of the Architect/Engineer or Owner's Representative, all or any portion of the substandard work cannot be satisfactorily repaired without sacrifice to the appearance or serviceability of the area, then the Contractor shall immediately commence to remove and replace the defective work.

b. Replacement section boundaries shall be made to coincide with the test section boundaries as previously defined.

c. Sections requiring replacement shall be removed by sawcutting along the section boundary lines to provide a neat clean joint between new replacement floor and existing floor.

d. The new section shall be reinforced the same as the removed section and doweled into the existing floor as required by the Engineer. No existing removed reinforcing steel may be used. All reinforcing steel shall be new steel.

e. Replacement sections may be retested for compliance at the discretion of the Architect/Engineer or Owner's Representative.

f. The judgment of the Architect/Engineer or Owner's Representative on the need for replacement shall be final.

g. All replacement work shall be performed at no additional cost to the Owner and with no extension to the construction schedule.

3.9 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of concrete. Limit moisture loss to a maximum of 0.05 pounds per square foot per hour for concrete containing silica fume and 0.2 pounds per square foot per hour for all other concrete before and during finishing operations. If using an evaporation retarder, apply in accordance with manufacturer's instructions after screeding and bull floating, but before power floating and troweling.

2. Curing shall commence as soon as free water has disappeared from the concrete surface after placing and finishing. The curing period shall be seven days for all concrete except high early strength concrete that shall be cured for three days minimum.

3. Alternatively, curing times may be reduced if either of the following provisions is complied with:

a. If tests are made of cylinders kept adjacent to the structure and cured by the same methods, curing measures may be terminated when the average compressive strength has reached 70% of the specified compressive strength.

b. If the temperature of the concrete is maintained at a minimum of 50°F for the same length of time required for laboratory cured cylinders of the same concrete to reach 85% of the specified compressive strength, then curing may be terminated thereafter.

4. Curing shall be in accordance with ACI 301 procedures. Avoid rapid drying at the end of the curing period.

B. Curing Formed Surfaces: Where wooden forms are used, cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. When forms are removed, continue curing by one or a combination of the methods specified below, as applicable:

1. Columns and Shear Walls Not Exposed to View: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a high–solids, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type I, Class A or B for Method 3.
2. Columns and Shear Walls Exposed to View: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a high-solids, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, class A for Method 3.
3. Sides and Soffits of Beams and Pan-Joist Ribs, Soffits of Slabs: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.
4. Basement Walls, Sides of Exterior Retaining Walls: Moist cure in forms or by one or a combination of Methods 1, 2, or 3 specified below. Use a liquid membrane-forming dissipating resin curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.

C. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by one or a combination of the methods specified below, as applicable. The Contractor shall choose a curing method that is compatible with the requirements for subsequent material usage on the concrete surface.

1. Ramps and Horizontal Surfaces of Parking Areas, Exposed Exterior Balconies: Cure using only Methods 1 or 2 as specified below.
2. Floors Directly Exposed to Vehicular or Foot Traffic [Not in Parking Areas] and Not Otherwise Receiving a Chemical Hardener or Penetrating Sealer Finish: Apply two coats of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class A in accordance with Method 3 as specified below.
3. Floors in Non-Public Spaces that are Left Exposed to View and Not Receiving Sealers or Hardeners, Floors Involved in Under-Floor Air Distribution Systems: Apply one coat of a high-solids, water-based, non-yellowing, liquid membrane-forming curing and sealing compound conforming to ASTM C 1315, Type 1, Class A or B in accordance with Method 3 as specified below.
4. Floors that are to Receive Subsequent Cementitious Toppings, Sealers, Hardeners, Ceramic Tile, Acrylic Terrazzo, Vinyl Composition Tile, Sheet Vinyl, Linoleum, Vinyl-Backed Carpet, Rubber, Athletic Flooring, Synthetic Turf, Wood, Epoxy Overlay or Adhesive, or Other Coating or Finishing Products: Cure using Methods 2 or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.
5. Industrial Slabs: Cure using Methods 1 or 2 as specified below for seven days. The temperature of applied water shall be within 10°F of concrete surface temperature.

6. All Other Surfaces: Cure using Methods 1, 2, or 3 as specified below. Use a water-based dissipating resin type curing compound conforming to ASTM C 309, Type 1, class A or B for Method 3.

D. Curing Methods:

1. Method 1 – Moisture Curing: Provide moisture curing by one of the following methods:
   a. Keep concrete surface continuously wet by covering with water.
   b. Continuous water-fog spray.
   c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water, and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
2. Method 2 – Moisture-Retaining Cover Curing: Provide moisture-retaining cover curing as follows:
   a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape. Water may be added to concrete surface to prevent drying before the cover is installed, but the surface shall not be flooded with water if a non-absorptive cover is used.
3. Method 3 – Curing or Curing and Sealing Compound: Provide curing, liquid membrane-forming curing, or curing and sealing compound as follows:
   a. Apply specified compound to concrete slabs as soon as final finishing operations are complete (within two hours and after surface water sheen has disappeared). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Do not allow to puddle. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Apply second coat for sealing two to three hours after the first coat was applied.
   b. Do not use membrane-forming curing and sealing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring (such as ceramic or quarry tile, glued-down carpet, vinyl composition tile, linoleum, sheet vinyl, rubber, athletic flooring, synthetic turf, or wood), paint, or other coatings and finish materials. Dissipating resin type cures are acceptable in these locations.

3.10 HOT WEATHER CONCRETING

A. Definition:

1. Conditions warranting hot weather concreting practices are defined as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise result in abnormal properties. If conditions cause an evaporation rate of 0.2 pounds per square foot per hour or greater as calculated by the figure “NRMCA Nomograph for Estimating Evaporation Rate on the Basis of Menzel Formula” in Appendix A of ACI 305.1, then precautions shall be taken to prevent plastic shrinkage cracks from occurring.

B. Specification: Follow hot weather concreting practices specified below when required to limit the concrete temperature at the truck discharge point to the stated maximum acceptable temperature.

C. Records: Under hot weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature at truck discharge and general weather conditions.

D. Hot Weather Concreting Requirements: The following items, all or in part as required, shall be followed to limit the concrete temperature to the stated maximum acceptable temperature and to minimize the possibility of plastic shrinkage cracks from developing.

1. Design the concrete mixtures specifically for hot weather conditions replacing some cement with fly ash or other pozzolan and using a water reducing retarding admixture (ASTM C 494 Type D).
2. Use the largest size and amount of coarse aggregate compatible with the job.
3. Use sunshades and/or windbreaks.
4. Delay construction of indoor slabs-on-grade until the walls and roof are constructed.
5. Cool and shade aggregate stockpiles.
6. Use ice as part of the mixing water or cool the water with liquid nitrogen. Do not place concrete that contains unmelted ice.
7. Limit the number of revolutions at mixing speed to 125 maximum.
8. Reduce time between mixing and placing as much as possible.
9. Do not add water to ready-mixed concrete at the job site unless it is part of the amount required initially for the specified water-cement ratio and the specified slump.
10. Schedule concrete placement for early morning, late afternoon, or night.
11. Have all forms, equipment, and workers ready to receive and handle concrete.
12. Maintain one standby vibrator for every three vibrators used.
13. Keep all equipment and material cool by spraying with water including exteriors of forms, reinforcing steel, subgrade, chutes, conveyors, pump lines, tremies, and buggies.
14. Protect slab concrete at all stages against undue evaporation by applying a fog spray or mist above the surface or applying a monomolecular film. Where high temperatures and/or placing conditions dictate, use water-reducing retarding admixture (Type D) in lieu of the water-reducing admixture (Type A) as directed by the Owner's Testing Laboratory.
15. Provide continuous curing, preferably with water, during the first 24 hours using wet burlap, cotton mats, continuous spray mist, or by applying a curing compound meeting ASTM C 1315. Continue curing for three days minimum.
16. Cover reinforcing steel with water soaked burlap so that steel temperature will not exceed ambient air temperature immediately before placement of concrete.
17. As soon as possible, loosen forms and run water down the inside. When forms are removed, provide a wet cover to newly exposed surfaces.

3.11 COLD WEATHER CONCRETING

A. Definition:

1. Concrete shall not be placed when the outside air temperature is 40°F or less unless cold weather concreting practices are followed as specified below.
2. Cold weather concreting practices should also be followed whenever the average daily air temperature is expected to be less than 40°F for more than three successive days. The average daily air temperature is the average of the highest and lowest temperature occurring during the period from midnight to midnight. The requirement for adhering to these cold-weather concreting practices may be terminated when the air temperature is above 50º F for more than half of any 24 hour duration.
3. Cold-weather concreting practices invoked shall keep the temperature of the concrete immediately after placing within the following temperature ranges:
   a. 55º to 75º F for sections less than 12 inches in the least dimension.
   b. 50º to 70º F for sections 12 to 36 inches in the least dimension.
   c. 45º to 65º F for sections 36 to 72 inches in the least dimension.
   d. 40º to 60º F for sections greater than 72 inches in the least dimension.

4. Concrete Protection: Protect the concrete immediately after placing and during the defined protection period such that the concrete does not freeze nor fall below the temperature levels stated in the above paragraph. For concrete not loaded during construction, the protection period shall be for a minimum of three days if cold-weather conditions persist. The time may be reduced to a minimum of two days if Type III cement or an accelerating admixture is used or if an additional 100 pounds of cement per cubic yard is added to the concrete mix. Concrete fully loaded during construction shall be protected during cold weather conditions for whatever time is required to obtain the required strength as determined by nondestructive strength tests (Windsor probe, Swiss Hammer Test) on the in-place concrete. Protect concrete surfaces from freezing for the first 24 hours even if cold-weather conditions do not officially exist due to high volatility in ambient temperatures.
5. Protection Deficiency: If the temperature requirements during any portion of the protection period are not met but the concrete surface did not freeze, the protection period shall be extended until twice the deficiency expressed in degree-hours is made up. Deficiency degree-hours are defined as the average deficiency in temperature below the required value times the number of hours the deficiency persisted. Make-up degree hours are the average increase in temperature above the minimum value times the hours required to make up twice the deficiency degree-hours. Contact the Architect/Engineer if the concrete surface was allowed to freeze during the protection period.
6. Protection Removal: As the protection is being removed the decrease in temperature measured at the surface of the concrete in a 24 hour period shall not exceed the following:
    a. 50º F for sections less than 12 inches in the least dimension.
    b. 40º F for sections 12 to 36 inches in the least dimension.
    c. 30º F for sections 36 to 72 inches in the least dimension.
    d. 20º F for sections greater than 72 inches in the least dimension.
7. The maximum concrete temperature heated by artificial means at point of placement shall not exceed 90°F.

B. Records: Under cold weather conditions, the Contractor shall keep records of outside air temperature, concrete temperature as placed and general weather conditions. The temperature record shall be taken no less than two times per 24 hour duration.

C. Cold Weather Concreting Requirements: The following items, all or in part as required, should be followed to assure acceptable concrete in cold weather conditions:

1. Design the concrete mixture to obtain high early strength by using higher cement content, a high early strength cement (Type III), or a specified non-chloride accelerator (ASTM C 494 Type C or E).
2. Protect the concrete during curing period using insulating blankets, insulated forms, enclosures, and/or heaters.
3. Concrete cured in heated enclosures shall have heaters vented to prevent exposure of concrete and workmen to noxious gases.
4. Frozen subgrade shall be thawed prior to concrete placement and snow and ice shall be removed from forms.
5. Temperature of embedments in concrete must be heated to above 32°F prior to placing concrete
6. Heat the mixing water and then blend hot and cold water to obtain concrete no more than 10°F above the required temperature.
7. Heat the aggregates by circulating steam in pipes placed in the storage bins for air temperatures consistently below 32°F. When either water or aggregate is heated to over 140°F, combine them in the mixer first to obtain a maximum temperature of the mixture not to exceed 140°F in order to prevent flash set of the concrete.

8. Uniformly thaw aggregates far in advance of batching to prevent moisture variations in the stockpile.
9. Cover warmed stockpiles with tarps to retain heat.
10. Place air entraining admixture in the batch after the water temperature has been reduced by mixing with cooler solid materials.
11. Use wind screens to protect concrete from rapid cooling.
12. Place vertical pump lines inside the building, if possible, for concrete being pumped.
13. Maintain artificial heat as low as possible to reduce temperature stresses during cooling.
14. Avoid water curing of concrete except for parking garage structures. Apply the required curing compound to unformed surfaces as soon as possible to prevent drying of concrete from heated enclosures.
15. Delay form stripping as long as possible to help prevent drying from heated enclosures and to reduce damage to formed surfaces caused by premature stripping.
16. Provide triple thickness of insulating materials at corners and edges vulnerable to freezing.
17. Wrap protruding reinforcing bars with insulation to avoid heat drain from the warm concrete.
18. Gradually reduce the heat at the end of the heating period to reduce likelihood of thermal shock.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor rods for machines and equipment to template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink, non-metallic grout. Use high-flow grout where high fluidity and/or increased placing time are required. This grout shall be used for all base plates larger than 10 square feet.

E. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and finish concrete surfaces as scheduled.

F. Adhesive Anchors: All drilled holes for adhesive anchors shall be within six degrees of perpendicular to the surface of the concrete member.

3.13 INVESTIGATION OF LOW CONCRETE STRENGTH TEST RESULTS

A. Contractor Responsibility for Low Strength Concrete:

1. If the average of any three consecutive strength tests falls below the required f’c for a class of concrete but no individual strength test is more than 500 PSI below the required f’c, the Contractor shall immediately notify the Engineer by telephone or email and take immediate steps to increase the average of subsequent strength tests.

2. If any individual strength test falls more than 500 PSI below the required f'c, the Contractor shall immediately notify the Engineer by telephone or e-mail and take immediate steps to assure that the load-carrying capacity of the structure is not jeopardized.

B. Additional Field Tests to Confirm Low Concrete Strengths:

1. The cost of all investigations of low-strength concrete, as defined by any individual strength test being more than 500 PSI below the required f'c, shall be borne by the Contractor.
2. Code-Prescribed Acceptance: The only accepted field-test methods of determining actual in-situ concrete strength is by the way of core tests as prescribed by ACI 318.
3. Non-Destructive Tests: If any individual strength test falls more than 500 PSI below the required f'c, the Engineer may request that non-destructive field tests be performed on the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer. Report the comparative test results of the suspect concrete under consideration with identical tests done on concrete of known strength and of the same class. The Engineer considers these test results as only approximate indicators of strength and may not necessarily, by themselves, resolve the low concrete strength issue. These test results will be considered as additional information by which to make an informed judgment. The Engineer reserves the right to accept the concrete based on the results of these approximate tests or order that core tests be taken as prescribed below. At the Contractor's option, the approximate non-destructive field-tests may be waived and core tests immediately initiated.
4. Core Tests: If, in the opinion of the Engineer, the likelihood of low-strength concrete is confirmed and it has been determined that the load-carrying capacity of the structure is significantly reduced as a result, the Engineer may request that core tests be taken from the area in question as directed by the Engineer. There shall be a minimum of three cores taken for each strength test more than 500 PSI below the required f'c in accordance with ASTM C 42. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for seven days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 40 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.
5. Acceptance Criteria for Core Test: Concrete in an area represented by core tests shall be considered adequate if the average of three cores is equal to at least 85% of the required f'c and no single core is less than 75% of the required f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.
6. Load Test: If the concrete strength is not considered adequate based on core tests and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 be conducted for the questionable portion of the structure.
7. Strengthening or Demolition of the Structure: If the structural adequacy of the affected portion of the structure remains in doubt following the load test, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt at the Contractor's expense.

3.14 CONCRETE SURFACE REPAIRS

A. Defective Areas:

1. Formed Surfaces: Concrete surfaces requiring repairs shall include all cracks in excess of 1/32" in width and any other defects that affect the durability or structural integrity of the concrete. Voids, including honeycombing and rock pockets, and tie holes shall be repaired as required by the specified Surface Finish.

2. Unformed Surfaces: Concrete surfaces requiring repair shall include all surface defects such as crazing, cracks in excess of 1/32” in width or cracks that penetrate to reinforcement or through the member, popouts, spalling, and honeycombs.

B. Classification:

1. Structural Concrete Repair: Major defective areas in concrete members that are load carrying (such as shear walls, beams, joists and slabs), are highly stressed, and are vital to the structural integrity of the structure shall require structural repairs. Structural concrete repairs shall be made using a two-part epoxy bonder, epoxy mortar, or specified polymer repair mortar. The Engineer shall determine the locations of required structural concrete repairs.
2. Cosmetic Concrete Repair: Defective areas in concrete members that are non-load carrying and minor defective areas in load carrying concrete members shall require cosmetic concrete repair when exposed to view and not covered up by architectural finishes. Cosmetic concrete repairs may be made using a polymer repair mortar and compatible bonding agent. The Architect/Engineer shall determine the locations of required cosmetic concrete repairs. Stains and other discolorations that cannot be removed by cleaning and are exposed to view will require cosmetic repair. Cosmetic concrete repair in exposed-to-view surfaces will require Architect's approval prior to patching operation.
3. Slab Repairs: High and low areas in concrete slabs shall be repaired by removing and replacing defective slab areas unless an alternate method, such as grinding and/or filling with self-leveling underlayment compound or repair mortar is approved by the Architect/Engineer. Repair of slab spalls and other surface defects shall be made using epoxy products as specified above and as determined by the Engineer. The high strength flowing repair mortar may be used for areas greater than one inch in depth.

3.15 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Refer to Specification 01 45 29 “Structural Testing and Inspections” for testing and inspection requirements associated with cast-in-place concrete.

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SECTION 04 20 00 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Clay face brick.
   3. Mortar and grout.
   4. Embedded flashing.
   5. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:
   1. Steel lintels in unit masonry.
   2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:
   1. Section 04 22 13 " Structural Reinforced Concrete Unit Masonry" for reinforced masonry load bearing walls.
   2. Section 04 72 00 “Cast Stone Masonry” for cast-stone trim furnished and installed in unit masonry.

1.3 REFERENCE STANDARDS

A. The Brick Industry Association (BIA), 11490 Commerce Park Drive, Reston VA 20191, www.bia.org

B. National Concrete Masonry Association (NCMA) 13750 Sunrise Valley Drive, Herndon, VA 20171-4662, www.ncma.org

C. Portland Cement Association (PCA), 5420 Old Orchard Road, Skokie, IL 60077, www.portcement.org

D. ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959, www.astm.org
   1. ASTM C216 Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)
   2. ASTM C652 Standard Specification for Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
   3. ASTM C780 Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
   4. ASTM C270 Standard Specification for Mortar for Unit Masonry
   5. ASTM C1019 Standard Test Method for Sampling and Testing Grout
   6. ASTM C109/C109M Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)

1.4 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
   1. Clay face brick, in the form of straps of five or more bricks.

D. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

1.7 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:
   1. Concrete Masonry Units. See Section 04 22 13.
   2. Brick units.
      a. Include size-variation data verifying that actual range of sizes falls within specified tolerances.
      b. Include test report for efflorescence according to ASTM C67.
   3. Cementitious materials. Include name of manufacturer, brand name, and type.
   4. Mortar admixtures.
   5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   6. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.
   1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.

C. Statement of Compressive Strength: For brick and mortar, provide statement of average net-area compressive strength of brick units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for typical exterior walls in sizes approximately 48 inches long by 60 inches high by full thickness, including face and backup wythes and accessories.
    a. Include cast stone units.
    b. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    c. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.
    d. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    e. Include veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

C. Building Commissioning: The University may employ an independent consultant to serve as building envelope Commissioning agent. In such cases, the technical specifications should stipulate Commissioning procedures and requirements.

1.10 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Local Manufacturing: Manufacture concrete masonry units within 700 miles of project site.

B. Local Raw Materials Extraction: Harvest, extract, or recover raw materials from within a 700-mile radius from project site.

C. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

2.2 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners unless otherwise indicated.

B. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 1900 psi.
2. Density Classification: Normal weight, unless otherwise indicated].
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

2.5 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following:

B. Manufactured Concrete Lintels: ASTM C1623, matching CMUs in color, texture, and density classification.

C. Concrete Lintels: Solid or U-shaped, grout-filled. Comply with the requirements of Division 03, “Cast-in-Place Concrete”, reinforced with mild reinforcing steel or prestressed with prestressing cables.

D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Clay Face Brick: Facing brick complying with ASTM C216.

1. Manufacturers: Full brick shall be manufactured by one of the following:
   a. Cherokee (Macon, GA)
   b. Carolina Ceramics (Columbia, SC).
   c. Triangle (Raleigh, NC)
2. Grade: SW.
3. Type: HBS.
4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C67.
5. Efflorescence: Provide brick that has been tested according to ASTM C67 and is rated "not effloresced."
6. Size (Actual Dimensions): 3-1/2 inches wide by 2-1/4 inches high by 7-5/8 inches long.
7. Basis of Design Colors:
   a. Field (BR-1): Cherokee MS Cherokee Flash 536308.
   b. Accent (BR-2): Cherokee MS Smooth Black.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.
   2. Calcium chloride shall not be added to mortar mixes.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

F. Water: Potable.

2.8 REINFORCEMENT

A. Masonry-Joint Reinforcement, See Section 04 22 13 “Structural Reinforced Concrete Unit Masonry.”

2.9 TIES AND ANCHORS

A. General: See Section 04 22 13 “Structural Reinforced Concrete Unit Masonry.”

2.10 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.016 inch thick.
   2. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
   3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
   4. Fabricate through-wall metal flashing embedded in masonry from stainless steel or copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
   5. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
   6. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
   7. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.

B. Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."
   1. Solder for Stainless Steel: ASTM B32, Grade Sn60, with acid flux of type recommended by stainless steel sheet manufacturer.
   2. Solder for Copper: ASTM B32, Grade Sn50 with maximum lead content of 0.2 percent.
   3. Elastomeric Sealant: ASTM C920, chemically curing urethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.11 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, Type PVC-654-4 with a durometer hardness of 90 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

D. Weep / Cavity Vent Products: Use the following unless otherwise indicated:
   1. Mesh Weep / Vent: Free-draining honeycomb mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch less than depth of outer wythe; in color selected from manufacturer's standard.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
   1. Configuration: Provide one of the following:
      a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
      b. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.13 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use portland cement-lime or unless otherwise indicated.
   3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. Use Type S.
   2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   3. For interior nonload-bearing partitions, Type N may be used instead of Type S.

D. Grout for Unit Masonry: See Section 04 22 13 “Structural Reinforced Concrete Unit Masonry.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

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

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
4. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

G. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

H. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together as indicated in Section 04 22 13 “Structural Reinforced Concrete Unit Masonry.”

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

3.7 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement].

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
   1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

3.9 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry] lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches], and 1-1/2 inches into the inner wythe.
   3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
   1. Use specified weep/cavity vent products to form weep holes.
   2. Space weep holes 24 inches o.c. unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.12 MASONRY WASTE DISPOSAL

A. Masonry Waste: Remove masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

a. For each type of wall construction, test masonry prisms per ASTM C 1314 and as follows:

1) Prepare three sets of prisms for testing at 7 days and three sets for testing at 28 days.
2) Build prisms on job using same materials and methods as for wall construction. Mark each test prism for identification. Construct, store, transport, cure and test prisms according to the requirements of ASTM C 1314.

b. For each type of wall construction, test masonry per ASTM E518 for Flexural Bond Strength.

3. Preconstruction Tests for Shear.

a. Test masonry assemblages for diagonal tension (shear) per ASTM E 519.

4. Preconstruction Strength Tests

a. Test building panels for strength per ASTM E 72.

5. Grout Demonstration Panel: If the proposed grouting procedures, construction techniques, and grout space geometry, including such items as maximum grout pour and grout lift heights and consolidation techniques, do not conform to the requirements of ACI 530.1/ASCE 6/TMS 602, construct a grout demonstration panel prior to masonry construction.
6. Masonry work will not begin until test results are submitted to and approved by the Architect/Engineer.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each type of masonry unit, accessory, and other manufactured products, including certifications that each type complies with specified requirements. Provide certification of pull-out strength of all masonry ties and anchors. Submit certification of compliance with required standards for all masonry units.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars and for templates for layout of dowels for columns and pilasters. Comply with the fabrication tolerances of ACI 315, “Details and Detailing of Concrete Reinforcement.” Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies as required for fabrication and placement of reinforcement for unit masonry work.

C. Formwork Design Calculations: Prepared and sealed by a professional engineer licensed in the state where the project is located.

D. Mix Designs:

1. Mortar mix proportions for type of mortar required to achieve specified compressive strength of masonry.
2. Mix designs and mortar tests performed in accordance with ASTM C 270
3. Grout mix proportions according to ASTM C476 for the types of grout required for the work.
4. Mix designs and grout tests performed in accordance with ASTM C 476.

E. Certificates: Prior to delivery, submit to Architect/Engineer certificates attesting compliance with the applicable specifications for grades, types or classes of all products included in these specifications.

1. All materials required for mortar and grout including type, source, brand, and name of manufacturer.
2. Each combination of masonry unit type and mortar type. Include statement of net area compressive strength of masonry units, mortar type and net compressive strength of masonry determined according to Table 2 in ACI 530.1/ASCE 6/TMS 602.
3. Mill Certificates: Steel producer's certificates of mill analysis, tensile and bend test for reinforcing steel required for project.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver masonry materials to project in undamaged condition.

B. Store and handle masonry units to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion or other causes During freezing weather, protect masonry units with tarpaulins or other suitable material. If units become wet, do not install until they are dry.

C. At the time of delivery, the linear shrinkage of masonry units shall not exceed 0.065 percent.

D. Store cementitious materials and masonry units off the ground, under cover and in dry location. All materials must be protected from wetting by capillary action, rain, or snow, and protected from mud, dust, or other materials and contaminants likely to cause staining or defects.

E. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying in dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

F. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

G. Store masonry accessories, including metal items, in such a way as to prevent corrosion or accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Protection of Work: The Contractor shall construct and maintain temporary protection as required to permit continuous progress of the work. During erection, cover top of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

C. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required.

1. When ambient temperature exceeds 100 degrees F or 90 degrees F with a wind velocity greater than 8 mph, do not spread mortar beds more than 48 inches ahead of masonry. Set masonry units within one minute of spreading mortar.

2. Comply with hot-weather preparation and construction provisions of ACI 530.1/ASCE 6/TMS 602

PART 2 - PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Comply with referenced standards and other requirements indicated below applicable to each form of concrete masonry unit required.

B. Provide special shapes where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions. All special shapes provided shall match approved samples available for inspection at the Architect's office.

C. Provide square-edged units for outside corners, except where indicated as bullnose.

D. Provide units complying with the characteristics indicated below for type, size, strength, and weight.

1. Hollow Loadbearing Block: ASTM C 90
2. Solid Loadbearing Block: ASTM C 90
3. Unit Compressive Strength: Provide units with a minimum average net-area compressive strength of 1900 psi.
4. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" high (15-5/8" x 7-5/8" actual) x thicknesses indicated unless shown otherwise on the drawings.

2.2 CONCRETE AND MASONRY LINTELS

A. General: Provide one of the following consistent with the span and reinforcing tables on the drawings:

1. Manufactured Concrete Masonry Lintels: ASTM C 1623, matching Concrete Masonry Units in color, texture and density classification.
2. Precast Concrete Lintel Units: Solid or U-shaped, grout-filled. Comply with the requirements of Division 03, “Cast-in-Place Concrete”, reinforced with mild reinforcing steel or prestressed with prestressing cables.
3. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam Concrete Masonry Units with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.3 MORTAR AND GROUT MATERIALS

A. Do not use calcium chloride in mortar or grout.

B. See specification section 04 22 00 for mortar specifications.

C. Mortar: ASTM C 270, Proportion Specification, Type S, limiting cementitious materials to those described below:

1. Portland Cement-Lime
2. Mortar Cement

D. Grout: Provide grout that conforms to either of the two requirements below:

1. ASTM C 476, Proportion Specification

SECTION 04 22 13 – STRUCTURAL REINFORCED CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 CODES AND STANDARDS

A. All concrete masonry construction shall conform to the requirements of the local building code and the Specification for Concrete Masonry Structures, ACI 530.1/ASCE 6/TMS 602.

1.2 DESCRIPTION OF WORK

A. Extent of each type of reinforced unit masonry work is indicated on the architectural and structural drawings and in schedules. Provide all labor, materials, equipment, and services necessary for and incidental to the installation of all reinforced masonry construction as indicated on the drawings and specified herein and in Section 04 22 00.

B. Reinforced unit masonry construction includes reinforced concrete masonry including concrete filled masonry beams, columns, pilasters, lintels, and soffits.

C. Accessories include, but are not necessarily limited to ties, horizontal and vertical reinforcement, anchors to the structure, and control joints.

D. The masonry contractor shall install all accessory items that are required in the work and supplied by others, including: bolts, nailing blocks, inserts, anchors, flashing, steel lintels, expansion joints, conduits, cast-stone trim, hollow-metal door frames, etc.

E. Types of masonry work required include Concrete unit masonry (CMU).

1.3 QUALITY ASSURANCE

A. Single Source Responsibility for Masonry Units: Obtain exposed masonry units of uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one manufacturer for each different product required for each continuous surface or visually related surfaces.

B. Single Source Responsibility for Mortar Materials: Obtain mortar ingredients of uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source and producer for each aggregate.

C. Masonry Preconstruction Testing Service: Employ and pay for the services of an independent testing laboratory acceptable to Architect and experienced in performing types of preconstruction masonry tests indicated. The testing laboratory shall meet the basic requirements of ASTM E 329 and have current accreditation from either the American Association for Laboratory Accreditation, the AASHTO Accreditation Program, or the “NIST” National Voluntary Laboratory Accreditation Program..

1. Preconstruction Verification by Unit Strength Method

   a. Concrete Masonry Units: For each type of concrete masonry wall construction shown on the structural or architectural drawings, submit results of tests conducted in accordance with ASTM C140 that demonstrate that the strength of the concrete masonry units are consistent with required compressive strength of the masonry construction shown on the drawings.
   b. Mortar: Submit the proportions of the mortar mix to verify compliance with the specified type.

2. Preconstruction Tests by Prism Methods:

2. The material requirements of ASTM C 476; attains the specified compressive strength or 2000 psi, whichever is greater, at 28 days when tested in accordance with ASTM C 1019; has a slump flow of 24 in. to 30 in. as determined by ASTM C 1611; and has a Visual Stability Index (VSI) less than or equal to 1 as determined in accordance with ASTM C1611.
3. Grout consistency is to be coarse grout unless fine grout is required by ACI530.1/ASCE6/TMS602 based on minimum grout space dimensions coupled with maximum pour heights or unless a stricter requirement is defined by the local code.

2.4 REINFORCING STEEL

A. Uncoated Steel Reinforcing Bars: ASTM A 615, Grade 60.

B. Epoxy-Coated Steel Reinforcing Bars: ASTM A 615, Grade 60, epoxy coated to comply with ASTM A 775.

C. Galvanized Steel Reinforcing Bars: ASTM A 767, Grade 60.

2.5 JOINT REINFORCEMENT, TIES AND ANCHORING DEVICES

A. General:

1. Comply with requirements indicated below for basic materials and with requirements indicated under each form of joint reinforcement, tie and anchor for size and other characteristics.
2. Manufacturers:

a. Subject to compliance with requirements, provide products of one of the following:

1) AA Wire Products Co.
2) Dur-O-Wall, Inc.
3) Hohmann & Barnard, Inc.
4) National Wire Products Corp.
5) Heckman Building Products

b. Other manufacturers shall be used only with Engineer approval. The Contractor shall submit technical literature for all reinforcing units.

3. Finishes: Provide reinforcement, ties, and anchors specified in subsequent paragraphs that are made from materials or that have the finishes that comply with the subparagraphs below, depending on the finish specified, unless otherwise indicated.

a. Hot-Dip Galvanized Finishes

1) Joint Reinforcement, Wire Ties, Wire Anchors: ASTM A 153, (1.5 oz/ft^2).
2) Sheet-metal Ties and Anchors: ASTM A 153, Class B.
3) Steel Plates and Bars: ASTM A 123 or ASTM A 153, Class B.

b. Epoxy Coatings:

1) Joint Reinforcement: ASTM A 884, Class A, Type 1 ≥ 7 mils.
2) Wire Ties and Anchors: ASTM A 889, Class C – 20 mils.
3) Sheet-metal Ties and Anchors: 20 mils per surface or manufacturer's specification.

c. Stainless Steel: AISI Type 304 or Type 316.

B. Joint Reinforcement: ASTM A 951: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods in straight lengths of not less than 10 feet, with prefabricated corner and tee units, and complying with the requirements indicated below:

1. Materials and Finishes:

   a. Galvanized: ASTM A 82.
   b. Epoxy: ASTM A 82.
   c. Stainless Steel: ASTM A 580.

2. Width: Fabricate joint reinforcement in units with widths a minimum of 2" less than nominal width of walls. Provide mortar coverage over joint reinforcement of not less than 5/8" on joint faces exposed to exterior and 1/2" elsewhere.
3. Wire Size for Side and Cross Rods:

   a. 0.1875" diameter (W2.8.) for both side and cross rods.

4. For single-wythe masonry provide either ladder or truss type with single pair of side rods and cross wires in ladder-type or points of connection in truss-type reinforcement spaced no more than 16 inches o.c. horizontally.

C. Bent Wire Ties: Provide individual prefabricated bent-wire units complying with requirements indicated below:

1. Materials and Finishes:

   a. Galvanized: ASTM A 82.
   b. Epoxy: ASTM A 82.
   c. Stainless Steel: ASTM A 580.

2. Wire Size: 0.1875" diameter.
3. Length: Provide units of length indicated but not less than that required for embedment of at least 1 ½ " into the mortar bed of solid units or solid grouted hollow units and for a minimum of 1/2" embedment of tie end into outer face shells of hollow units, with not less than 5/8" mortar cover on exterior face joints, 1/2" elsewhere.
4. Tie Shape for Hollow Masonry Units Laid with Cells Vertical: Rectangular with ends welded closed and not less than 4" wide.
5. Tie Shape for Solid Masonry Units or hollow units laid with cells horizontal: Z-shaped ties with ends bent 90° to provide hooks not less than 2" long.

D. Adjustable Anchors: Where adjustable anchors are indicated for connecting masonry to structural framework, provide 2-piece assemblies as described below which permit vertical or horizontal differential movement between wall and framework parallel to, but resist tension and compression forces perpendicular to, plane of wall.

1. Materials and Finishes:
   a. Galvanized: ASTM A 82 for wire and ASTM A 1008 for sheet metal.
   b. Epoxy: ASTM A 82 for wire and ASTM A 1008 for sheet metal.
   c. Stainless Steel: ASTM A 580 for wire and ASTM A 480 and ASTM A 240 for sheet metal.

2. For anchorage to concrete framework, provide manufacturer's standard anchors with dovetail anchor section formed from 0.0966" thick sheet metal and triangular-shaped wire tie section sized to extend within 1" of masonry face.
3. For anchorage to steel framework provide manufacturer's standard anchors with crimped 1/4" diameter wire anchor section for welding to steel and triangular-shaped wire tie section sized to extend within 1" of masonry face.
4. Wire Size for triangular section: 0.1875" diameter.

E. Rigid Anchors: Provide straps of form and length indicated, fabricated from sheet metal strips of following width and thickness, unless otherwise indicated. Typical length to be 24" plus 2" long, 90° bends at ends.

1. Material and Finishes:

   a. Galvanized: ASTM A 1008.
   b. Epoxy: ASTM A 1008.
   c. Stainless Steel: ASTM A 480 and ASTM A 240.

2. Width: 1-1/2".
3. Thickness: 1/4".

F. Dovetail Slots: Furnish dovetail slots, with filler strips, of slot size indicated, fabricated from 0.0336" (22 gage) sheet metal, ASTM A 1008, Hot-dip galvanized.

G. Anchor Bolts: Provide steel bolts with hex nuts and flat washers complying with ASTM A 307, Grade A, hot-dip galvanized to comply with ASTM A 153, Class C, in sizes and configurations indicated.

H. Postinstalled Anchors:

1. ICC Approval: Only anchors evaluated by the ICC Evaluation Service, Inc. (ICC-ES) with a published Evaluation Report specifically addressing anchorage to hollow or fully grouted concrete masonry shall be approved for use.
2. Type:

   a. Hollow Concrete Masonry: Anchors into or through hollow concrete masonry units shall be the chemical type used with a galvanized or stainless steel screen tube that allows the chemical adhesive to create a key within the hollow cell of the unit.
   b. Fully Grouted Concrete Masonry: Anchors into fully grouted masonry shall be either chemical anchors or expansion anchors specifically approved by ICC-ES for use in fully-grouted concrete masonry.

3. Finish:

   a. Interior Exposure: All anchors, nuts and washers for use in interior environments free of potential moisture shall be manufactured from carbon steel, zinc plated in accordance with Federal Specification QQ-Z-325C, Type II, Class 3.
   b. Exterior or Exposed Use: All anchors, nuts, and washers for use in exposed or potentially wet environments, or for attachment of exterior cladding materials shall be galvanized or stainless steel. Galvanized anchors, nuts and washers shall conform to ASTM A 153. Stainless steel anchors shall be manufactured from 300 series stainless steel and nuts and washers from 300 series or Type 18-8 stainless steel.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Non-Metallic Expansion Joint Strips: Premolded, flexible cellular neoprene rubber filler strips complying with ASTM D 1056, Grade RE 41E1, capable of compression up to 35%, of width and thickness indicated.

B. Premolded Control Joint Strips: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Premolded PVC Control Joint Strips. Strips shall be polyvinyl chloride complying with ASTM D 2287, Type PVC 654-4 with a durometer hardness of 90.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Inspect surfaces that are to support masonry work to assure completion to proper lines and grades and are free of dirt and other deleterious material. Do not begin work until surfaces not properly prepared have been satisfactorily corrected.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations or other supporting surfaces are within specified tolerances.
3. Verify that reinforcing dowels are properly spaced.
4. Examine rough-in and built-in construction to verify actual locations of piping connections.

B. The horizontal and vertical spacing between anchors tying the masonry wall to the structural frame shall be as indicated on the drawings. Intersecting walls may substitute for an anchor.

C. Cleaning Reinforcing: Before placing, remove loose rust, ice and other coatings from reinforcing.

D. Installation of Masonry, General:

1. Build cavity and composite walls, floors and other masonry construction to the full thickness shown. Build single-wythe walls (if any) to the actual thickness of the masonry units, using units of nominal thickness indicated.
2. Build chases and recesses as shown or required for the work of other trades. Provide not less than 8" of masonry between chase of recess and jamb of openings, and between adjacent chases and recesses.
3. Leave openings for equipment to be installed before completion of masonry work. After installation of equipment, complete masonry work to match work immediately adjacent to the opening.
4. Cut masonry units using motor-driven dry-cutting or water-cooled saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous patterns and to fit adjoining work. Use full-size units without cutting where possible.
5. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Do not install cracked, broken, or chipped masonry units exceeding ASTM allowances.

F. Protect sills, ledges, and offsets from mortar droppings or other damage during construction. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface. Remove misplaced mortar or grout immediately. Protect face materials against staining. Protect door jambs and corners from damage during construction.

G. Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry.

H. Mixing Mortar and Grout: Comply with the requirements of ACI 530.1/ASCE 6/TMS 602.

3.2 CONSTRUCTION TOLERANCES

A. Comply with tolerance in ACI 530.1/ASCE 6/TMS 602 and the following.

B. For conspicuous vertical lines such as external corners, reveals, expansion and control joints, do not exceed 1/4" in any story or 20 feet maximum, nor 1/2" maximum.

C. For vertical alignment of exposed head joints do not vary from plumb by more than 1/4" in 10 feet, nor 1/2" maximum.

D. Variation from Level: For conspicuous horizontal lines such as exposed lintels, sills, parapets, and reveals, do not exceed 1/4" in any bay or 10 feet maximum, nor 1/2" maximum. For top surface of bearing walls do not exceed 1/8" between adjacent floor elements in 10 feet or 1/16" within width of a single unit.

3.3 LAYING MASONRY WALLS

A. Do not wet concrete masonry prior to laying up units unless written permission is obtained from the Engineer.

B. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate location of openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units, particularly at corners, jambs and wherever possible at other locations.

C. Lay-up walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other work.

D. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2". Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4" horizontal face dimensions at corners or jambs.

E. Stopping and Resuming Work: In each course, rack back one-half-unit length for one-half running bond or one-third unit for one-third running bond. Do not tooth. Clean exposed surfaces at set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

F. Built-in Work: Install bolts, anchors, nailing blocks, inserts, frames, vent flashings, conduit, and other built-in items specified under this and other sections of these specifications as masonry work progresses. Avoid cutting and patching. Solidly grout spaces around built-in items. Provide joints around exterior framed openings 1/4" to 3/8" wide, raked and tooled smooth to a uniform depth of 3/4", ready for caulking by others. Build chases, do not cut. Consult other trades in advance and make provisions for installation of their work to avoid cutting and patching. Install chases minimum of one full masonry unit length from jambs.

1. Fill in space between hollow metal frames and masonry solidly with mortar, unless otherwise indicated.
2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core, unless detailed otherwise.
3. Fill cores in hollow concrete masonry units with grout to supporting beam or slab below under bearing plates, beams, lintels, posts and similar items, unless otherwise indicated.

G. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

1. For horizontally reinforced masonry, provide continuity at corners with prefabricated "L" units, in addition to masonry bonding.

H. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, provide same type of bonding specified for structural bonding between wythes and space as follows:

1. Provide individual metal ties at not more than 16" o.c. vertically.
2. Provide continuity with horizontal joint reinforcement using prefabricated "T" units.

I. Intersecting Load-bearing Walls: If carried up separately, block or tooth vertical joint with 8" maximum offsets and provide rigid steel anchors spaced not more than 4'-0" o.c. vertically, or omit blocking and provide rigid steel anchors at not more than 2'-0" o.c. vertically. If used with hollow masonry units, embed ends in mortar-filled cores.

3.4 MORTAR BEDDING AND JOINTING

A. Provide uniform nominal joint thickness of 3/8” for concrete masonry units, unless noted otherwise on the drawings.

B. Lay solid masonry units and fully-grouted hollow CMU with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not furrow bed joints or slush head joints.

C. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings and in all courses of piers, columns and pilasters, and where adjacent to cells of cavities to be reinforced or filled with concrete or grout. For starting course on footings where cells are not grouted, spread out full mortar bed including areas under cells.

D. Joint Profile: Provide weather-proof, concave, tooled joints in exposed surfaces when mortar is thumbprint hard, using round jointing tool. Strike joints flush in surfaces to be plastered, stuccoed, or covered with other material or surface-applied finish other than paint. Concave tool exterior joints below grade. Remove mortar protruding into cells or cavities to be grouted. Do not permit mortar droppings to block weep holes. Do not fill horizontal joints between top of masonry partitions and underside of concrete or steel construction with mortar unless specifically shown on the drawings. If not shown otherwise, provide 1" clear joint to be filled with caulk. Keep movement joints clean of all mortar and debris. For tuckpointing, rake mortar joints to a depth of 1/2 to 3/4 in., saturate with clean water, fill solidly with pointing mortar, and tool to match existing joints.

E. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners of jambs to shift adjacent stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

F. Collar Joints: Unless otherwise required, After each course is laid, fill the vertical longitudinal joint between wythes solidly with mortar (grout if walls are grouted) for the following masonry work:

1. All below grade conditions.

3.5 CONSTRUCTION STABILITY

A. Design, provide and install bracing that will assure stability of masonry during construction.

B. Allow 16 hours to elapse after completion of masonry columns and walls before placing floor or roof construction loads. Allow an additional 48 hours before applying concentrated loads such as girders, beams, or trusses.

3.6 STRUCTURAL BONDING OF MULTI-WYTHE MASONRY

A. Where Horizontal Joints Align:

1. Tie wythes together with continuous horizontal joint reinforcing, installed in mortar joints at not more than 16" o.c. vertically.
2. Alternatively, use bent wire ties, providing one for every 4.5 sq. ft. of wall area but spaced no greater apart than 36” horizontally and 24” vertically.

B. Where Horizontal Joints do not Align:

1. Tie wythes together with adjustable, two-piece, ladder-type horizontal joint reinforcing placed in the mortar joint of the thicker wall at no more than 16” vertically.
2. Bed joints of opposing wythes shall not be farther apart vertically than 1-1/2" either direction.

C. Openings: Provide additional ties around openings greater than 16’ in either direction within 12” of the opening and around the perimeter at a maximum of 3’-0” on center.

D. Provide ties within 12” of unsupported edges at a maximum of 24” vertically.

3.7 CAVITY WALLS

A. Keep cavity clean of mortar droppings and other materials during construction. Strike joints facing cavity flush.

B. Provide weep holes in head joints in first course immediately above all flashing. Leave head joint free and clean of mortar or install weep hole tube in head joint. Space weep holes 32" on center maximum for concrete unit masonry. Keep weep holes and area above

3.8 HORIZONTAL JOINT REINFORCEMENT

A. General:

1. Provide continuous horizontal joint reinforcement as indicated. Install longitudinal side rods in mortar for their entire length with a minimum cover of 5/8" on exterior side of walls, 1/2" elsewhere. Lap reinforcing a minimum of 6" at splices.
2. Cut or interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.
3. Reinforce walls with continuous horizontal joint reinforcing unless specifically noted to be omitted.
4. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.
5. Space continuous horizontal reinforcement as follows:

a. For multi-wythe walls (solid or cavity) space horizontal reinforcement 16" o.c. vertically.
b. For single-wythe walls, space reinforcement at 16" o.c. vertically, unless otherwise indicated.
c. For perforated masonry screen walls, space reinforcement at every other course vertically, not to exceed 16” o.c., unless otherwise indicated.
d. For concrete masonry cantilever walls and fences, space reinforcement at 8" o.c. vertically, unless otherwise indicated.

6. Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcement placed in two horizontal joints approximately 8" apart, immediately above the lintel and immediately below the sill. Extend reinforcement a minimum of 2'-0" beyond jambs of the opening except at control joints. Horizontal joint reinforcement interrupted by the jamb of an opening shall have the cross rod or side rod bent and hooked at the jamb. Provide an additional rectangular adjustable tie at the jamb for each joint not containing the normal horizontal reinforcing unit.
7. Provide reinforcement at openings in addition to other specified wall reinforcement.

3.9 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at the spacing indicated. Prior to grouting, support and secure vertical bars against displacement. Vertical bars shall be held in position at the top and bottom and at intervals not exceeding 8'-0" with a minimum clearance of 1/4" if fine grout is used or 1/2” if coarse grout is used from the face of the masonry and not less than one bar diameter or 1" (whichever is greater) between adjacent bars.

C. All dowels shall be grouted into a cell even if the dowel is in an adjacent cell to the vertical steel. Unless detailed otherwise on the drawings, dowels shall be the same size and number as the vertical steel. Unless noted otherwise provide a lap length of dowels to vertical reinforcement equal to 50 times the nominal dowel diameter.

D. All horizontal reinforcing steel shall be placed in continuous bond beam or lintel block units and shall be solidly grouted in place. Maintain a minimum of one bar diameter or 1" (whichever is greater) clearance between adjacent bars and a minimum of 1/4" clearance if fine grout is used or 1/2” if coarse grout is used from the face of the masonry. Horizontal reinforcement may be placed as the masonry work progresses.

E. Splice reinforcement bars where shown; do not splice at other points unless acceptable to the Engineer. Where splices occur, adjacent splices shall be staggered so that no more than 25% of the total number of bars is spliced at any one point with a minimum stagger between splices in adjacent bars of at least the lap length. Provide lapped splices, unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie. Minimum lap splice length shall be 50 bar diameters unless indicated otherwise.

F. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.

3.10 FORMWORK AND SHORES

A. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

B. Construct formwork to conform to shape, line and dimensions shown. Make sufficiently tight to prevent leakage of mortar, grout, or concrete (if any). Brace, tie and support as required to maintain position and shape during construction and curing of reinforced masonry.

C. Formwork shall be designed and shop drawings prepared by a registered professional engineer in the state where the project is located.

D. Formwork shall not be removed until the reinforced masonry member has cured sufficiently to carry its own weight and any other loads that may be placed on it during construction. Allow not less than the following minimum time to elapse after completion of the member before removing shores or forms provided adequate curing conditions have been obtained during the curing period:

1. Lintels and beams: 10 days.
2. Reinforced masonry soffits: 7 days.

3.11 GROUTING

A. General: Where detailed, grout in reinforced masonry walls, columns, and pilasters. Fully grout vertical cells of concrete masonry containing steel reinforcement.

B. Specification: Comply with the requirements of ACI 530.1/ASCE 6/TMS 602 for cleanouts, grout space preparation, and grout placement, including minimum grout space, maximum pour height, maximum lift height and consolidation.

1. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
2. Place grout in lintels or beams over openings in one continuous pour.
3. Where bond beam occurs more than one course below top of pour and vertically reinforced cells are present above the bond beam, fill bond beam course to within 1-1/2" of the top of the bond beam.
4. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 1-1/2" of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.12 CONTROL AND EXPANSION JOINTS

A. General: Provide vertical and horizontal expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses.

B. Where control joints are not indicated on the drawings the Contractor shall submit a proposed control joint layout for Architect and Engineer approval. General guidelines for control joint locations are as follows:

1. At major changes in wall height.
2. At changes in wall thickness.
3. At corresponding control joints in foundations, floor, or roof construction.
4. At one or both sides of wall openings (masonry veneer only).
5. Near wall intersections.
6. At column centerlines.

C. Maximum Spacing: Maximum control joint spacing in concrete masonry construction shall be such that the ratio of wall length to height shall not exceed 1.5 with a maximum spacing of 25 feet.

D. Form control joints in concrete masonry as follows:

1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake joints in exposed faces.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake joint.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete.

E. Build in horizontal pressure relieving joints where indicated; construct joints by inserting non-metallic compressible joint filler of width required to permit installation of sealant and backer rod.

F. Provide continuous bond break at steel columns and members.

G. Provide pressure-relieving joints by adhering a continuous 3/8" thick neoprene pad below shelf angles supporting masonry veneer.

H. Leave joints around outside perimeters of exterior doors, window frames and other wall openings:

1. Depth: Uniform 3/4 in. (19mm).
2. Width: 1/4 in. (6.4 mm) to 3/8 in. (9.5mm).

3.13 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and wherever openings of more than 2'-0" for block size units are shown without structural steel or other supporting lintels.

1. For hollow concrete masonry unit walls, use specially formed U-shaped lintel units with reinforcement bars placed as shown filled with coarse grout.

C. Provide minimum bearing as noted on the drawings.

3.14 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing:

1. During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Pointup all joints including corners, openings and adjacent work to provide a neat, uniform appearance, prepared for application of sealants. If the repairs must be made after the mortar has hardened, the joint must be raked or chiseled out to a depth of about 1/2" thoroughly wetted, and repointed with fresh mortar.
2. To prehydrate mortars, thoroughly mix all ingredients except water in proportions used for original mortar mix; then mix again, adding only enough water to produce a damp unworkable mix which will retain its form when pressed into a ball. After 1 to 2 hours, add sufficient water to bring it to the proper consistence; that is conventional masonry mortars.

C. Final Cleaning: After mortar is thoroughly set and cured, clean masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and non-metallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave 1/2 panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film or waterproof masking tape.
4. Saturate wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clean water.
5. Clean concrete unit masonry to comply with masonry manufacturer's directions and NCMA Tek 8-2 bulletin.

D. Protection and Cleanup:

1. Provide final protection and maintain conditions in a manner acceptable to Installer, which ensure unit masonry work being without damage and deterioration at time of substantial completion.
2. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

3.15 QUALITY ASSURANCE TESTING AND INSPECTION DURING CONSTRUCTION

A. See Testing Laboratory Services section of these Specifications for masonry work inspection and test requirements.

END OF SECTION 04 22 13

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SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cast-stone trim including, but not limited to the following:
      a. Surrounds.
      b. Cornices
      c. Wall panels.
      d. Column covers.

B. Related Sections:
   1. Section 04 20 00 "Unit Masonry" for additional information regarding the mock-up.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
   1. Include building elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar.

E. Samples for Verification:
   1. For each color and texture of cast stone required, 10 inches square in size.
   2. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

F. Full-Size Samples: For each color, texture] [and] [shape] of cast-stone unit required.
   1. Make available for Architect's review at Project site.
   2. Make Samples from materials to be used for units used on Project before beginning production of units for Project.
   3. Approved Samples may be installed in the Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.
   1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C1364.

B. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C1364, including test for resistance to freezing and thawing.
   1. Provide test reports based on testing within previous two years.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of typical panels as part of the mock-up specified in Section 04 20 00 “Unit Masonry.”

1.6 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work.

B. Pack, handle, and ship cast-stone units in suitable packs or pallets.
   1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
   2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Local Manufacturing: Manufacture cast stone units within 700 miles of project site.

B. Local Raw Materials Extraction: Harvest, extract, or recover raw materials from within a 700-mile radius from project site.

C. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST-STONE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C114. Provide white cement as required to produce cast-stone color indicated.

B. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C33/C33M; gradation and colors as needed to produce required cast-stone textures and colors.

C. Fine Aggregates: Natural sand or crushed stone complying with ASTM C33/C33M, gradation and colors as needed to produce required cast-stone textures and colors.

D. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C260/C260M. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-Reducing Admixture: ASTM C494/C494M, Type A.
5. Water-Reducing, Retarding Admixture: ASTM C494/C494M, Type D.
6. Water-Reducing, Accelerating Admixture: ASTM C494/C494M, Type E.

E. Reinforcement: Deformed steel bars complying with ASTM A615/A615M, Grade 60. Use epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast-stone material.

1. Epoxy Coating: ASTM A775/A775M.

F. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666, Type 304.

2.3 CAST-STONE UNITS

A. Local Manufacturing: Manufacture cast stone units within 700 miles of Project site.

B. Local Raw Materials Extraction: Harvest, extract, or recover raw materials from within a 700-mile radius from project site.

C. Cast-Stone Units: Comply with ASTM C1364.

1. Units shall be manufactured using the vibrant dry tamp or wet-cast method.

D. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

E. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

F. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:
    a. No fewer than five days at mean daily temperature of 70 deg F or above.
    b. No fewer than six days at mean daily temperature of 60 deg F or above.
    c. No fewer than seven days at mean daily temperature of 50 deg F or above.
    d. No fewer than eight days at mean daily temperature of 45 deg F or above.

G. Acid etch units after curing to remove cement film from surfaces to be exposed to view.

H. Colors and Textures: Match the color and texture of the cast sone on adjacent Building 1291 (Plant Diagnostic Center).

2.4 MORTAR MATERIALS

A. Regional Materials: Extract, harvest, or recover aggregate for mortar and grout**, cement, and lime** within 700 miles of Project site.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Aggregate for Mortar: ASTM C144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

E. Water: Potable.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666.

B. Dowels: 1/2-inch-diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276, or ASTM A666.

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast-stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.6 MORTAR MIXES

A. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Comply with ASTM C270, Proportion Specification.
1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

2.7 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast-stone units according to ASTM C1364.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.
   1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
   2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

B. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

C. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Set units with joints 3/8 to 1/2 inch wide unless otherwise indicated.
   2. Build anchors and ties into mortar joints as units are set.
   3. Fill dowel holes and anchor slots with mortar.
   4. Fill collar joints solid as units are set.
   5. Build concealed flashing into mortar joints as units are set.
   6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
   7. Keep joints at shelf angles open to receive sealant.

D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

F. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes labor, materials, services, equipment, and appliances required in conjunction with or related to the furnishing, fabrication, delivery, and erection of all structural steel, as defined below. Include all supplementary parts, members, and connections necessary to complete the structural steel work, regardless of whether all such items specifically are shown or specified on the drawings. Miscellaneous metal fabrications, architecturally exposed structural steel, metal stairs and ladders, steel joists and joist girders, cold-formed metal framing, and steel deck are specified in other Division 05 sections.

B. Related Requirements:

1. Specification 014529 “Structural Testing and Inspections” for testing and inspection requirements associated with structural steel.
2. Specification 099100 “Painting” for surface preparation and priming requirements.

1.2 PRICE AND PAYMENT PROCEDURES

A. Alternates: Substitutions for the member sizes, type(s) of steel connection details, or any other modifications proposed will be considered by the Architect/Engineer only under the following conditions:

1. The request has been made and accepted prior to the submission of shop drawings. All substitutions shall be marked clearly and indicated on the shop drawings as a substitute.
2. There is a substantial cost advantage or time advantage to the Owner or that the proposed revision is necessary to obtain the required materials or methods at the proper times to accomplish the work in the time scheduled.
3. Sufficient sketches, engineering calculations, and other data have been submitted to facilitate checking by the Architect/Engineer, including cost reductions or savings in time to complete the work.
4. In no case shall such substitutions result in additional cost to the Owner.

1.3 REFERENCES

A. Definitions:

1. Erection Drawings: Field installation or member-placement drawings that are prepared by the Fabricator to show the location and attachment of the individual shipping pieces.
2. Erection-Bracing Drawings: Drawings that are prepared by the Erector to illustrate the sequence of erection, any requirements for temporary supports, and the requirements for raising, bolting, and or/welding. These drawings are in addition to and separate from the Erection Drawings.
3. Professional Engineer: A professional engineer who is licensed to practice engineering in the state where the project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material.
4. Shop Drawings: Drawings of the individual structural steel shipping pieces that are to be produced in the fabrication shop.
5. Structural Steel: Structural steel shall be defined as that work prescribed in Section 2.1 of AISC 303 and all steel support for elevator guide rails and catwalks (including support

members and attached structural steel shapes and plates such as hangers, toe plates, and the walking surface).

B. Reference Standards:

1. Codes and Standards: Comply with provisions of following codes, specifications, and standards, except where more stringent requirements are shown or specified.
   a. All federal (OSHA), state, and local laws that govern safety requirements for steel erection and other requirements if more stringent than the codes and standards enumerated below. OSHA requirements include regulation 29 CFG 1926, Part R, “Safety Standard for Steel Erection”.
   b. AASHTO, “LRFD Bridge Design Specifications”, U.S. Customary Units.
   c. AASHTO, “LRFD Bridge Construction Specifications.”
   d. AISC, “Steel Construction Manual.”
   e. AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," except as noted herein.
      1) Certain sections in this specification contain requirements that are more restrictive and/or different than contained in this standard. In such cases, the requirements of this specification shall control.
   f. ANSI/AISC 360, “Specification for Structural Steel Buildings.”
   g. ANSI/AWS D1.1, "Structural Welding Code – Steel.”
   h. ANSI/AWS D1.3, "Structural Welding Code – Sheet Steel.”
   i. ANSI/AWS D1.4, "Structural Welding Code – Reinforcing Steel.”
   j. ANSI/AWS D1.8, “Structural Welding Code – Seismic Supplement.”
   k. Research Council on Structural Connections (RCSC), “Specification for Structural Joints using High-Strength Bolts.”
   l. The Society of Protective Coatings, "SSPC Painting Manual", Volumes 1 and 2.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Quality Control:
   a. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.
   b. The Contractor shall coordinate the fabrication and erection of all structural steel work with the work of other trades.
   c. The Fabricator alone shall be responsible for all errors of detailing, fabrication, and for the correct fitting of the structural members.
   d. The Fabricator shall coordinate connection details, joint fit-up procedures, and field adjustment requirements with Erector. The Contractor shall coordinate provision of all erection bolts, lifting lugs, or other devices required for erection with the Fabricator and the Erector and for interference with architectural finishes and constraints.
2. Document Conflict and Precedence:
   a. In case of conflict among documents, including architectural and structural drawings and specifications, notify Architect/Engineer prior to submitting proposal. In case of conflict between and/or among the structural drawings and specifications, the strictest interpretation shall govern, unless specified otherwise in writing by the Architect/Engineer.
   b. Questions about Contract Documents: The Contractor shall notify promptly the Architect/Engineer whenever design of members and connections for any portion of the structure are not indicated clearly or when other questions exist about the

Contract Documents. Such questions shall be resolved prior to the submission of shop drawings.

3. Materials and installed work may require testing and retesting, as directed by the governing building code or the Architect/Engineer, at any time during progress of work.
   a. The Contractor shall provide adequate notification to the Owner's Testing Agency of construction operation including the project schedule to allow the Testing Agency to schedule inspections. Failure to notify sufficiently may result in additional costs incurred by the Testing Laboratory that may be back-charge to the Contractor by the Owner.
   b. The Contractor shall cooperate with laboratory personnel, provide access to the work, and provide access to manufacturer's operations.
   c. The Contractor shall cooperate with the Owner's Testing Laboratory when Arbitration Testing and Inspection is called for due to a disagreement regarding the tension in installed bolts that have been inspected according to the Structural Testing and Inspections specification.
   d. The Contractor shall make adequate arrangement with the Owner's Testing Agency for inspection of material stockpiles and facilities.
   e. The Contractor shall provide to the laboratory certificates and representative samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.
   f. The Contractor shall furnish labor, equipment, and facilities as required for sampling and testing by the laboratory and other facilitates the required inspections and test.
   g. Inspection or testing by the Owner does not relieve the Contractor of his responsibility to perform the Work in accordance with the Contract Documents. Test not specifically indicated to be done at the Owner's expense, including retesting of rejected materials and installed work, shall be done at the Contractor's expense. See the Structural Testing and Inspections Specification.

B. Preinstallation Meetings:
   1. At least 14 days prior to beginning structural steel erection, the Contractor shall hold a meeting to review the detailed quality control and construction requirements and to determine the procedures for producing proper structural steel construction. Also, review requirements for submittals, status of coordinated work, and availability of materials. Establish work progress schedule and procedures for materials inspection, testing, and certification.
   2. The Contractor shall require responsible representatives of every party who is concerned with the structural steel work to attend the conference, including, but not limited to, the following:
      a. Contractor's Superintendent.
      b. Laboratory responsible for field quality control.
      c. Special Inspector or Laboratory responsible for shop inspection or testing.
      d. Structural steel detailer.
      e. Structural steel fabricator.
      f. Structural steel erector.
      g. Owner's Representative.
      h. Engineer.
   3. Minutes of the meeting shall be record, typed, and printed by the contractor and distributed to all parties concerned within five days of the meeting. One copy of the minutes shall be transmitted to the following for information purposes:
      a. Owner's Representative.
      b. Architect.

c. Engineer.

4. The Engineer shall be present at the conference. The Contractor shall notify the Engineer at least seven days prior to the scheduled date of the conference.

1.5 SUBMITTALS

A. Product Data: Submit producer's or manufacturer's specifications and installation instructions for following products to show compliance with specifications, including the specified standards):

1. Shrinkage-Resistant Grout.
2. Welding Electrodes.
3. Structural Steel Primer Paint.
4. Inorganic or Other Protective Paint.

B. Shop Drawings:

1. Detailed Shop Drawings: Submit drawings showing complete details and schedules for fabrication and assembly of structural steel members. Drawings shall include the following minimum information:
   a. Details of cuts, connections, camber, holes, and other pertinent data.
   b. Indication of welds by standard AWS symbols, and show size, length, and type of each weld.
   c. Indication of type, size, and length of bolts, distinguishing between shop and field bolts. Identify the type of high-strength bolted connection (slip-critical, direct-tension, or bearing connections). Indicate locations of pretensioned bolts.
   d. Connection material specification and sizes.
   e. Holes, flange cuts, slots, and openings shall be made as required by the structural drawings, all of which shall be properly located by means of templates.
   f. Setting drawings, templates, and directions for installation of anchor rods and other anchorages to be installed by others.
   g. Non-Destructive Testing (NDT) to be performed by the Fabricator, if any.
   h. A letter sealed by the Fabricator's Professional Engineer responsible for the design of any of the connections shown on the shop drawings attesting that the engineer has reviewed the shop drawings and that the connections detailed and shown on the shop drawings conform to the engineer's design.
   i. Identification of:
      1) Demand Critical Welds.
      2) Locations where weld backing is to be removed.
      3) Locations where fillet weld reinforcement is to be added to steel backing left in place.
      4) Locations where weld tabs are to be removed.
2. Erection Drawings: Submit complete erection drawings showing field installation and member-placing instructions for locating and attaching the individual shipping pieces.
3. Erection-Bracing Drawings: Submit, for record purposes only, complete erection-bracing drawings.
4. All drawings submitted for review shall have blank space for a 2" high and 3.5" wide shop drawing stamp of the Engineer as part of the title block

C. Samples:

D. Certificates:

1. Structural Steel: Submit for each type.
2. Unfinished Bolts and Nuts.

E. Test and Evaluations Reports: Submit certified reports of tests required by this Specification. Include data on type(s) of tests conducted and test results.

1. For structural steel where is it unclear if the steel conforms to the ASTM requirements, submit certified test reports that verify conformity to ASTM standards.

F. Field Quality Control Submittals:

1. Surveys: Submit for each survey required.

G. Qualification Statements:

1. Submit qualification data, including required certifications, for firms and persons specified in the “Qualifications” section under Part 1, to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
2. Submit a resume from the structural steel detailer showing a minimum of two years of experience selecting or completing structural steel connection details using information found in tables in the AISC “Steel Construction Manual”.
3. Submit Welding Procedure Specifications (WPS) in accordance with ANSI/AWS D1.1 for all welded joints. Submit test reports showing successful passage of qualification tests for all non-prequalified WPSs.
4. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests as specified in the “Qualifications” section under Part 1. If recertification of welders is required, retesting will be at Contractor's responsibility.
5. A fabricator that is registered with the local building official and is approved to perform fabrication without special inspection shall submit a certificate of compliance stating that the work was performed in accordance with the approved construction documents.

H. Record Documentation:

I. Minutes of Preinstallation Meeting: Submit for review.

1.6 QUALITY ASSURANCE

A. Scope of Work:

1. Contract Obligations:
   a. Owner Responsibility: The Owner shall pay for initial shop and field inspections and tests as required during the fabrication and erection of the structural steel.
   b. Testing Laboratory Responsibility: The inspection by the Testing Laboratory of the Fabricator’s work shall be in sequence, timely, and performed in such a manner so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years of experience in structural steel testing and inspection. Refer to “Qualifications of Welding Inspectors” Paragraph below. The Testing Laboratory shall provide test reports of inspections. All test reports shall indicate types and locations of defects found during inspection, the measures required and performed to correct such defects, statements of final approval of welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. Weld inspection reports shall be signed by an inspector with current certification as an AWS Certified Welding Inspector (CWI). In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of the test reports.
   c. Rejection of Material or Workmanship: The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Testing Laboratory Requirements: The Owner's Testing Laboratory shall:
   1. Verify the fabrication shop's certification from AISC.
   2. Verify that the fabricator's fabrication and quality control procedures provide a sound basis for inspection control of workmanship and of the ability to conform to construction documents and industry standards. Review the procedures for completeness and adequacy relative to code requirements for the fabricator's finished product.
   3. Review field welder qualifications by certification or verify by retesting. Obtain welder certificates.

C. Qualifications:
   1. Fabricator:
      a. The structural steel fabricator shall have not less than five years of experience in the successful fabrication of structural steel similar to this project.
      b. The structural steel fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant in Category STD, Standard for Steel Building Structures.
   2. Detailer:
      a. The structural steel detailer shall have not less than five years of experience in the successful detailing of structural steel similar to this project including experience in selecting or completing structural steel connection details using information found in tables in the AISC "Steel Construction Manual.
      b. The structural steel detailer firm shall be certified under the Quality Procedures Program of the National Institute of Steel Detailing. The project shall be detailed by qualified structural steel detailers who are either personally certified under the National Institute of Steel Detailing as a Class I or Class II Detailer in the Structural/Miscellaneous discipline or are supervised by a detailer certified as a Class I Senior Detailer in the Structural/Miscellaneous discipline.
   3. Erector:
      a. The structural steel erector shall have not less than five years of successful experience in the erection of structural steel of a similar nature to this project.
      b. The structural steel erector must participate in the AISC Erector Certification Program and be designated an AISC Advanced Certified Steel Erector.
      c. The structural steel erector shall have not less than five years of successful experience in the erection of structural steel including not less than three projects using heavy trusses.
   4. Welding Qualifications: Qualify welding processes and welding operators in accordance with AWS "Structural Welding Code – Steel".
   5. Professional Engineer:
      a. The Professional Engineer employed by the Fabricator for connection design shall be experienced in the specific area of structural steel connection design with demonstrated experience of not less than three projects of similar scope and complexity.
      b. The Professional Engineer employed by the Erector for preparation of Erection Bracing Drawings shall be experienced in the specific area of structural frame bracing during erection design with demonstrated experience of not less than three projects of similar scope and complexity.
   6. Specialty Welding Consultant: The welding consultant employed by the Fabricator shall be a licensed Professional Engineer registered in the state where the project is located and shall have a minimum of five years of experience in weld engineering.
   7. Independent Testing Laboratory:

a. Any testing laboratory retained to perform tests that are required by this specification shall meet the basic requirements of ASTM E 329 and shall submit to the Owner, Architect, and Engineer evidence of current accreditation from the American Association for Laboratory Accreditation, the AASTHO Accreditation Program or the “NIST” National Voluntary Laboratory Accreditation Program.

b. The Testing Laboratory shall be an Approved Agency by the Building Official to perform Special Inspections and other tests and inspections as outlined in the applicable building code.

c. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

d. Qualification of Welding Inspectors:

1) Inspectors performing visual weld inspection shall meet the requirements of AWS D1.1 Section 6.1.4. Inspectors shall have current certification as an AWS Certified Welding Inspector (CWI). Assistant inspectors, if any, shall be supervised by an Inspector and shall be qualified by training and experience to perform the specific functions to which they are assigned.

2) Inspectors performing nondestructive examinations of welds other than visual inspection (MT, PT, UT, and RT) shall meet the requirements of AWS D1.1, Section 6.14.6.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such intervals to ensure uninterrupted progress of work.

B. Deliver anchor rods and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time so as not to delay work.

C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration. Do not store materials on structure in a manner that might exceed allowable loads on or cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed by Architect/Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. All hot rolled steel plates, shapes, sheet piling, and bars shall be new steel conforming to ASTM A 6.

2. Comply with the provisions of the following ASTM Specifications as appropriate for the grades and types, and at the locations as specified on the drawings:

a. Structural Steel Wide Flange and WT Shapes: High Strength Steel, ASTM A 992.

b. Angle Shapes: Carbon Steel, ASTM A 36.

c. Steel Pipe: ASTM A 53 (Type E or S) Grade B (Fy = 35 ksi).

d. Round HSS: ASTM A 500 Grade B (Fy = 42 ksi) or ASTM A 501 with written approval from the Engineer.

e. Square and Rectangular HSS: ASTM A 500, Grade C (Fy = 50 ksi).

3. Connection Material: Unless noted otherwise on the drawings, column stiffener plates and doubler plates at moment connections shall be the same grade of steel as the beam connecting the column (highest grade if more than one grade is used). All other

connection material except as noted otherwise on the drawings including bearing plates, gusset plates, stiffener plates, filler plates, angles, etc. shall be A36 steel unless a higher or matching grade of steel with the members connected is required by strength or stiffness calculations and provided the resulting sizes are compatible with the members connected.

4. Structural Steel Surfaces: For fabrication of work which will be exposed to view in the completed structure, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.
5. Potential Non-conforming Material: For structural steel for which evidence exists that the steel may not conform to ASTM requirements, the Contractor, where permitted by the Engineer, shall engage the services of an independent testing laboratory to test the material according to ASTM A 6 and submit certified test reports that verify conformity to ASTM standards. Tests shall be made for each 10 tons of affected material unless otherwise directed by the Engineer.

B. Structural Bolts and Threaded Fasteners: Structural bolts and threaded fasteners shall comply with the following ASTM Specifications as appropriate for the types and at the locations as specified on the drawings:

1. ASTM F 3125 Grade A325 Type 1.
2. Threaded Round Stock:
   a. ASTM A 36.
3. Bolts and Nuts, High Strength Bolts: Bolts and nuts for all high strength bolts shall be heavy hex head conforming to ANSI Standards B18.2.1 and B18.2.2 respectively. Nuts shall conform to ASTM A 563.
4. Washers: All washers shall be circular, flat and smooth and shall conform to the requirements of Type A washers in ANSI Standard B23.1. Washers for high strength bolts shall be hardened and conform to ASTM F 436. Beveled washers for American Standard Beams and channels shall be square or rectangular, shall taper in thickness (16 2/3% slope) with an average thickness of 5/16". When an outer face of a bolted part has a slope greater than 1:20 with respect to a plane normal to the bolt axis, a beveled washer shall be used. Washers to be used with A490 bolts larger than 1 inch in diameter and installed over oversized or short-slotted holes and other similar situations shall conform to ASTM F 436 except with 5/16 inch minimum thickness.
5. Zinc-Coated Bolts: ASTM F 3125 Grade A325 bolts, with their nuts and washers, that are used to connect steel called for on the drawings or in the specifications as hot-dip galvanized after fabrication shall be zinc-coated either by the hot-dip process in accordance with ASTM A 153, Class C or by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. The bolts, nuts, and washers shall all be zinc-coated using the same process and they shall be considered together as an assembly and shall be tested and shipped together as such. Comply with all the requirements of ASTM F 3125 Grade A325 and ASTM A 563 as they relate to zinc-coated materials. ASTM F 1852 bolts with their nuts, and washers shall be zinc-coated only by the mechanical deposition process in accordance with ASTM B 695, Class 50, Type 1. Do not zinc-coat ASTM F 3125 Grade A490 bolts.
6. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts will not be allowed.
7. New Bolts: All bolts shall be new and shall not be reused.

C. Electrodes for Welding:

1. Provide electrodes that comply with AWS D1.1, "Structural Welding Code - Steel" and that can produce welds that have a minimum Charpy V-notch toughness of 20 ft-lbs at 40° F, unless noted otherwise in these specifications or on the drawings.
2. Electrodes for various welding processes shall be as specified below:
    a. SMAW:
        1) E70XX low hydrogen.
        2) E80XX for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
    b. SAW:
        1) F7X-EXXX.
        2) E8X–EXX-XX for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
    c. GMAW:
        1) ER70S-X.
        2) ER80S-X for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
    d. FCAW:
        1) E7XT-X.
        2) E8XT-X for Grade 60 and 65 steel with complete joint penetration (CJP) welds or as indicated on the drawings.
3. Weathering Steel Electrodes shall conform to Table 3.3 of the ANSI/AWS D1.1 Manual.
4. Electrodes shall be compatible with parent metal joined.

D. Headed Studs used as Anchors for Structural Steel Plates and Members connecting to Concrete: AWS Type A studs manufactured in conformance with ASTM A 29 with a minimum tensile strength of 61,000 psi of sizes as specified on the drawings.

E. Deformed Bar Anchors: 3/8” to 5/8” diameter AWS Type C studs manufactured in conformance with ASTM A 1064 with a minimum yield strength of 70,000 psi and a tensile strength of 80,000 PSI. 3/4" or larger diameter, ASTM A 706 bars of equal size with welds to steel substrate that develop the full strength of the anchor. ASTM A 615 reinforcing bars may not be substituted for deformed bar anchors. Reinforcement shall be approved by the ICC-Evaluation Service, Inc and shall have the Evaluation Service Report submitted for Engineer review. The following are acceptable products, provided that their Evaluation Service Reports are still valid at the time of intended use on the project:
    a. Nelson Stud Welding, Inc.; Nelson D2L Deformed Bar Anchor Studs (ESR-2907).
    b. Tru-Weld Division, TFP Corporation; Deformed Bar Anchors (ESR-2823).

F. Anchor Rods:
1. All anchor rods shall conform to ASTM F 1554. unless noted otherwise on the drawings and shall be of the yield strength as specified below as appropriate for the types and at the locations as specified on the drawings:
    a. Grade 55 (1/4 inch to 4 inches in diameter), complying with Supplementary Requirement S1 of ASTM F 1554.
    b. Grade 36, (1/4 inch to 4 inches in diameter). Substitution for Grade 36 anchor rods with Grade 55 anchor rods shall only be permitted provided the Grade 55 anchor rods comply with Supplementary requirements S1 of ASTM F 1554.
    c. Grade 105 (1/4 inch to 3 inches in diameter).
2. Anchor rods used with ASTM A 588 base plates shall be threaded round stock conforming to ASTM A 588, Grade 50.
3. Anchor rods used with galvanized baseplates shall be galvanized.
4. Nuts: All nuts with anchor rods shall be heavy hex head conforming to ASTM A 563.

5. Washers: Unless indicated otherwise, washers for all base plates shall be in accordance with the AISC “Steel Construction Manual”, Table 14-2 with holes 1/16” larger than the anchor rod diameter. Washers shall conform to ASTM A 36 steel.

G. Structural Steel Primer Paint:

1. Primer paint shall produce a Class B coating on all painted faying surfaces that are a part of a slip-critical connection as noted on the drawings; surface prepared according to SSPC-SP-6 (Commercial Blast Cleaning) and shall be of the following types.
   a. Organic zinc-rich primer utilizing either an epoxy or urethane binder with a minimum volume solids ratio of 50 percent with a minimum zinc content of 80 percent by weight in the dry film. Apply primer at a rate to achieve a dry film thickness of 3.0 to 4.0 mils. The primer shall comply with the AISC Class B slip critical requirement. (SSPC-SP6 Commercial Blast Cleaning).
   b. Ethyl Silicate Inorganic zinc-rich primer with a minimum volume solids ratio of 60 percent and with a minimum zinc content of 75 percent by weight in the dry film. The primer shall comply with the AISC Class B slip critical requirement. (SSPC-SP6 Commercial Blast Cleaning).
   c. Polyamide Epoxy with a minimum volume solids ratio of 65 percent. The primer shall comply with the AISC Class A slip critical requirement. (SSPC-SP6 Commercial Blast Cleaning).
2. Unless noted otherwise, primer paint shall be one of the following types with the indicated surface preparation:
   a. SSPC-Paint 25.1, Type II; zinc oxide, raw linseed oil and alkyd primer, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification.
   b. Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664, surface prepared according to SSPC-SP-2 (Hand Tool Cleaning) unless noted otherwise in this specification. The contractor is responsible for supplying a paint that complies with the VOC requirements of all local governing agencies.
   c. SSPC-Paint 23 acrylic primer, surface prepared according to SSPC-SP-6 (Commercial Blast Cleaning).
   d. Hyrdrophobic Acrylic Polymer with dry film thickness of not less than 2.0 mils: Tnemec Series 30, Spra-Saf EN or Sherwin Williams, Spraylastic Exterior Waterborn Dryfall (SSPC-SP6 Commercial Blast Cleaning).
3. Refer to Architect's drawings and specifications for final paint finish requirements of structural steel. Primer paint shall be compatible with final paint requirements.

H. Non-Shrink Grout: Provide grout type(s) as specified on the drawings:

1. Non-Metallic Non-Shrink Grout: Premixed, non-corrosive, non-staining product containing Portland cement, silica sands, shrinkage compensating agents, and fluidity improving compounds. Conform to ASTM C 1107. Provide the minimum strength as shown below as determined by grout cube test at 28 days:
   a. <**6,000**> PSI for supporting concrete 3,000 PSI and less.
   b. <**8,000**> PSI for supporting concrete greater than 3,000 PSI and less than or equal to 4,000 psi.
   c. Unless noted otherwise on the drawings, grout strength for supporting concrete greater than 4,000 PSI shall be <**8,000**> PSI.

   Subject to conformance with specified requirements, acceptable non-shrink grouts include:
   d. L&M Construction Chemicals, Inc.; Crystex and Duragrout.

e. Dayton-Superior Corporation; Sure Grip High Performance Grout and 1107 Advantage Grout.
f. BASF Construction Chemicals; Masterflow 555 and Set Grout.
g. U.S. Grout Corp.; Five Star Grout.
h. The Euclid Chemical Company; NS Grout.
i. Hilti, Inc.; CG 200 PC.

2. High Flow, Non-Metallic Grout: Use high-flow grout where high fluidity and/or increased placing time is required and for base plates that are larger than 10 square feet. The factory pre-mixed grout shall conform to ASTM C 1107, "Standard Specification for Packages Dry, Hydraulic-Cement Grout (Non-Shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under an 18" x 36" base plate. Provide one of the following:
   a. The Euclid Chemical Co.; Hi-Flow Grout.
   b. BASF Construction Chemicals; Masterflow 928.
3. Metallic Non-Shrink Grout: Premixed, factory packaged, ferrous aggregate grout conforming to Corps of Engineers CRD-C621. Provide minimum strength of 8,000 psi at 28 days as determined by grout cube tests.
   a. Subject to conformance with specified requirements acceptable products include:
      1) BASF Construction Chemicals; Embeco 636 and Embeco 885.
      2) The Euclid Chemical Company; NS Metallic Grout and Hi-Flow Metallic Grout.
4. Epoxy Grout: A three-part grout system consisting of a blend of epoxy resin, curing agent and specialty aggregates conforming to Corps of Engineers CRD-590.
   a. Subject to conformance with specified requirements, acceptable products include:
      1) L&M Construction Chemicals, Inc.; Epogrout 758.
      2) The Euclid Chemical Company; E^3-G, E^3-F and E^3-HP.
      3) Dayton-Superior Corporation; Sure-Grip High-Flow Epoxy Grout.
      4) BASF Construction Chemicals; Masterflow 648 CP and Masterflow MP.

I. Hot-Dip Galvanizing:
1. Scope: All structural steel items and their connections permanently exposed to exterior conditions or that are within areas of unconditioned airspace, whether specified on the drawings or not, shall be hot-dip galvanized after fabrication unless indicated on the drawings or in Specification **099100** to receive a primer and/or finish coat. Such items include, but are not limited to:
   a. Base plates and anchor rods supporting galvanized members.
   b. Shelf angles.
   c. Parapet wall supporting members.
   d. Screen wall supporting members.
   e. Window washing support members.
   f. Exterior covered walkways.
   g. Embedded plates in concrete exposed to unconditioned airspace.
   h. Garage guardrail steel and connections.
   i. Cooling tower support steel.
   j. Building skin support steel exposed to moisture outside the exterior waterproofing surface.
   k. Examine the architectural and structural drawings for other items required to be hot-dip galvanized.

2. Zinc-coat all ASTM F 3125 Grade A325 bolts nuts, and washers used in the connection of such steel. Field welded connections shall have welds protected and the exposed portions of ASTM F3125 Grade A490 bolts, nuts, and washers shall be protected with galvanizing repair paint.
3. Surface Preparation: All steel to be hot-dip galvanized shall undergo the following surface preparation as specified by the Society for Protective Coatings (SSPC), Volume 2.
    a. Remove all grease, oil, grime and foreign contaminants by thorough cleaning with an alkaline or organic solvent followed by thorough rinsing in cold water.
    b. Remove scale by pickling in diluted sulfuric or hydrochloric acid. Pickling shall be followed by a rinse in warm water and a second rinse in cold water. As an alternative to pickling, the steel may be white metal blast cleaned according to SSPC-SP-5.
    c. Dip in a flux solution of zinc ammonia chloride followed by drying at room temperature.
4. Zinc Coating: The zinc coating for steel shapes and plates shall conform to ASTM A 123. Weight of zinc coating per square foot of surface for 1/8 inch and 3/16 inch thick steels shall average not less than 3.0 mils with no individual thickness less than 2.6 mils. The coating weight shall average not less than 3.9 mils for 1/4" thick and heavier steel with no individual thickness less than 3.3 mils.

J. Galvanizing Repair Paint: Galvanizing repair paint shall be "ZRC Cold Galvanizing Compound" as manufactured by ZRC Chemical Products or a paint complying with SSPC-Paint 20, Level 1.

2.2 FABRICATION

A. Structural steel members for which shop drawings have not been reviewed shall not be fabricated. Any steel detailed or fabricated prior to the Initial Survey from Part 3 below is at contractor’s risk.

B. All fabricated material and connections shall fit within architectural constraints.

C. The omission from the shop drawings of any materials required by the Contract Documents shall not relieve the Contractor of the responsibility of furnishing and installing such materials, even though the shop drawings may have been reviewed.

D. Shop Fabrication and Assembly:
1. Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specification and as indicated on approved final shop drawings. Provide camber in structural members where indicated.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
3. Clearly mark the grade of steel on each piece, distinguishable in the field from floor surfaces, for purpose of field inspection and confirmation of grade of steel.
4. Milled surfaces of built-up sections shall be completely assembled or welded before milling.
5. Fitted stiffeners shall be fabricated neatly between flanges, and the ends of stiffeners shall be milled or ground to secure an even bearing against abutting surfaces. All milled or ground joints shall bear throughout their contact length.

E. Dimensional Tolerances: Dimensional tolerances of fabricated structural steel shall conform to Section 6.4 of the AISC Code of Standard Practice.

F. Cutting: Manual oxygen cutting shall be done only with a mechanically guided torch. An unguided torch may be used provided the cut is not within 1/8 inch of the finished dimension

and final removal is completed by means such as chipping or grinding to produce a smooth surface quality free of notches or jagged edges. All corners shall be smooth and rounded to a minimum 1/2" radius.

G. Anchor Rods: Furnish anchor rods and other connectors required for securing structural steel to foundations and other in-place work. Furnish 1/8" minimum steel templates for presetting bolts and other anchors to accurate locations.

H. Large Plates to be Embedded in Concrete: For steel plates that are larger than 24”x24” and are to be embedded horizontally in and at the top surface of concrete, provide one-inch diameter holes to prevent trapped air underneath plates and to achieve full consolidation. The location of holes shall be shown on the shop drawings and shall not impair the strength of the plate.

I. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members as shown on the contract documents, and/or the final shop drawings.

1. Provide specialty items as indicated to receive other work.
2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

J. Lifting and Erection Devices: The Fabricator shall be responsible for designing, detailing, and furnishing all lifting devices and erection aids required for erection. Such devices shall be removed after erection if they interfere with architectural finish requirements.

K. Drainage Holes: Provide 1 inch diameter drainage (weep) holes in all members (trusses, girders, beams, etc.) exposed to weather where rain water could collect (at low points and/or behind dams caused by connections, stiffener plates, etc.). Show all holes on shop drawings for review by the Engineer.

2.3 WELDING

A. Code: All shop and field welding shall conform to all requirements in the "Structural Welding Code – Steel", ANSI/AWS D1.1, as published by the American Welding Society (AWS).

B. Welder Certification: All shop and field welders shall be certified according to all the applicable AWS procedures for the welding process and welding position used. Each welder shall be assigned an identifying symbol or mark and all shop and field welded connections containing complete or partial joint penetration welds, multi-pass fillet welds, and fillet welds greater than 5/16” shall be identified by the symbol or mark of the welder responsible for the connection.

C. Minimum Size and Strength:

1. Fillet Welds: Minimum size of fillet welds shall be as specified in Table J2.4 in AISC Specification, Chapter J.
2. Partial-Penetration Groove Welds: The minimum effective throat thickness of partial-penetration groove welds shall be as specified in Table J2.1 in AISC Specification, Chapter J.
3. Minimum Strength of Welded Connections: Except as specified below in "Connections" or noted otherwise on the drawings, all shop and field welds shall develop the full tensile strength of the member or element joined. All members with moment connections as indicated on the drawings shall be welded to develop the full flexural capacity of the member, unless noted otherwise on the drawings.

D. Filler Metal Requirements: Weld metal shall be as specified in Table J2.5 in AISC Specification, Chapter J and other requirements of this specification.

E. Welding Procedure Specification:

1. All welding shall be performed in accordance with a Welding Procedure Specification (WPS) as required in AWS D1.1 and reviewed by the Owner’s Testing Laboratory and by

the Architect/Engineer. The WPS variables shall be within the parameters established by the filler-metal manufacturer. Engage the services of an independent Testing Laboratory to provide the qualification testing required by AWS D 1.1, Chapter 4, part B to qualify any non-prequalified WPS needed for the project. The independent Testing Laboratory shall prepare Welding Procedure Qualification Records (WPQR) documenting the successful qualification of each Welding Procedure Specification.

F. Welding Procedures:

1. All welding processes shall comply with the requirements of ANSI/AWS D1.1 unless noted otherwise.
2. Complete joint penetration welds of beam bottom flanges to columns or to continuity plates shall be sequenced to conform to the requirements of AWS D1.8, Section 6.9.
3. Welds not specified shall, if possible, be continuous fillet welds developing the minimum strength, as specified above, using not less than the minimum fillet welds as specified by AISC.
4. The toughness and notch sensitivity of the steel shall be considered in the formation of all welding procedures to prevent brittle and premature fracture during fabrication and erection.
5. The Welding Procedure Specification shall be followed without deviation unless specific approval for change is obtained from the Owner's Testing Laboratory and the Architect/Engineer.
6. Before welding, particular attention shall be paid to surface preparation, fit up, and cleanliness of surfaces to be welded.
7. Minimum preheat and interpass temperatures for structural steel welding shall be as specified in ANSI/AWS D1.1, except that no welding shall be performed when the ambient temperature is lower than 0 degrees F. The temperature shall be measured from the side opposite that upon which the preheat is applied.
8. The heat, input, length of weld, and sequence of weld shall be controlled to prevent distortions. The surfaces to be welded and the filler metals to be used shall be subject to inspection before any welding is performed.
9. Welds shall be sound throughout. There shall be no crack in any weld or weld pass. Welds shall be considered sound if they conform to AWS requirements, as confirmed by non-destructive testing.
10. Welds shall be free from overlap.
11. Craters shall be filled to the full cross section of the welds.
12. For high-strength low-alloy steels, follow welding procedures as recommended by steel producer for exposed and concealed connections.
13. Fabricator and Erector shall coordinate welding responsibility at all welded joints.

G. Stress Relieving: All welding sequences shall be such as to reduce the residual stresses due to welding to a minimum value. If high residual stresses are present, stress relieving of joints shall be required. Welded connections shall be detailed and designed to minimize the accumulation and concentration of through-thickness strains due to weld shrinkage.

2.4 BOLTING

A. Bolt Diameter: Minimum bolt diameter shall be 3/4 inch. The difference in diameter between bolts of differing sizes used on the project shall be not less than ¼”.

B. Connection Type: Unless noted otherwise on the drawings, all bolted connections shall be snug-tightened using high-strength bolts in standard holes (hole diameter nominally 1/16 inch greater than the nominal bolt diameter) with threads included in the shear planes. Notwithstanding, the contractor shall be responsible to adhere to provisions of ANSI/AISC 360

Section J1.10, which lists circumstances under which certain connections require pretensioned high strength bolts.

C. Oversize, Short-Slotted and Long-Slotted Holes: The dimensions and washer requirements of oversize, short-slotted, and long-slotted holes shall conform to ANSI/AISC 360 Table J3.3.

D. Bolt Lubrication: All bolts shall be well lubricated at time of installation. Dry, rusty bolts are not be allowed.

E. Impact Wrenches: Properly sized and lubricated air impact wrenches with adequate air pressure shall be utilized for all bolt installation.

F. New Bolts: All bolts shall be new and shall not be reused.

2.5 CONNECTIONS

A. Typical connection details are indicated on the drawings.

B. Design and Detailing Procedure:

1. Unless noted otherwise or specifically detailed on the drawings, end connections of beams, girders, and trusses shall be designed as flexible and the connection shall accommodate end rotations of the unrestrained beams. Restrained end connections, as indicated on the drawings, shall be designed for the combined effect of bending moment and shears induced by the rigidity of the connection. Forces to be used in the design are described below.

C. Design Intent: It is the intention of the plans and specifications that shop connections be welded or bolted and that field connections be bolted, unless detailed otherwise on the drawings.

D. Flexible (Simple) Beam Connections:

1. All typical beam simple connections shall conform to requirements of the AISC specifications. Refer to the drawings for typical connection types.
2. Beam connections shall conform to the “Structural Integrity” requirements of the governing Building Code.
3. Seated beam connections and stiffened seated beam connections shall not be used unless indicated on the drawings or unless Engineer approval is obtained to verify capacity of supporting member for the resulting eccentricity. The Fabricator must verify and bear responsibility that the use of such connections does not interfere with architectural or MEP requirements.
4. Simple Beam Connection Capacity: Support a factored load reaction R equal to the reaction shown on the plans. Contact the Engineer if no reaction for a beam is shown on the plan. Each connection shall contain not less than the minimum number of bolts shown in the AISC connection tables for each beam size.

E. Base Plates and Bearing Plates:

1. Finish: All baseplates and bearing plates shall be finished in accordance with AISC Specification M2.8.
2. Anchor Rod Holes in Baseplates: Hole sizes in baseplates for anchor rods shall be per the AISC “Steel Construction Manual”, Table 14-2.

F. Stiffeners: Provide stiffeners finished to bear under load concentrations where shown on the drawings.

G. Steel Shelf Angles: Shelf angles supporting veneer shown on the drawings to be continuous shall be furnished to a maximum length of 20’-0”. Provide a 1/4" gap at each joint. The gap shall not be welded. The distance from the joint to the first supporting bolt shall not exceed 40% of the bolt spacing (12" maximum). Shelf angles shall be continuous around corners with

corner joint complete-joint penetration welded. The distance to the first supporting bolt from the corner shall not exceed 12”.

2.6 SURFACE PREPARATION AND SHOP PRIME PAINTING

A. Specification: Surface preparation, paint, and painting practices shall conform to the "SSPC Painting Manual", Volumes 1 and 2.

B. Scope: All steel shall remain unpainted, except the following:

1. Shop paint surfaces that are to remain exposed to view in the final construction.
2. Shop paint any steel other than weathering steel that, in the final construction, will not be in a controlled environment and is therefore subject to moisture or high humidity infiltration and that has not been specified to be galvanized.
3. Shop paint any steel that is shown on the drawings to receive a finished paint system as defined in Specification 099100.
4. Coordinate all shop painting of structural steel with Architect's painting requirements as specified on the architectural drawings and in the specifications. The Fabricator shall be responsible for determining all painting requirements (which surfaces are to be painted or left unpainted) on the project prior to fabrication.

C. Additional Painting Requirements:

1. Extend shop paint to 2" from location of welds on surfaces that are to be field welded.
2. All unpainted mating surfaces of all elements that are welded together into an assembly that is permanently exposed to the exterior shall be seal welded in addition to structural welding requirements.
3. If individual elements (including the mating surfaces) of an assembly that is required to be painted are painted prior to welding into an assembly, then all painted surfaces affected by welding shall be touched-up and repaired (according to manufacturer’s instructions, if any) to prevent corrosion bleeding.
4. The fabricator shall be responsible to ensure that all elements of all assemblies that are to be painted are fabricated so that no exposed surface shall be subject to stains due to corrosion bleeding during the warranty period of the paint.
5. Structural steel elements that are bolted with slip-critical joints and are required on the drawings to be painted shall have all faying surfaces (including all surfaces of filler plates, member end supplement plates, and welds) painted to comply with the specified slip-critical coating requirement.

D. Surface Preparation – Unpainted Steel: All structural steel that is not specified to receive a shop coat of primer paint shall be prepared in accordance with Society for Protective Coatings specifications as follows:

1. SSPC-SP 2, “Hand Tool Cleaning” or SSPC-SP 3, “Power Tool Cleaning” unless otherwise specified.
2. SSPC-SP 6, “Commercial Blast Cleaning” shall be applied to the faying surfaces of connections that are noted on the drawings as slip-critical connections requiring a Class B surface. Apply this surface preparation to the area surrounding all bolt holes including the area up to 2” outside the outer-most holes.

E. Surface Preparation and Primer Paint – Shop Painted Steel:

1. Surface Preparation: Prepare the surface of all structural steel specified to be shop painted as required by the paint manufacturer or the Society for Protective Coatings specifications, but not less than the following:
   a. SSPC-SP 2, “Hand Tool Cleaning” or SSPC-SP 3, “Power Tool Cleaning” unless otherwise specified.

b. SSPC-SP 6, “Commercial Blast Cleaning” shall be applied to the faying surfaces (including filler and member-end supplement plates, if any) of connections that are noted on the drawings as requiring a slip-critical coating. At a minimum, apply this surface preparation to the area between and surrounding all bolt holes including the area up to 2” outside the outer-most holes.

2. Priming: Immediately after surface preparation, apply primer to all structural steel specified to be shop primed in strict accordance with manufacturer’s instructions and the Society for Protective Coatings specifications. Apply paint at a rate to conform to the manufacturer’s written instructions and to provide a dry film thickness of not less the 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, welds, and all exposed surfaces. Apply two coats to surfaces that are inaccessible after assembly or erection. Change the color of the second coat to distinguish it from the first coat.

3. Finish Coat: Coordinate shop primer paint requirements with architectural drawings and specifications. The primer selected must be compatible with any specified finish coat.

F. Shop Touch-Up Painting: The Fabricator shall provide for cleaning and touch-up painting of welds, bolted connections (including nuts, bolts, washers, filler plates, member end supplement plates and welds, if any), and abraded areas. Prior to shipment, apply paint to exposed areas using same materials and surface preparation as used for shop painting. Paint shall be applied by brush or spray with minimum dry film thickness of 1.5 mils.

2.7 SOURCE QUALITY CONTROL

A. Source Testing and Inspection: Refer to Specification 014529 “Structural Testing and Inspections” for testing and inspection requirements associated with structural steel.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection Prior to Erection: Erector shall examine areas and conditions under which structural steel work is to be installed and notify the Contractor and the Architect/Engineer in writing of conditions detrimental to proper and timely completion of the work.

3.2 PREPARATION

A. Temporary Shoring and Bracing:

1. The lateral-load resisting or stability-providing system and connecting diaphragms are identified on the drawings. Comply with the provisions of the Code of Standard Practice regarding stability of the structure during the erection process, except where stricter requirements are noted herein.

2. The Erector shall design and provide all required temporary shoring and bracing to hold structural framing securely in position and to safely withstand all loads as specified in the Code of Standard Practice and ASCE 37 unless larger loads are required by the local building code or specified herein. Provide all bracing, any additional structural members, and increase member sizes and/or connections shown on the drawings as required to accommodate the erection loads, methods, sequence of erection, and equipment until the lateral-load resisting or stability-providing system is completely installed. Clearly show all temporary supports and modifications to designed members on the Shop Drawings and the Erection-bracing Drawings. A qualified licensed professional engineer, hired by the Erector, shall design the temporary shoring and bracing and shall seal the erection-bracing drawings.

3. Where architectural or MEP requirements do not allow for any temporary supports, members, erection devices, or connections to be left in place permanently or where such

items affect the final structural behavior, they shall be removed by the Erector. All costs associated therewith shall be included in the bid price.

3.3 ERECTION

A. The erection work shall comply with the requirements of AISC Specification Section M4.

B. Surveys: The following surveys shall be performed by a qualified land surveyor:

1. Initial Survey: Check elevations of concrete and masonry bearing surfaces, anchor bolt locations, embedded connection plates, and all dimensions of existing structures to which new connections are to be made prior to erection and submit any discrepancies to the Engineer prior to the start of erection. Corrections or compensating adjustments to the structural steel shall be made and approved prior to the start of erection.
2. Intermediate Survey: Measure and submit elevations of column splices at every 4th floor. Do not proceed with erection until after discrepancies are reported and compensated for by instructions from the Engineer and the surveyor submits a report certifying compliance with specified tolerances.
3. Final Survey: Upon completion of erection of the steel frame, and before the start of work by other trades that may be supported, attached, or applied to the frame, a final survey shall be made and a report submitted certifying compliance with specified tolerances.

C. Erection Tolerances: Erection tolerances of anchor rods, embedded items, and all structural steel shall conform to the AISC Code of Standard Practice, Section 7, unless stricter tolerances are specified elsewhere in the contract documents.

1. Erection Bracing for Composite Frame: Erection of the bare steel frame shall not proceed more than 12 floors above the point where concrete is poured around the composite columns steel core nor six floors above the point where concrete is poured on the steel deck floors. Bracing required to maintain frame stability until concrete is poured around the composite columns steel core is shown on the drawings.

D. Wherever the erection equipment is supported by the structure, the contractor shall be responsible for the retention of a licensed professional engineer to determine the adequacy of the member supporting the erection equipment in relation to the loads imposed thereon. The Contractor shall submit to the Architect/Engineer, for review, the loads that will be imposed by the erection equipment on the building structure. Where the imposed load exceeds the allowable strength, the Contractor shall be responsible for any additional materials, supports, bracing, connections and similar measures required to support the imposed load of the equipment while in use, subject to review by the Architect/Engineer.

E. Anchor Rods: Tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout. Use only steel wedges or shims.

F. Base Plates and Bearing Plates: Remove loose latent material from bearing surfaces and base and bearing plates. Set plates to the elevation indicated on the drawings and level using steel shims (plastic shims will not be allowed) or by three leveling screws with weldments at the plate edges. After all protruding plates have been trimmed, grout plates solidly between bearing surfaces using the specified grout, ensuring no voids are present. Finish exposed surfaces, protect installed materials, and allow to wet cure. For proprietary grout materials, comply with manufacturer's instructions. Tighten anchor bolts after supported members have been positioned and plumbed.

G. Field Assembly of Structural Steel:

1. As erection of the steel progresses, the work shall be fastened securely to safely carry all dead load, wind, and erection forces. Particular care shall be exercised to ensure straightness and tautness of bracing immediately upon raising a steel column.

2. Provide temporary planking and working platforms as necessary to effectively complete work.
3. Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment. Level and plumb individual members of structure within specified AISC tolerances. The Contractor shall coordinate with Erector and Fabricator regarding possible discrepancies in member lengths between temperature at time of fabrication and temperatures during erection, and shall make necessary adjustments to ensure plumbness within AISC tolerances at 70°F. Compensate for cumulative welding draw, construction loadings, sequential applications of dead loads, or any other predictable conditions that could cause distortions to exceed tolerance limitations.
4. On welded construction exposed to view or weather, remove erection bolts, fill holes with plug welds or filler and grind smooth at exposed surfaces.
5. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces receiving field welds.
6. Comply with all bolting and welding requirements of Part 2 of this specification.

H. Field Modifications to Structural Steel: Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and structural fitting of parts shall be reported immediately to the Architect/Engineer, and approval of the method of correction shall be obtained. Approved corrections shall be made at no additional cost to the Owner. Do not use cutting torches, reamers, or other devices in the field for unauthorized correction of fabrication errors.

I. Miscellaneous Framing: Provide supplemental structural steel support framing for steel deck where columns, or other framing members or floor openings interrupt normal deck bearing whether shown or not on the architectural, mechanical, or structural drawings.

J. Removal of Erection Aids and Devices: The Erector shall remove all erection aids and devices that interfere with architectural finish or MEP requirements.

K. Field Touch-Up Painting:
1. Clean field welds, unpainted areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any shop painted areas that are abraded. Apply paint to all exposed areas using same material and surface preparation as used for shop painting. Apply by brush or spray to provide minimum dry film thickness of 1.5 mils.
2. Clean field welds, ungalvanized areas of bolted connections (including all exposed areas of nuts, bolts, washers, filler plates, member end supplement plates, and welds), and any galvanized areas that are abraded. Prepare surfaces and apply two coats of the specified galvanizing repair paint in accordance with ASTM A 780.
3. The Contractor shall ensure that, at the substantial completion of the project, all structural steel, bolted and/or welded, required to be painted shall have all necessary steel surfaces painted (including touch-up painting as required) to prevent corrosion bleeding.

L. Clean Up: Clean up all debris caused by the Work of this Section, keeping the premises neat and clean at all times.

3.4 FIELD QUALITY CONTROL

A. Field Testing and Inspection: Refer to Specification 01 45 29 “Structural Testing and Inspections” for testing and inspection requirements associated with structural steel.

END OF SECTION 05 12 00

SECTION 05 21 00 - STEEL JOIST FRAMING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Extent of steel joists is shown on drawings, including basic layout and type of joists required.

B. Quantity of joists required shall be determined from the contract drawings.

1.2 QUALITY ASSURANCE

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Qualifications:

1. The steel joist manufacturer shall be a firm experienced in manufacturing joists similar to those indicated for this Project and with a record of successful in-service performance for a minimum of 2 years.
2. The steel joist manufacturer must show evidence of compliance with the submittal, testing, and inspection requirements of the Steel Joist Institute (SJI) Standard Specifications for verification of design and manufacturing.

C. Design and Manufacturing: Provide joists designed and manufactured in compliance with the following, and as herein specified.

1. Steel Joist Institute (SJI) Standard Specifications, Load Tables and Weight Tables for K and LH/DLH Series Steel Joists and Joist Girders, latest edition.
2. Design top and bottom chords for additional bending stresses resulting from a vertical concentrated load of 100 pounds (service) located anywhere between panel points. This load is used only for a bending check of the chord members.
3. Recommended Code of Standard Practice for Steel Joists and Joist Girders, latest edition.
4. SJI Technical Digest #8 "Welding of Open Web Steel Joists"
5. Comply with all OSHA requirements.

D. Load Test of Joists: Full scale load tests of joists are required for the project as specified herein.

1. Frequency of Testing: Load tests shall be performed on one joist out of every 200 or fraction thereof up to a maximum of 5 tests for the project. The joists series to be tested shall be indicated by the Engineer-of- Record on the approved shop drawings. Actual joists to be tested shall be selected on a random basis by the Owner's Testing Laboratory from joists fabricated for this project.
2. Test Load Procedure:

a. First, the joist shall be loaded to design load in 25% increments and deflection measurements at midspan shall be taken.
b. Secondly, the joist shall be loaded to 1.2 times the dead load (including self weight) plus 1.60 times the design live load and the midspan deflection measurement taken while the load is still in place.
c. All test loads shall then be removed and the final deflection measured.

d. All test loads shall be applied to the joists either uniformly or at panel points. In no case shall the test load be applied in a manner that would cause overload in any of the members.
e. The weight of the steel joist and any weight applied by the test apparatus itself shall be included in the total test load.
f. The top and bottom chords of the joist shall be laterally supported in accordance with the SJI specifications or as shown otherwise on the contract drawings.

3. Acceptance Criteria: The load test shall be considered successful if the following criteria are satisfied:

a. No evidence of failure has occurred in any member, connection, splice, or bearing seat.
b. The permanent deflection immediately upon removal of all test load shall not exceed 20% of the deflection under full test loading.

4. Failure of Load Test:

a. Final decision as to passage or failure of any load test shall rest solely with the Engineer-of-Record.
b. The Owner reserves the right, at no cost penalty, to reject usage of the joist manufacturer's product if any load test has failed.
c. The Owner reserves the right to perform further inspections of any or all joists proposed to be used on the project at his own cost.
d. All repair costs required by the Engineer-of-Record to be implemented on joists proposed for use on the project in order to bring them in compliance with this specification shall be borne by the joist manufacturer.
e. One additional successful load test shall be performed if requested by the Owner for each test that fails, at no additional cost to the Owner.

5. Joists Used in Load Test: Joist used in any load test shall not be utilized in the project.

E. Qualification of Field Welding: Qualify field welding processes and welding operators in accordance with American Welding Society (AWS) qualification procedure.

1.3 SUBMITTALS

A. Qualification Data: Submit evidence of compliance with the requirements listed in section 1.3 A and B.

B. Shop Drawings:

1. Submit detailed drawings showing layout of joist units, connections, jointing and accessories. Include length, camber, mark, number, type, location and spacing of joists and bridging. Submit details for member splices.
2. Provide templates or location drawings for installation of anchorage devices and bearing plates in other construction materials.

C. Design Calculations: Submit design calculations for all joists showing complete geometry and member sizes, including web and chord member splices to verify compliance with these specifications, contract drawings, and SJI specifications. Calculations shall be signed and sealed by a licensed engineer in the state where the project is located.

D. Mill Certificates: Submit mill reports for the structural steel used in the joists and for the bolts certifying compliance with specified requirements.

E. Certificate of Compliance: Submit certificate of compliance to Architect and Building Official certifying that manufacturing work was done in accordance with approved construction documents and with SJI Standard Specifications.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle steel joists as recommended in SJI specifications. Handle and store these in a manner to avoid deforming members and to avoid excessive stresses.

1.5 SHOP INSPECTION

A. The manufacturer's quality assurance inspector shall inspect joists before shipment to insure compliance of materials and workmanship with the documents specified in this specification. Repair any defects found prior to shipment of the joists.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: Comply with SJI specifications for chord and web members

B. Steel Bearing Plates: ASTM A 36

C. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular hexagon type, low carbon steel.

D. High-Strength Threaded Fasteners: ASTM A 325 heavy hexagon structural bolts with nuts and hardened washers.

E. Steel Prime Paint: Comply with SJI specifications.

F. Welding Electrodes: Comply with AWS standards.

2.2 FABRICATION

A. General: Fabricate steel joists in accordance with all documents listed in "Quality Assurance," except as noted below.

B. Splices in Chord Members: All splices shall be designed and provided in accordance with SJI Specifications. The splices in each of the two angles or bars of all members shall not be at the same location, but shall be staggered a minimum of 6 inches.

C. Holes in Chord Members: Provide holes in chord members where shown in contract drawings for securing other work to steel joists; however, deduct area of holes from the area of chord when calculating strength of member.

D. Joists shall be cambered for dead loads: Provide all joists with SJI standard camber unless specified otherwise on the drawings. Review the Structural Drawings and Specifications for information concerning dead loads for joists requiring other than standard camber. Joist camber must be shown on shop drawings submitted for review. Not showing camber information on shop drawings shall be cause for rejection of shop drawings.

E. Joist Bearing: Provide minimum end bearing of joists as required by SJI specifications but subject to requirements below: Provide sloped shoes if joist slope exceeds ¼ inch per 12 inches (1:48).

1. Joists Less than 60-Foot Span:

a. If two joists do not abut each other at a support, provide required joist bearing centered on the supporting member unless detailed otherwise on the drawings.

b. If two joists abut each other at a support and sufficient minimum bearing for each joist exists, provide 1/4" space between joist ends centered over the support unless detailed otherwise on the drawings.

c. If two joists abut each other at a support and sufficient minimum bearing for each joist does not exist at the support, offset the ends of each joist and center joist bearing on the center of the support.

2. Joists Greater than or Equal to 60-Foot Span: All joists having a span greater than or equal to sixty feet must have required minimum bearing centered over the support. Joists abutting each other at a support must be offset at the bearing end to satisfy this requirement.

F. Top Chord Extensions and Extended Ends: Provide top chord extensions and extended ends on joists where shown in contract drawings complying with the requirements of SJI specification and load tables.

G. Ceiling Extensions: Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord. Provide either an extended bottom chord element or a separate unit, to suit manufacturer's standards, of sufficient strength to support ceiling construction. Extend ends to within 1/2" of finished wall surface unless otherwise indicated.

H. Bridging: Provide horizontal and/or diagonal type bridging for all joists, complying with SJI specifications at a minimum.

1. Examine the drawings carefully for special bridging requirements such as may be required to resist net uplift forces as shown on the drawings or to provide special bracing.

2. Provide bridging anchors for ends of bridging lines terminating at walls or beams.

I. End Anchorage: Provide end anchorages to secure joists to adjacent construction, complying with SJI specifications, unless otherwise indicated.

J. Header Units: Any situation requiring heading of joists not shown on the structural drawings shall be referred to engineer for framing.

K. Shop Painting: Remove loose scale, heavy rust, grease, oil and other foreign materials from fabricated joists and accessories by rotary wire brushes and/or solvents before application of shop paint.Apply one shop coat of primer paint to steel joists and accessories, by spray, dipping, or other method to provide a continuous dry paint film thickness of not less than 0.50 mil.

PART 3 - EXECUTION

3.1 ERECTION

A. Place and secure steel joists strictly in accordance with SJI code of standard practice, SJI specifications, final shop drawings, and as herein specified.

B. Bearing Plates: Furnish steel bearing plates to be built into concrete and masonry construction.

1. Refer to Division 03 sections for installation of plates set in concrete.

2. Refer to Division 04 sections for installation of plates set in masonry.

C. Placing Joists: Do not start placement of steel joists until supporting work is in place and secured. Place joists on supporting work, adjust and align in accurate locations and spacing before permanently fastening.

1. Comply with SJI specifications regarding required bridging, connections, and anchors to ensure lateral stability during construction. Remove as required for architectural, structural, and mechanical clearances after erection.

2. Where members support joists from both sides and the supporting width does not meet the SJI recommendations for bearing lengths of both joists, the joists shall be offset to provide recommended bearing lengths. Such offsets shall be subject to approval by the Architect/Engineer.

D. Bridging: Install bridging simultaneously with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords where terminating at walls or beams.

3.2 ANCHORING JOISTS

A. Anchor steel joists to supporting steel framework with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used. Joists on column lines shall be field bolted with high-strength threaded fasteners installed snug tight.

B. Joists where shown with bottom chord extensions shall not have the bottom chords connected to the supporting members until the full dead load is applied.

C. Anchor joists resting on masonry or concrete to steel bearing plates embedded therein with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used.

D. Anchor joists resting on masonry to steel bearing plates embedded therein with welds, bolts, or a combination of the two in accordance with SJI specifications for type of joists used.

E. Touch-Up Painting: After joist installation, paint field bolt heads and nuts, welded areas, and abraded or rusty surfaces on joists and steel supporting members. Wire brush surfaces and clean with solvent before painting. Use same type of paint as used for shop painting.

3.3 ATTACHMENTS TO JOISTS

A. The Contractor shall ensure that no cuts or holes are made in the members of the erected joists for attachment of ceiling, ducts, pipes, or any other items not specifically shown in the contract drawings. Use of power driven fasteners in the diagonal and bottom chord members of the joists is prohibited.

B. The Contractor shall not hang any elements from the top or bottom chords of joists except ceiling, ducts, pipes or other items specifically shown on the Contract Documents, without the written authorization of the Engineer.

1. All pipes, ducts, and other mechanical, electrical, and plumbing equipment suspended from the joists' top or bottom chord and producing hanger loads exceeding 100 pounds shall have the hanger attached at a joist panel point only except if the chord member is stiffened according to the typical detail shown on the drawings.
2. All ceilings hung from the joists and producing a concentrated load of 100 pounds or less may have the grid hung anywhere along the bottom chord. Hung ceilings producing more than a 100 pound concentrated load shall have the grid hung only at joist panel points except if the chord member is stiffened according to the typical detail shown on the drawings.
3. Heavy pipes, ducts, or other equipment hung from joists may require additional reinforcement and shall be referred to the Engineer for framing.

3.4 QUALITY ASSURANCE TESTING AND INSPECTION DURING FABRICATION AND ERECTION

A. See Testing Laboratory Services section of the Specifications for open web steel joist inspection and testing requirements.

END OF SECTION 05 21 00

SECTION 05 31 23 - STEEL ROOF DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 SCOPE OF WORK

A. Supplier: The steel deck supplier shall furnish all steel deck materials and accessories indicated on the Architectural, Structural, and Mechanical Drawings required to produce a complete job including but not necessarily limited to deck units, cover plates, steel deck edge closures, cell closures, cant strips, sump pans, and all related accessories.

B. Erector: The Subcontractor responsible for erecting the steel deck shall provide all labor and equipment as required to place all steel deck components and accessories as described above.

1.3 QUALIFICATIONS

A. The steel deck supplier shall be a manufacturer with a minimum of two years successful experience and with a minimum of two successful jobs of a comparable size and scope to this project.

1.4 QUALITY ASSURANCE

A. The Contractor is responsible for quality control, including workmanship and materials furnished by his subcontractors and suppliers.

B. Codes and Standards: Comply with provisions of the following codes and standards except as otherwise indicated or specified:

1. SDI, "Design Manual for Composite Decks, Form Decks, and Roof Decks."
2. AISI, "Specification for the Design of Cold Formed Steel Structural Members."
3. AWS D1.3, "Structural Welding Code – Sheet Steel."

C. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with AWS procedures.

1.5 SUBMITTALS

A. Product Certification: Submit manufacturer's specifications and installation instructions for each type of deck specified. Also submit a certificate of product compliance with SDI Standards as specified.

B. Shop Drawings: Submit detailed shop drawings showing type of deck, complete layout, attachment details, closures, edge strips, supplementary framing, and all other accessories.

C. Insurance Certification: Assist Architect and Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire, windstorm, and extended coverage insurance.

D. Welding Certificates: Submit Copies of certificates for welding procedures and personnel.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. See General Notes on the drawings for the location, depth of deck, design thickness, and type of deck required.

B. Acceptable manufacturers include:

1. ASC Steel Deck.
2. Canam Group.
3. Consolidated Systems, Inc.
4. Cordeck.
5. Epic Metals Corp.
6. Loadmasters Systems, Inc.
7. Marylyn Steel Decks, Inc.
8. New Millennium Building Systems, Inc.
9. United Steel Deck, Inc.
10. Valley Joist, Inc.
11. Verco Manufacturing Co.
12. Vulcraft/Div. Nucor Corp.
13. Wheeling Corrugating Co.
14. Other manufacturers may be used only with Architect/Engineer approval.

2.2 GRADES OF STEEL

A. Steel deck shall be manufactured from steel conforming to ASTM A1008 Grades C, D, or E for painted deck or A653, Structural Steel Grade for galvanized deck or Engineer approved equal, having a minimum yield strength of 33,000 PSI.

2.3 FINISH

A. Galvanizing: Steel deck shall be galvanized with a protective zinc coating conforming to ASTM A653 G60.

B. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Department of Defense Specifications DOD-P-21035.

2.4 ROOF DECK ACCESSORIES

A. Provide minimum 20 gauge ridge and valley plates, minimum 20 gauge cant strips, minimum 14 gauge sump pans, minimum 20 gauge inside or outside closure channels angles or plates, minimum 20 gauge butt strips at change of deck directions, and minimum 20 gauge filler sheets.

2.5 MECHANICAL FASTENERS

A. Powder-Actuated or Pneumatically Driven Pins: Provide corrosion-resistant, powder-actuated or pneumatically driven fasteners manufactured from steel conforming to AISI 1060 or 1061 steel, austempered to a core hardness of 52 to 58 Rockwell C. Fasteners shall have a knurled shank and shall be zinc-plated in accordance with ASTM B633, Sc. I, Type III.

1. Subject to compliance with requirements, provide products of one of the following manufacturers:
   a. Hilti, Inc.
   b. ITWBuildex.

c. Pneutek, Inc.

B. Self-Drilling Screw Fasteners: Provide corrosion-resistant, hexagonal head, steel self drilling screws, austempered to a core hardness of Rockwell C 50.

1. Subject to compliance with requirements, provide products of one of the following manufacturers:
   a. ITWBuildex.
   b. Grabber Construction Products.
   c. SFS Intec Fastening Systems, Inc., Wyomissing.
   d. Textron Fastening Systems.

2.6 SIDE-LAP FASTENERS:

A. Provide Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

2.7 FABRICATION

A. General: Fabricate deck panels, without top-flange stiffening grooves, to comply with “SDI Specifications and Commentary for Steel Roof Deck”, in SDI Publication No. 29, and the following.

B. Steel Deck Spans: Where possible, all steel deck shall extend over three or more supports. Single span deck is prohibited.

2.8 ROOF OPENINGS

A. Provide a 20 gage galvanized flat plate to reinforce openings in roof deck that are greater than 6” and less than 10” in any one direction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install deck units and accessories in accordance with manufacturers recommendations and approved shop drawings, and as specified herein:

1. Place deck units on supporting framework and adjust to final position with accurately aligned side laps and ends bearing 2" minimum on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks. Place the end joint over a chord angle for deck bearing on steel bar joists.
2. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
3. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
4. Do not place deck units on concrete supporting structure until concrete has cured and is dry.
5. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.
6. Do not use roof deck units for storage or working platforms until permanently secured.

B. Attachment of Roof Deck:

1. The method of attachment, attachment pattern, and side lap fastener type and spacing shall be as shown on the drawings and comply with the requirements noted below.

2. Method of Attachment: The attachment method noted in the drawings shall comply with the applicable requirements below.
    a. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work. Weld metal shall penetrate all layers of deck material at end laps and side joints and shall have good fusion to the supporting member. Welding washers shall be used only when welding steel deck less than 0.028" thickness. The diameter of the puddle weld on the supporting member shall be, at a minimum, the diameter stated in the drawings but no less than 1/2 inch.
    b. Powder-Actuated or Pneumatically Driven Pins: An operator licensed by the pin manufacturer shall install all pins. Comply with the manufacturer's requirements to install the pins through all layers of the deck material and the manufacturer's required embedment into the supporting member.
    c. Self-Drilling Fasteners: Comply with the manufacturer's requirements to install the screws through all layers of the deck material and the manufacturer's required embedment into the supporting member.
3. Side Lap Fastening: Unless required otherwise by provisions of this specification, side laps of adjacent units shall be fastened by #10 (min.) TEK screws so that spacing between supports and fasteners does not exceed the value prescribed on the drawings. Button Punching is not allowable as a side-lap fastener.
4. End Bearing: Provide a minimum end bearing of 2" over supports.
5. End Joints: End joints of sheets shall be lapped 2” minimum over supports. Decks that slope 1/4 inch or more in 12 inches in the long direction shall be erected beginning at the low side to insure that end laps are shingle fashion.
6. Underwriters Laboratories Wind Uplift Classification Requirements: Unless a more stringent attachment requirement is specified elsewhere in this specification or on the drawings, roof deck units shall be attached to the supporting structure as required by the Construction Number specified elsewhere in this section.
7. Attachment to Girders: At locations noted in the drawings, attach the deck to steel members that are parallel to the deck flutes in accordance with the requirements noted in the drawings.

C. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.

D. Reinforcement at Openings: Roof openings less than 6" square or diameter require no reinforcement. Openings 6" to 10" inclusive shall be reinforced with a 20 gauge galvanized plate welded to the deck at each corner and 6" maximum centers with a 5/8" diameter puddle weld or sheet metal screws. For openings greater than 10" in diameter or width, refer to the drawings and structural steel specifications for additional framing to support the deck around the opening.

E. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and weld flanges to top of deck. Space welds not more than 12 inches apart with at least 1 weld in each corner.

F. Joint Covers: Provide steel joint covers at changes in direction of deck units, except where taped joints are specified.

G. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, and reinforcing channels according to deck manufacturer’s written instructions. Weld to substrate to provide a complete deck installation.

3.2 TOUCH-UP PAINTING

A. After deck installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.

B. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

3.3 QUALITY ASSURANCE INSPECTION DURING CONSTRUCTION

A. The method of attaching the deck to the frame is subject to inspection by the Owner’s designated Testing Laboratory. The Contractor shall, at its own expense, remove work found to be defective and replace with new acceptable work.

B. The Owner shall engage a qualified testing and inspection agency (The Owner’s Testing Laboratory) to perform the following inspections and prepare reports.

1. Welding or Self-drilling Fasteners
    a. Visually inspect 100% of the attachment of the steel deck to the structural frame and at side laps.
    b. Periodically monitor the method of attaching the steel deck to the structural frame.
2. Powder-actuated or pneumatically-driven pins
    a. Visually inspect 100% of the Powder-Actuated or Compressed-Air fasteners using an inspection gauge supplied by the manufacturer to verify that the stand-off distance from the top of the deck is in accordance with the manufacturer's requirements.

END OF SECTION 05 31 23

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SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes, but is not limited to:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Slotted channel framing.
   4. Shelf angles.
   5. Metal ladders.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:
   1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   2. Section 05 12 00 "Structural Steel Framing" for steel framing, supports, and other steel items attached to the structural-steel framing.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Shop primers.
   2. Shrinkage-resisting grout.
   3. Slotted channel framing.
   4. Manufactured metal ladders.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Steel framing and supports for mechanical and electrical equipment.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
3. Metal ladders.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
1. Size of Channels: 1-5/8 by 1-5/8 inches.
2. Material: Galvanized steel, ASTM A653/A653M, [commercial steel, Type B structural steel, Grade 33, with G90 coating; [0nominal thickness.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
1. Provide stainless steel fasteners for fastening aluminum.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.

C. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.

D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting," and Section 09 91 23 "Interior Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.
3. to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.

C. Galvanize miscellaneous framing and supports.

2.7 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 3/8-by-2-1/2-inch, minimum, steel flat bars, with eased edges.
3. Rungs: 3/4-inch-diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
6. Galvanize ladders, including brackets.

2.8 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels.

2.9 GENERAL FINISH REQUIREMENTS

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor shelf angles securely to existing construction with expansion anchors.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

3.3 INSTALLATION OF METAL LADDERS

A. General: Install metal ladders to comply with including manufacturers' written instructions and requirements indicated on Shop Drawings.

END OF SECTION 05 50 00

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SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Stainless steel railings.

1.3 COORDINATION

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Fasteners.
   3. Post-installed anchors.
   4. Handrail brackets.
   5. Bituminous paint.
   6. Nonshrink, nonmetallic grout.
   7. Metal finishes.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Initial Selection: For products involving selection of color, texture, or design, including mechanical finishes.

E. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated-design professional engineer.

B. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
   1. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
1. Intermediate Rails:
   a. Concentrated load of 50 lbf applied at any point and in any direction.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STAINLESS STEEL RAILINGS

A. Tubing: ASTM A554, Grade MT 304.

B. Pipe: ASTM A312/A312M, Grade TP 304.

C. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

2.4 FASTENERS

A. Fastener Materials:

1. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
2. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC30

1. Material: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel, 3-1/8 inches from face wall.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

I. Form changes in direction as follows:

1. As detailed.

J. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
   1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
   2. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces.
   3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Pipe and Tubing Finishes:
   1. 180-Grit Polished Finish: Uniform, directionally textured finish.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.
   1. Fit exposed connections together to form tight, hairline joints.
   2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
   3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
   4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
   6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

3.4 ATTACHING RAILINGS

A. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

B. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.5 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 05 52 13

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SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Wood blocking and nailers.
   2. Plywood backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:
   1. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Certified Wood:
      a. Submit a copy of the wood certification and the calculations showing percentage of certified wood used in the construction of the project.
      b. Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   4. Composite Wood:
      a. Provide signed approved submittal for installed products and manufacturers catalog cut sheet for each composite wood product used in the building indicating that the bonding agent used in each product contains no added urea-formaldehyde.
      b. Provide photos of installed wood products.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For the following, from ICC-ES:
   1. Preservative-treated wood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

B. Local Manufacturing: Manufacture wood products within 700 miles of project site.

C. Local Raw Materials Extraction: Harvest, extract, or recover raw materials from within a 700-mile radius from project site.

D. Certified Wood: Use a minimum of 50% certified of wood-based materials and products, for wood building components including, but not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

E. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

F. Composite Wood and Agrifiber: Products shall not contain urea-formaldehyde resin.

2.2 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.

B. Maximum Moisture Content of Lumber: 19 percent, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.

2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.

2. Nailers.
3. Rooftop equipment bases and support curbs.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
1. Mixed southern pine or southern pine; SPIB.

C. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of the following species:
1. Mixed southern pine or southern pine; SPIB.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F1667.

C. Screws for Fastening to Metal Framing: ASTM C1002, length as recommended by screw manufacturer for material being fastened.

D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC58, ICC-ES AC193, or ICC-ES AC308 as appropriate for the substrate.
1. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

2. Provide solid pressure treated wood blocking, 2 by 6 minimum or 2 layers of ¾ plywood 6” high minimum, between wood or metal framing for attachment of wall mounted accessories and equipment, including but not limited to the following:
    a. Wall stops for doors.
    b. Toilet Compartments; provide continuous vertical blocking for continuous wall brackets.
    c. Toilet and Bath Accessories.
    d. Handrail and Guard rail brackets.
    e. Projection Screens
    f. Mechanical equipment.
    g. Electrical equipment.
    h. TV and VCR Mounting Brackets.
    i. AV projectors

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
    1. Table 2304.10.1, "Fastening Schedule," in the Florida Building Code.
    2. ICC-ES evaluation report for fastener.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILER

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

END OF SECTION 06 10 53

SECTION 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Plastic-laminate-clad architectural cabinets.
   2. Cabinet hardware and accessories.
   3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
   2. Section 12 36 61 "Solid Surfacing Countertops."

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For plastic-laminate-faced architectural cabinets.
   1. Include plans, elevations, sections, and attachment details.
   2. Show large-scale details.
   3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.
   5. Apply AWI Quality Certification Program label to Shop Drawings.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Local Raw Materials Extraction: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   4. Certified Wood:
      a. Submit a copy of the wood certification and the calculations showing percentage of certified wood used in the construction of the project.
      b. Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   5. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

6. Composite Wood and Agrifiber:
    a. Provide signed approved submittal for installed products and manufacturers catalog cut sheet for each composite wood or agrifiber product used in the building indicating that the bonding agent used in each product contains no added urea-formaldehyde.
    b. Provide photos of installed wood and agrifiber products.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's or fabricator's standard size.

D. Samples for Verification: For the following:
1. Plastic Laminates: 12 by 12 inches, for each type, color, pattern, and surface finish required.
    a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Thermoset Decorative Panels: 12 by 12 inches, for each color, pattern, and surface finish.
    a. Provide edge banding on one edge.
3. Corner Pieces:
    a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
    b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
1. Shop Certification: AWI's Quality Certification Program accredited participant.

B. Installer Qualifications: Fabricator of products.

C. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed / concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

B. Local Manufacturing: Manufacture wood products within 700 miles of project site.

C. Local Raw Materials Extraction: Harvest, extract, or recover raw materials from within a 700-mile radius from project site.

D. Certified Wood: Use a minimum of 50% certified of wood-based materials and products.

E. Volatile Organic Compounds (VOC) shall meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.

F. Composite Wood and Agrifiber: Products shall not contain urea-formaldehyde resin.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide certificates from AWI certification program indicating that woodwork and installation complies with requirements of grades specified.
   2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Grade: Premium.

C. Type of Construction: Face frame.

D. Door and Drawer-Front Style: Flush overlay.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.

F. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Vertical Surfaces: Grade HGS.
   3. Edges: Grade HGS, matching laminate in color, pattern, and finish.
   4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
      a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
      b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber.
   3. Drawer Bottoms: Hardwood plywood.

H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

I. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

J. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As selected by Architect from laminate manufacturer's full range in the following categories:
      a. Solid colors, matte finish.
      b. Wood grains, matte finish.
      c. Patterns, matte finish.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated. Products shall be made without urea formaldehyde.
   1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
   2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
   3. Softwood Plywood: DOC PS 1.
      a. Marine grade, water resistance, at Breakroom

2.4 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening.

B. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch.

C. Catches: Magnetic catches, BHMA A156.9, B03141.

D. Shelf Rests: BHMA A156.9, B04013; metal, two-pin type with shelf hold-down clip.

E. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
      a. Type: Full extension.
      b. Material: Epoxy-coated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
   4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
   5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.

F. Door and Drawer Silencers: BHMA A156.16, L03011.

G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630.

H. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Resorcinol.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inchesusing concealed shims.
   1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
   2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide

unencumbered operation. Complete installation of hardware and accessory items as indicated.

3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets and countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets and countertops on exposed and semi-exposed surfaces.

END OF SECTION 06 41 16

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Cold-applied, emulsified-asphalt dampproofing.

B. Related Requirements:

1. Section 07 14 16 "Cold Fluid-Applied Waterproofing" for waterproofing.

1.3 ACTION SUBMITTALS

1. Product Data: For each type of product.

1.4 FIELD CONDITIONS

A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain primary dampproofing materials and primers from single source from single manufacturer. Provide auxiliary materials recommended in writing by manufacturer of primary materials.

2.2 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Trowel Coats: ASTM D 1227, Type II, Class 1.

B. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

C. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.3 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended in writing by dampproofing manufacturer for intended use and compatible with bituminous dampproofing.

B. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

C. Asphalt-Coated Glass Fabric: ASTM D 1668/D 1668M, Type I.

D. Patching Compound: Epoxy or latex-modified repair mortar of type recommended in writing by dampproofing manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.

B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.

B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

C. Clean substrates of projections and substances detrimental to dampproofing work; fill voids, seal joints, and remove bond breakers if any.

D. Apply patching compound to patch and fill holes, reveals, and other imperfections.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written instructions for dampproofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.

1. Apply dampproofing to provide continuous plane of protection.
2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.

B. Where dampproofing exterior face of inner wythe of exterior masonry cavity walls, lap dampproofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.

1. Extend dampproofing over outer face of structural members and concrete slabs that interrupt inner wythe.
2. Lap dampproofing at least 1/4 inch onto shelf angles supporting veneer.

C. Where dampproofing interior face of above-grade, exterior concrete and single-wythe masonry walls, continue dampproofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by dampproofing wall before constructing intersecting walls.

3.4 COLD-APPLIED, EMULSIFIED-ASPHALT DAMPPROOFING

A. Masonry Backup for Brick Veneer Assemblies: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft.

3.5 PROTECTION

A. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 07 11 13

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Glass-Fiber board insulation.
   2. Glass-fiber blanket insulation.

B. Related Requirements:
   1. Section 07 52 16 “SBS Modified Bituminous Membrane Roofing" for insulation specified as part of roofing construction.
   2. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Polyisocyanurate foam-plastic board insulation.
   2. Glass-fiber blanket insulation.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   3. Insulation: Provide signed approved submittal for insulation materials and manufacturers catalog cut sheet for each insulation product used indicating that it contains no formaldehyde.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Insulation shall be free of formaldehyde.

2.2 BLANKET (BATT) INSULATION

A. At Contractor’s option provide either of the following:

B. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 BOARD INSULATION

A. At Contractor’s option provide either of the following:

B. Glass-Fiber Board Insulation, Unfaced: ASTM C612, Type IA; unfaced, passing ASTM E136 for combustion characteristics.
   1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
   3. Nominal Density: 3 lb/cu. ft.
   4. Minimum Thickness: 2 inches.
   5. Thermal Resistivity: 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F.
   6. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

C. Mineral-Wool Board Insulation, Types IA and IB, Unfaced: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.
   1. Nominal Density: 4 lb/cu. ft. Flame-Spread Index: Not more than 15 when tested in accordance with ASTM E84.
   2. Minimum Thickness: 2 inches.
   3. Smoke-Developed Index: Not more than zero when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.4 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

2.5 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
   2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
   1. Volatile Organic Compounds (VOC) shall meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF BOARD INSULATION

A. Install at interior side of exterior wall above ceilings.

B. Butt panels together for tight fit.

C. Anchor Installation: Install board insulation on masonry substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 52 16 - STYRENE-BUTADIENE-STYRENE (SBS) MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Styrene-butadiene-styrene (SBS)-modified bituminous membrane roofing.
   2. Roof insulation.
   3. Cover board.
   4. Walkways.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry” for wood cants.
   2. Section 07 71 00 "Roof Specialties" for premanufactured metal copings and roof edge flashings.
   3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review temporary protection requirements for roofing system during and after installation.
   8. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Approval: For each roofing system provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Sustainable Design Submittals:
   1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
   2. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   4. Insulation: Provide signed approved submittal for insulation materials and manufacturers catalog cut sheet for each insulation product used indicating that it contains no formaldehyde.

C. Product Data: For each type of product.
   1. Provide data sheet to facilitate the addition of the roof system information and Warranty information to the Owner's Roof Asset Management database. Contact the maintenance group in charge of the facility for data input forms and more information.

D. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Crickets, saddles, and tapered edge strips, including slopes.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

E. Samples for Verification: For the following products:
   1. Cap sheet.
   2. Walkway Pads.

1.6 INFORMATIONAL SUBMITTALS

A. Product Approval: For each roofing system provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Qualification Data: For Installer.

C. Protection Plans: Provide a specific protection plan that describes the means of maintaining the building in a safe and watertight condition throughout the construction period. Newly installed roof systems shall be considered in the protection plan to ensure roofing operations do not damage them. Areas where the roof deck/structure are (or may be) damaged or deteriorated shall only be re-roofed when the occupied spaces below are unoccupied. Other potential phases of reroofing operations can be hazardous to the facility and its occupants and shall be carefully reviewed during bidding and at appropriate phases during construction.

D. Field quality-control reports.

E. Roof Database: Provide data sheet to facilitate the addition of the roof system information and Warranty information to the Owner's Roof Asset Management database. Contact the maintenance group in charge of the facility for data input forms and more information.

F. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that has a current State of Florida license and is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. The Roofing contracting firms shall have a minimum of five (5) years of experience installing the type of system specified. This experience shall have been earned by the firm proposing the work, not by individual employees.
2. The job site superintendent shall have a minimum of five (5) years of experience installing the type of system specified.

B. Membrane Manufacturer Inspections: The project the roof membrane manufacturer make a minimum of three visits during application and one visit at the time of the substantial completion inspection with a written report of each visit to the Architect/Engineer and UF Project Manager.

1. Manufacturer inspections shall be accomplished by technical representatives with a minimum of five (5) years direct working experience with the technical department of that manufacturer.
2. The manufacturer shall certify the installation on completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

B. Hot Work Safety: Comply with the UF EH&S Hot Work Safety Policy. This policy can be found at http://www.ehs.ufl.edu/programs/os/hotwork

1.11 WARRANTY

A. Manufacturer’s Warranties: Manufacturers shall provide system warranties that meet the following criteria:

1. Roofing system shall be guaranteed against defects in materials and/or workmanship for a period of 30-year NDL (No-Dollar-Limit) warranty from the date of the Certificate of Substantial Completion. During this period, the manufacturer shall pay all costs of repairs to the roof system necessary to correct roof leaks resulting from any one of the following causes:
    a. Improper workmanship in application of roofing system and substrate components.

b. Deterioration of roof membrane or flashing caused by ordinary weathering and/or exposure to ultra-violet light.
c. Blisters, buckles, ridges, wrinkles, fish mouths, and slips.
d. Damage to roofing system and substrate due to thermal shock (extreme temperature fluctuations).
e. Slippage of roofing system components.
f. Breaks in roofing system or substrate components.

2. During the warranty period, the Manufacturers and the Contractor agree that, within 24 hours of receipt of notice from the Owner, they will inspect and make immediate emergency repairs to defects or to leaks in the roofing system. They further agree that, within a reasonable time, they shall restore the affected items to the standard of the original specifications.

3. Warranty shall be in written form acceptable to the Owner and shall be made by an authorized representative the manufacturer of the roofing membrane system used and shall be for the full period of time as specified herein.

B. Roofing Contractor's Warranties: Roofing Contractor shall provide a guarantee against defects in materials and/or workmanship for a period of 2-years from the date of the Certificate of Substantial Completion.

C. During the warranty period, the Manufacturers and the Roofing Contractor agree that, within 24 hours of receipt of notice from the Owner, they will inspect and make immediate emergency repairs to defects or to leaks in the roofing system. They further agree that, within a reasonable time, they shall restore the affected items to the standard of the original specifications.

D. All emergency work and permanent work done during the Warranty Period shall be done without cost to the Owner, except in the event it is determined that such leaks were caused by Owner abuse, vandalism, lightning, hurricane, tornado, hail storm or other cause typically excluded by warranty documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. General: Roofing systems/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. Approved Roofing Materials: Limited to those manufacturers with a 15-year history of satisfactory manufacture and installation of at least 250,000 squares of their roof system, and who provide a minimum 20-year unlimited warranty/guarantee for labor and materials, including metal finishes.

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

1. Johns Manville; a Berkshire Hathaway company.
2. Siplast, Inc.
3. Tremco
4. Sika / Sarnafil

D. Source Limitations: Obtain components including roof insulation, fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Roofing systems/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures as indicated on the Drawings.

D. FM Global Listing: Roofing, base flashings, and component materials shall comply with requirements in FM Global 4450 or FM Global 4470 as part of a roofing system and shall be listed in FM Global's "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Global markings.

E. SPRI's Directory of Roof Assemblies Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system and shall be listed in SPRI's Directory of Roof Assemblies for roof assembly identical to that specified for this Project.

1. Wind Uplift Load Capacity: 120 psf.

F. Energy Performance: Roofing system shall have an initial solar reflectance of not less than 82 when calculated according to ASTM E 1980.

G. Exterior Fire-Test Exposure: ASTM E108 or UL 790, **Class A**; for application and roof slopes indicated; testing by a qualified testing agency.

1. Identify products with appropriate markings of applicable testing agency.

2.3 ROOFING SHEET MATERIALS

A. Base Sheet: ASTM D 4601, Type II, SBS-modified asphalt-impregnated and -coated sheet, with glass-fiber-reinforcing mat, dusted with fine mineral surfacing on both sides.

1. Weight: 25 lb/100 sq. ft., minimum.

B. Roofing Membrane Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet reinforced with polyester fabric or ASTM D 6163, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers; smooth surfaced; suitable for application method specified.

C. Granule-Surfaced Roofing Cap Sheet: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet reinforced with polyester fabric or ASTM D 6163, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with glass fibers; granule surfaced; suitable for application method specified, and as follows:

1. Granule Color: White.

2.4 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6164/D 6164M, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); smooth surfaced; suitable for application method specified.

B. Flashing Sheet: Provide one of the following:

1. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, glass-fiber-reinforced SBS-modified asphalt sheet (reinforced with glass fibers); metal-foil surfaced; suitable for application method specified, and as follows:

a. Foil Surfacing: Aluminum.

C. Glass-Fiber Fabric: Woven glass-fiber cloth, treated with asphalt, complying with ASTM D 1668, Type I.

D. Liquid Flashing System: Roof membrane manufacturer's standard one- or two-part moisture curing resin with low solvent content, consisting of a primer, flashing cement, and scrim.

2.5 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

C. Roof Vents: As recommended by roof membrane manufacturer.
   1. Size: Not less than4-inch diameter.

A. Cold-Applied Asphalt Adhesive: ASTM D3019, Type III, roof membrane manufacturer's standard asphalt-based, one- or two-part, asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with roofing membrane and base flashings.

B. Cold-Applied Polymer-Modified Asphalt Adhesive: Roof membrane manufacturer's standard solvent-and asbestos-free, cold-applied adhesive, specially formulated for compatibility and use with interply sheets.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

E. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing.

F. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards, manufactured or approved by roof membrane manufacturer.
   1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent.
   2. Insulation shall be free of formaldehyde.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2 or Type II, Class 1, Grade 3, felt or glass-fiber mat facer on both major surfaces.
   1. Compressive Strength: 20 psi, minimum.
   2. Size: 48 by 48 inches
   3. Thickness:
      a. Base Layer: 1-1/2 inches.
      b. Upper Layers: As required to achieve a minimum 36 R value, continuous.

2.7 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Full-spread spray-applied, low-rise, two-component urethane adhesive.

2. Volatile Organic Compounds (VOC) shall meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

D. Insulation Cant Strips: ASTM C728, perlite insulation board.

E. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.
1. Thickness: 1/2 inch.
2. Surface Finish: Unprimed.

2.8 WALKWAYS

A. Walkway Cap-Sheet Strips: ASTM D 6164/D 6164M, Grade G, Type I or II, SBS-modified asphalt sheet (reinforced with polyester fabric); granule surfaced; suitable for application method specified, and as follows:
1. Granule Color: Gray.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

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

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions.
1. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Comply with roofing system manufacturer's written instructions.

3.4 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast.
1. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.5 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components, so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing system with vertical surfaces or angle changes greater than 45 deg F.

D. Installation Over Metal Decking:

1. Install base layer of insulation with [joints staggered not less than 24 inchesin adjacent rows.
    a. Locate end joints over crests of decking.
    b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    d. Fill gaps exceeding 1/4 inch with insulation.
    e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    f. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
        1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation, with joints of each layer offset not less than 12 inches from previous layer of insulation.
    a. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    d. Trim insulation, so that water flow is unrestricted.
    e. Fill gaps exceeding 1/4 inch with insulation.
    f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    g. Adhere each layer of insulation to substrate using adhesive according to Florida Product Approval.
        1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines, with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. Cut and fit cover board tight to nailers, projections, and penetrations.
3. Adhere cover board to substrate using adhesive according to Florida Product Approval as follows:

a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing, and maintaining insulation in place.

3.7 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions and applicable recommendations in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."

B. Start installation of roofing in presence of manufacturer's technical personnel.

C. Where roof slope exceeds 1/2 inch per 12 inches, install roofing membrane sheets parallel with slope.

D. Coordinate installation of roofing system so insulation and other components of the roofing system not permanently exposed are not subjected to precipitation or left uncovered at the end of the workday or when rain is forecast.

1. Provide tie-offs at end of each day's work to cover exposed roofing sheets and insulation with a course of coated felt set in roofing cement or hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings, and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.8 BASE-SHEET INSTALLATION

A. Before installing, unroll base sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature.

B. Installation of [SBS-Modified Bitumen Polyester-Mat] [SBS-Modified Fiberglass-Mat] [SBS-Modified Bitumen Polyester and Fiberglass-Mat] Base Sheet:

1. Install base sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
2. Extend roofing sheets over and terminate above cants.
3. Install base sheet in a shingle fashion.
4. Adhere to substrate in a uniform coating of cold-applied adhesive.
5. Install base sheet without wrinkles, rears, and free from air pockets.
6. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
    a. Lap side laps as recommended by roof membrane manufacturer but not less than 3 inches.
    b. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
    c. Stagger end laps not less than 18 inches.
    d. Completely bond and seal laps, leaving no voids.
    e. Roll laps with a 20-pound roller.
7. Repair tears and voids in laps and lapped seams not completely sealed.
8. Apply pressure to the body of the base sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.9 INSTALLATION OF INTERPLY SHEETS

A. Install two ply sheet, starting at low point of roofing.

1. Align ply sheets without stretching.

2. Shingle side laps of ply sheets uniformly to achieve required number of plies throughout thickness of roofing membrane.
    a. Shingle in direction to shed water.
3. Extend ply sheets over and terminate above cants.

3.10 SBS-MODIFIED BITUMINOUS CAP SHEET INSTALLATION

A. Before installing, unroll cap sheet, cut into workable lengths, and allow to lie flat for a time period recommended by manufacturer for the ambient temperature at which cap sheet will be installed.

B. Install modified bituminous roofing cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system.
1. Extend cap sheet over and terminate above cants.
2. Install cap sheet in a shingle fashion.
3. Install cap sheet as follows:
    a. Adhere to substrate in cold-applied adhesive.
4. Install cap sheet without wrinkles or tears, and free from air pockets.
5. Install cap sheet, so side and end laps shed water.

C. Laps: Accurately align roofing sheets, without stretching, and maintain uniform side and end laps.
1. Lap end laps as recommended by roof membrane manufacturer but not less than 12 inches.
2. Stagger end laps not less than 18 inches.
3. Completely bond and seal laps, leaving no voids.
4. Roll laps with a 20-pound roller.
5. Repair tears and voids in laps and lapped seams not completely sealed.

D. Apply pressure to the body of the cap sheet according to manufacturer's instructions, to remove air pockets and to result in complete adhesion of base sheet to substrate.

3.11 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof, and secure to substrates according to roofing system manufacturer's written instructions and as follows:
1. Prime substrates with asphalt primer if required by roofing system manufacturer.
2. Backer-Sheet Application: Adhere backer sheet to substrate in cold-applied adhesive.
3. Flashing-Sheet Application: Torch apply flashing sheet to substrate.

B. Extend base flashing up walls or parapets a minimum of 10 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.
1. Seal top termination of base flashing with a strip of glass-fiber fabric set in asphalt roofing cement.

D. Install liquid flashing system according to manufacturer's recommendations.
1. Extend liquid flashing not less than 3 inches in all directions from edges of item being flashed.

E. Install roofing cap-sheet stripping where metal flanges and edgings are set on roofing according to roofing system manufacturer's written instructions.

F. Roof Drains: Set 30 by 30-inch metal flashing in bed of asphaltic adhesive on completed roofing membrane. Cover metal flashing with roofing cap-sheet stripping and extend a minimum of 6 inches beyond edge of metal flashing onto field of roofing membrane. Clamp roofing membrane, metal flashing, and stripping into roof-drain clamping ring.

1. Install stripping according to roofing system manufacturer's written instructions.

3.12 WALKWAY INSTALLATION

A. Walkway Cap-Sheet Strips: Install walkway cap-sheet strips over roofing membrane, using same application method as used for roofing cap sheet.

1. Install walkways at the following locations:
   a. Perimeter of each rooftop unit.
   b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
   c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
   d. Locations indicated on Drawings.
   e. As required by roof membrane manufacturer's warranty requirements.
2. Provide 3-inch clearance between adjoining pads.
3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.13 FIELD QUALITY CONTROL

A. Independent Envelope Commissioning Consultant: Owner will engage a qualified Independent Envelope Commissioning Consultant to perform inspections and to review test reports.

B. Testing Agency: Construction Manager will engage a qualified testing agency to perform tests and to prepare test reports.

C. Test Cuts: Test specimens will be removed to evaluate problems observed during quality-assurance inspections of roofing membrane as follows:

1. Approximate quantities of components within roofing membrane will be determined according to ASTM D 3617.
2. Test specimens will be examined for interply voids according to ASTM D 3617 and to comply with criteria established in Appendix 3 in ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
3. Repair areas where test cuts were made according to roofing system manufacturer's written instructions.

D. Membrane Manufacturer Inspections: The roof membrane manufacturer shall make a minimum of three visits during application and one visit at the time of the substantial completion inspection with a written report of each visit to the Architect/Engineer and UF Project Manager.

E. Roof Moisture Survey: After a minimum 90-day weatherizing period, the roofing shall be scanned using infrared thermography or other approved methods to verify that the new insulation has not been damaged by moisture intrusion.

1. Scans shall be performed by an independent testing agency.
2. Test cuts to verify non-destructive survey results shall be repaired by the contractor who installed the roofing.
3. The roof system manufacturer shall approve the repair methods.

F. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

1. Notify Architect and Owner 48 hours in advance of date and time of inspection.

G. Roofing system will be considered defective if it does not pass tests and inspections.
   1. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.14 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

3.15 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name**> of <**Insert address**>, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:
   1. Owner: University of Florida.
   2. Address: <**Insert address**>.
   3. Building Name: **Blueberry Research Facility**.
   4. Address: <**Insert address**>.
   5. Area of the Work: Low Slope roof areas.
   6. Acceptance Date: <**Insert date**>.
   7. Warranty Period: Two years from the date of the Certificate of Substantial Completion.
   8. Expiration Date: <**Insert date**>.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
   1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:
      a. Lightning;
      b. Peak gust wind speed exceeding 135 mph;
      c. Fire;
      d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
      e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
      f. Vapor condensation on bottom of roofing; and
      g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
   2. When the work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to the work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the work.
4. During Warranty Period, if Owner allows alteration of the work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of the alterations, but only to the extent the alterations affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim, that the alterations would likely damage or deteriorate the work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect the work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on the work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of the work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <**Insert day**> day of <**Insert month**>, <**Insert year**>.
1. Authorized Signature: <**Insert signature**>.
2. Name: <**Insert name**>.
3. Title: <**Insert title**>.

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SECTION 07 71 00 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Copings.
   2. Roof-edge drainage systems.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
   3. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
   4. Section 07 92 00 "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

C. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, roofing-system testing and inspecting agency representative, roofing Installer, roofing-system manufacturer's representative, Installer, structural-support Installer, and installers whose work interfaces with or affects roof specialties, including installers of roofing materials and accessories.
   2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification:
   1. Include Samples of each type of roof specialty to verify finish and color selection, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Product Approval: For each roofing system provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Qualification Data: For manufacturer.

C. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer offering products meeting requirements that are FM Approvals listed for specified class and SPRI ES-1 tested to specified design pressure.

B. Source Limitations: Obtain roof specialties manufactured by or approved by manufacturer providing roofing-system warranty specified in Section 07 52 16 “SBS Modified Bituminous Membrane Roofing.”

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Roofing-System Warranty: Roof specialties are included in warranty provisions in Section 07 52 16 “SBS Modified Bituminous Membrane Roofing."

B. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1. Manufactured Roof Specialty systems/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. SPRI Wind Design Standard: Manufacture and install copings and roof-edge specialties tested according to SPRI ES-1 and capable of resisting the following design pressures:
   1. Design Pressure: As indicated on Drawings.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 COPINGS

A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide OMG, Inc. < “PermaSnap Premier Plus” or comparable product by one of the following:
      a. Architectural Products Co.
      b. Metal-Era, Inc.
      c. The roofing manufacturer.
   2. Formed Aluminum Sheet Coping Caps: Aluminum sheet, thickness as required to meet performance requirements, but not less than 0.063 inch thick.
      a. Surface: Smooth, flat finish.
   3. Corners: Factory mitered and continuously welded.
   4. Coping-Cap Attachment Method: Snap-on or face leg hooked to continuous cleat with back leg fastener exposed, fabricated from coping-cap material.
      a. Snap-on Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.
      b. Face-Leg Cleats: Concealed, continuous galvanized-steel sheet.

2.3 ROOF-EDGE DRAINAGE SYSTEMS

A. Basis-of-Design Product: Subject to compliance with requirements, provide OMG, Inc. “Wind Resistant Box Gutter” or comparable product by one of the following:
   1. Architectural Products Co.
   2. Merchant and Evans.
   3. The roofing manufacturer.

B. Gutters: Manufactured in uniform section lengths not exceeding 12 feet, with matching corner units, ends, outlet tubes, roof edge flange and other accessories. Elevate back edge at least 1 inch above front edge. Furnish gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
   1. Aluminum Sheet: 0.063 inch thick.
   2. Gutter Profile: Style A according to SMACNA's "Architectural Sheet Metal Manual."
   3. Gutter Supports: Manufacturer's standard concealed aluminum supports.
   4. Gutter Accessories: Continuous hinged leaf guard of solid metal designed to shed leaves.

C. Downspouts: Plain rectangular complete with mitered elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Formed Aluminum: 0.063 inch thick.

D. Aluminum Finish: Three-coat fluoropolymer.

2.4 MATERIALS

A. Aluminum Sheet: ASTM B209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

B. Aluminum Extrusions: ASTM B221, alloy and temper recommended by manufacturer for type of use and finish indicated, finished as follows:

C. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GCP Applied Technologies Inc. “Grace Ice and Water Shield HT” or comparable product by one of the following:
   a. Henry Company.
2. Thermal Stability: ASTM D1970/D1970M; stable after testing at 240 deg F.
3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F.

B. Slip Sheet: Rosin-sized building paper, 3-lb/100 sq. ft. minimum.

2.6 MISCELLANEOUS MATERIALS

A. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Series 300 stainless steel.

B. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

C. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type joints with limited movement.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Aluminum Finish:

1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

b. Concealed Surface Finish: Apply pretreatment and manufacturer's standard acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.

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

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

1. Apply continuously under copings and roof-edge specialties.
2. Coordinate application of self-adhering sheet underlayment under roof specialties with requirements for continuity with adjacent air barrier materials.

B. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
   1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
   2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

3.4 INSTALLATION OF COPINGS

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
   1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at manufacturer's required spacing that meets performance requirements, but not less than 40-inch centers.

3.5 INSTALLATION OF ROOF-EDGE SPECIALTIES

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 INSTALLATION OF ROOF-EDGE DRAINAGE-SYSTEM

A. Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.

B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
   1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
   2. Install continuous leaf guards on gutters with noncorrosive fasteners, removable for cleaning gutters.

C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
   1. Connect downspouts to underground drainage system indicated.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 71 00

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SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Pinellas County School Board Bidding and Contractual Requirements and general provisions of Section 01 00 00 Procurement and Contracting Requirements shall apply to all work.

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

1.2 SUMMARY

A. Section Includes:
   1. Equipment supports.
   2. Roof hatches.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders for access to roof hatches.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, and miscellaneous sheet metal trim and accessories.

1.3 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

1.5 INFORMATIONAL SUBMITTALS

A. Product Approval: For each roofing accessory provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Roofing accessory systems/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

C. Wind-Restraint Performance: As indicated on Drawings.

2.2 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced perimeter metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, and integrally formed structure-mounting flange at bottom.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

D. Material: Aluminum-zinc alloy-coated steel sheet, minimum 0.064 inch thick.
   1. Finish: Baked enamel or powder coat.
   2. Color: As selected by Architect from manufacturer's full range.

E. Construction:
   1. Curb Profile: Manufacturer's standard compatible with roofing system.
   2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
   3. Nailer: Factory-installed continuous wood nailers 3-1/2 inches wide on top flange of equipment supports, continuous around support perimeter.
   4. Wind Restraint Straps and Base Flange Attachment: Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.
   5. Fabricate equipment supports to minimum height of 12 inches above roofing surface unless otherwise indicated.
   6. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.3 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing, and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.

B. Type and Size: Single-leaf lid, 36 by 36 inches.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Aluminum-zinc alloy-coated steel sheet.
   1. Thickness: Manufacturer's standard thickness for hatch size indicated.
   2. Finish: Baked enamel or powder coat.
   3. Color: As selected by Architect from manufacturer's full range.

E. Construction:
   1. Insulation: 2-inch-thick, polyisocyanurate board.
      a. R-Value: 12.0 according to ASTM C1363.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   4. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   5. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, galvanized steel butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
   1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
   2. Height: 42 inches above finished roof deck.
   3. Material: Steel tube.
   4. Post: 1-5/8-inch diameter pipe.
   5. Finish: Manufacturer's standard baked enamel or powder coat.
      a. Color: As selected by Architect from manufacturer's full range.

2.4 METAL MATERIALS

A. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, AZ50 coated.
   1. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
   2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

C. Steel Tube: ASTM A500/A500M, round tube.

D. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

E. Steel Pipe: ASTM A53/A53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.

C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

E. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C920, elastomeric polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

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

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation: Install each roof curb so top surface is level.

D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.

E. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
2. Attach safety railing system to roof-hatch curb.
3. Attach ladder-assist post according to manufacturer's written instructions.

3.4 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Clean exposed surfaces according to manufacturer's written instructions.

C. Clean off excess sealants.

D. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Silyl-terminated polyether joint sealants.
   4. Mildew-resistant joint sealants.
   5. Latex joint sealants.

B. Related Requirements:
   1. Section 07 92 19 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Sustainable Design Submittals:
   1. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content: Sealants shall have a VOC content of 50 or less.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses NT.

2.4 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.5 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

C. STPE, Mildew Resistant, S, NS, 50, NT: Mildew-resistant, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

2.6 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

2.7 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Plaster
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Exterior expansion joints.
      b. Perimeter joints at storefront framing, door frames, windows, and louvers.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT or STPE, S, NS, 50, NT.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement
   1. Joint Locations:
      a. Control joints on exposed interior surfaces of exterior walls.
      b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Acrylic latex.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
   1. Joint Locations:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Tile control and expansion joints where indicated.
      c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT or STPE, Mildew Resistant, S, NS, 50, NT.

D. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:
   a. Aluminum thresholds.
   b. Sill plates.
   c. Other concealed joints as indicated on Drawings.
2. Joint Sealant: One of the following:
   a. Silicone, nonstaining, S, NS, 50, NT.
   b. STPE, S, NS, 50, NT.
   c. Urethane, S, NS, 100/50, NT

END OF SECTION 07 92 00

SECTION 07 92 19 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical joint sealants.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each acoustical joint sealant.

B. Sustainable Design Submittals:

1. Submit Material Safety Data Sheet (MSDS) highlighting the stated VOC emissions for each acoustical sealant.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

B. VOC Content: Sealants shall have a VOC content of 50 or less.

2.2 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Exterior standard steel doors and frames.

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, core descriptions, and finishes.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Shop Drawings: Include the following:
   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.

D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Approval: For each type exterior door and frame provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Product Approval: Exterior door and frame systems/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

2.2 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
   1. Doors:
      a. Type: Flush.
      b. Thickness: 1-3/4 inches.
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
      d. Edge Construction: Model 2, Seamless.
      e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
      f. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
      g. Core: Polyisocyanurate.
   2. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
      b. Construction: Full profile welded.
   3. Exposed Finish: Prime.

2.3 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.4 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

H. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.5 FABRICATION

A. Doors

1. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.6 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Solidly pack mineral-fiber insulation inside frames.
   4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
   5. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI A250.8.

3.3 FIELD QUALITY CONTROL

A. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

B. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 REPAIR

A. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 11 13

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SECTION 08 12 16 – ALUMINUM FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior manual-swing door-frame units.

B. Related Requirements:
   1. Section 08 14 16 "Flush Wood Doors" for doors installed in aluminum frames.
   2. Section 08 71 00 "Door Hardware" for door hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For aluminum frames. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Glazing.

C. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum frames, made from 12" lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Glazing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Source Limitations: Obtain aluminum frames through one source from a single manufacturer.

C. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum frame openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by structural movements.
      c. Failure of operating components.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer North America; an Alcoa company; “InFrame Interior Framing System,” 2" x 6" nominal dimension, or a comparable product by one of the following:
   1. C R Lawrence Co.
   2. EFCO Corporation.
   3. Oldcastle Building Envelope™.
   4. RACO Interior Products, Inc.
   5. YKK AP America Inc.

2.2 FRAMING SYSTEM

A. Framing Members: Manufacturer's extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Fabrication Method: Field-fabricated stick system.

2. Finish: Clear anodic finish.
3. Glazing System: Center glazed, without projecting stops, retained mechanically with gaskets on four sides.

B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

C. Brackets and Reinforcing Members: Aluminum or nonmagnetic stainless steel; provide sufficient strength to withstand design pressure indicated.

D. Materials:
1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
a. Sheet and Plate: ASTM B 209.
b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
d. Structural Profiles: ASTM B 308/B 308M.

2.3 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

2.4 ACCESSORIES

A. Fasteners and Accessories: Aluminum or nonmagnetic stainless steel fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

2.5 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical isolation of glazing from framing members.
4. Accommodations mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Framing: Fabricate components for assembly using screw-spline system.

D. Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.

F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.6 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components plumb and true in alignment with established lines and grades.

D. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum frames. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 12 16

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Five-ply flush wood veneer-faced doors for transparent finish.
   2. Factory finishing flush wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Factory-finishing specifications.

B. Sustainable Design Submittals:
   1. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Certified Wood:
      a. Submit a copy of the wood certification and the calculations showing percentage of certified wood used in the construction of the project.
      b. Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   4. Composite Wood:
      a. Provide signed approved submittal for installed products and manufacturers catalog cut sheet for each composite wood product used in the building indicating that the bonding agent used in each product contains no added urea-formaldehyde.
      b. Provide photos of installed wood products.
   5. Door schedule indicating door location, type, size, fire protection rating, and swing.
   6. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
   7. Dimensions and locations of blocking for hardware attachment.
   8. Dimensions and locations of mortises and holes for hardware.
   9. Clearances and undercuts.

10. Requirements for veneer matching.
11. Doors to be factory finished and application requirements.
12. Apply AWI Quality Certification Program label to Shop Drawings.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:
1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.7 QUALITY ASSURANCE

A. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors[and frames] that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Delamination of veneer.
b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Provide labels and certificates from AWI certification program indicating that doors comply with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

B. Regional Materials: Manufacture wood doors within 700 miles of Project site.

C. Certified Wood: Use a minimum of 50% certified of wood-based materials and products, for wood building components including, but not limited to, structural framing and general dimensional framing, flooring, finishes, furnishings and non-rented temporary construction applications such as bracing, concrete form work and pedestrian barriers.

D. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

E. Composite Wood Products: Products shall not contain urea-formaldehyde resin.

F. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.3 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Eggers Industries.
   b. Lambton Doors.
   c. Masonite Architectural.
   d. Oshkosh Door Company.
   e. VT Industries Inc.
2. Performance Grade: ANSI/WDMA I.S. 1A Extra Heavy Duty.
3. Architectural Woodwork Standards Grade: Premium.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.
   a. Species: Red oak.
   b. Cut: Plain sliced (flat sliced).
   c. Match between Veneer Leaves: Book match.
   d. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
5. Exposed Vertical Edges: Same species as faces - Architectural Woodwork Standards edge Type A.
6. Core: Glued wood stave.
7. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Recessed tapered beads.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.
   1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
   2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
   3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.

C. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.
   1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   2. Finish faces, all four edges, edges of cutouts, and mortises.
   3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:
   1. Architectural Woodwork Standards Grade: Premium.
   2. Finish: Architectural Woodwork Standards System-11, Catalyzed Polyurethane.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Sheen: Semigloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

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SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Interior Flush Access Doors with Concealed Flanges:
   1. Description: Face of door flush with frame; with concealed flange for gypsum board and plaster installation and concealed hinge.
   2. Locations: Wall and ceiling, in non- occupied spaces.
   3. Door Size: 24 inches by 24 inches, unless otherwise indicated.
   4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage factory primed.
   5. Frame Material: Same material and thickness as door.
   6. Latch and Lock: Cam latch, screwdriver operated.

B. Interior Recessed Access Doors with Concealed Flanges:
   1. Description: Door face recessed 1/2 inch at ceilings and 5/8 inch at walls for gypsum board infill, with concealed flange for gypsum board installation and concealed hinge.
   2. Locations: Wall and ceiling, in public, student and faculty occupied spaces.
   3. Door Size: 24 inches by 24 inches, unless otherwise indicated.
   4. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch, 16 gage, factory primed.
   5. Frame Material: Same material and thickness as door.
   6. Latch and Lock: Cam latch, hex-head wrench operated.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 or A60 metallic coating.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Aluminum-framed storefront systems.
   2. Aluminum-framed entrance door systems.

B. Related Requirements:
   1. Section 08 12 16 "Aluminum Frames" for interior aluminum framing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:
   1. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   2. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Include point-to-point wiring diagrams showing the following:
      a. Power requirements for each electrically operated door hardware.
      b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

D. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.5 INFORMATIONAL SUBMITTALS

A. Product Approval: For each type exterior Aluminum-Framed Entrance and Storefront provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Sample Warranties: For special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      b. Cracking, peeling, or chipping.
   2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Exterior Aluminum-Framed Entrances and Storefront systems / products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:
    a. Thermal stresses transferring to building structure.
    b. Glass breakage.
    c. Noise or vibration created by wind and thermal and structural movements.
    d. Loosening or weakening of fasteners, attachments, and other components.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to [edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

E. Water Penetration under Static Pressure: Test according to ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. 15 lbf/sq. ft.

F. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Air Leakage:
    a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft. when tested according to ASTM E283.
    b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft.
2. Condensation Resistance Factor (CRF):
    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined according to AAMA 1503.
    b. Entrance Doors: CRF of not less than 57 as determined according to AAMA 1503.

G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 20 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.3 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Kawneer North America, an Arconic company.
2. Oldcastle Building Envelope.
3. U.S. Aluminum; a brand of C.R. Laurence.
4. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Exterior Framing Construction: Nonthermal.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.
4. Finish: Clear anodic finish.
5. Fabrication Method: Field-fabricated stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: Medium stile; 3 1/2-inch nominal width.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.
a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.5 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

2.6 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: Comply with Section 08 80 00 "Glazing."

D. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

2.7 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Extruded Structural Pipe and Tubes: ASTM B429/B429M.

D. Structural Profiles: ASTM B308/B308M.

E. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

F. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.

G. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

H. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

I. Regional Materials: Manufacture products within 700 miles of Project site.

2.8 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel].

B. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

C. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.9 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.

4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from [] interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
1. At exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:
1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.4 INSTALLATION OF WEATHERSEAL SEALANT

A. Install weatherseal sealant to completely fill cavity, according to sealant manufacturer's written instructions, to produce weatherproof joints.

3.5 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.6 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
   2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
      c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
   4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 41 13

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SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Related Requirements:
   1. Section 06 41 16 "Plastic-Laminate-Clad Architectural Cabinets" for cabinet door hardware provided with cabinets.
   2. Section 28 31 00 " Fire Detection and Alarm System " for connections to building fire-alarm system.

1.3 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

C. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Conference participants shall include Installer's Architectural Hardware Consultant.

B. Keying Conference: Conduct conference at Project site.
   1. Conference participants shall include Installer's Architectural Hardware Consultant.
   2. Incorporate conference decisions into keying schedule after reviewing door hardware keying system including, but not limited to, the following:
      a. Flow of traffic and degree of security required.
      b. Preliminary key system schematic diagram.
      c. Requirements for key control system.
      d. Requirements for access control.
      e. Address for delivery of keys.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For electrified door hardware.

1. Include diagrams for power, signal, and control wiring.
2. Include details of interface of electrified door hardware and building safety and security systems.

C. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
3. Content: Include the following information:
    a. Identification number, location, hand, fire rating, size, and material of each door and frame.
    b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
    c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
    d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
    e. Fastenings and other installation information.
    f. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
    g. Mounting locations for door hardware.
    h. List of related door devices specified in other Sections for each door and frame.

D. Keying Schedule: The Hardware schedule is intended for coordination of work and for the PPD Facilities Department to prepare a keying schedule. Submit final hardware schedule that complies with the construction progress schedule requirements and includes the information described below:

1. Type, style, function, size and finish of each hardware item.
2. Name and manufacturer of each item.
3. Fastenings.
4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
5. Explanation of abbreviations, symbols, and codes contained in schedule.
6. Mounting locations for hardware.
7. Door and frame sizes and materials.

E. Submittal Sequence

1. Submit schedule where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames), which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of work affected by hardware, and information essential to the coordinated review of hardware schedule.
2. The builder's attention shall be drawn to the lead-time required for delivery of certain hardware items and the required date of Substantial Completion. Extensions of the contract will not be accepted because of the builder's failure to order hardware in a timely manner.
3. The builder's attention shall also be drawn to the lead-time required for the University to produce a keying schedule after receiving the hardware schedule. Coordinate this

process with the PPD Facilities Department allowing sufficient time for timely completion by PPD.

1.6 INFORMATIONAL SUBMITTALS

A. Product Approval: For each exterior door hardware set provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Qualification Data: For Installer and Architectural Hardware Consultant].

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operations and Maintenance Manuals: Refer to Division 1 section for Operations and Maintenance Manuals; include technical information, templates, installation instructions, as-built wiring diagrams, door closer installation certificate, and any special details.

B. Maintenance Data: Catalogs or cut sheets for each type of door hardware to include in maintenance manuals.

C. Schedules: Final door hardware and keying schedule.

1.8 QUALITY ASSURANCE

A. Supplier and Installer Qualifications: Supplier of products shall be a factory authorized distributor and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
   1. The hardware supplier shall have been furnishing architectural hardware for a period of not less than 2 years.
   2. Warehousing Facilities: In Project's vicinity.
   3. Scheduling Responsibility: Preparation of door hardware and keying schedule.
   4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC) and an Electrified Hardware Consultant (EHC) or an Architectural Openings Consultant (AOC)].

C. Door Closer Installation Certificate: The builder shall furnish a certificate executed by a representative of the manufacturer of the door closers that all closers have been inspected and adjusted, are operating as designed, and have been installed in accordance with the manufacturer's instructions. Refer to the Division 1 section for Operations and Maintenance Manuals and include the certificate with that submittal.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Hardware Packaging: Packaging of hardware, on a set-by-set basis, is the responsibility of the supplier. As material is received by the hardware supplier from the various manufacturers, sort and repackage in containers marked with the hardware set number. Two or more identical sets may be packed in the same container.

B. Verification of Inventory: Inventory hardware jointly with representative of the hardware supplier and the hardware installer until each is satisfied that the count is correct.

C. Jobsite Security: Provide secure lock-up for hardware delivered to the project, but not yet installed. Control, handle, and install hardware so that completion of the work will not be delayed by hardware losses before or after installation.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.10 JOB CONDITIONS

A. Coordination: Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items for use on doors and frames of the thicknesses, profile, swing, and security indicated on the drawings and specified herein for installation and function. Deliver individually packaged hardware items to the shop or project site for installation.

B. Templates: Furnish hardware templates to each fabricator of doors, frames and work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such other work, to confirm that provisions are made for the installation of hardware.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Structural failures including excessive deflection, cracking, or breakage.
    b. Faulty operation of doors and door hardware.
    c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
    a. Electromagnetic Locks: Five years from date of Substantial Completion.
    b. Exit Devices: Three years from date of Substantial Completion.
    c. Manual Closers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

2.2 PERFORMANCE REQUIREMENTS

A. Product Approval: Exterior door hardware sets/products that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.

B. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

D. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the Florida Building Code – Accessibility.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

2. Comply with the following maximum opening-force requirements:
   a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
   c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
4. Adjust door closer sweep periods so that, from an open position of 90 degrees, the door will take at least 5 seconds to move to a position of 12 degrees from the latch.

2.3 SCHEDULED DOOR HARDWARE

A. General: Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the Architect and Owner.

D. HINGES: Stainless steel (US32D), 4-1/2" x 4-1/2", ball-bearing hinges, unpainted. Exterior hinges shall have non-removable pins.

E. MECHANICAL ACCESS (LOCKSETS)
1. Type: Locks shall be mortise style locksets and finish given below. Provide solid cast bronze or brass levers. Provide tactile warning at mechanical and hazardous spaces. Finish US 26D.
   a. Corbin/Russwin: ML2200 Series with NSN trim
   b. Sargent: 8200 Series with WTL trim
2. Non-Standard Door Locking Mechanisms
   a. A key-operated by-pass using a University approved restricted keyway shall be installed with all non-standard door locking mechanisms (e.g. keypad operated locks and card readers).
   b. Intellikey Locks: PPD shall program all keys and locks (after the programming schedule is worked out with the Users).
3. Keypad Mortise Lock: Keypad mortise locks shall be Sargent KP8276.

F. CYLINDERS: Cylinders shall be made by the same manufacturer as the locksets and shall be installed by the Contractor.

G. EXIT/PANIC DEVICES
1. Exit devices shall be Sargent 80 Series with ETL trim or Von Duprin 98 Series with L trim.
   a. Finish to be 26D or 32D.
2. Exit devices shall have a self-locking function on the exterior side.
3. Exit devices shall have an interior cylinder that controls the locking and unlocking function. (When this cylinder is locked a key will be needed every time entry is required (night latch function)).

H. DOOR CLOSERS
1. Type: Closers shall be set pre-sized #3; Builder shall adjust to meet field conditions. Provide arms and brackets to operate with conditions as detailed on the drawings. All

closers shall be supplied with hex nuts and shoulder bolts on labeled wood doors. Mount closers on room side of door. Do not provide hold-open feature.

2. Acceptable Manufacturers: LCN 4041 and LCN 1461 Supersmoothie.
3. Handing of Closers: Be consistent in the handing of door closers. For renovations and additions, be consistent with handing in existing building(s).

I. THRESHOLDS: Provide design and materials as listed. Provide proper fasteners to meet job conditions.

1. Provide flat, single piece thresholds. If saddle type is required, rise shall be no more than 1/2".
2. Set exterior thresholds on a bed of sealant.

J. POWER OPERATORS: Acceptable manufacturers/models are: LCN 4630 Series Electric (pull side), LCN 4640 Series Electric (push side), or Horton 7100 Series.

2.4 KEYING

A. General

1. Door lock installations shall be compatible with the University's restricted keyway systems. All other door hardware shall be compatible as well. Keys: Nickel silver.
2. All non-standard door locking mechanisms shall have key-operated by-pass using a University approved restricted keyway.
3. The PPD Facilities Department will key all entrance (exterior) doors to a building separately from the building's interior doors.

B. Door Keying

1. At the start of the Project, the Architect through the UF Project Manager shall provide the PPD Facilities Department with the following:
   a. A Work Order that identifies the UF Project Manager, the building number and floor, and the customer's name and phone number.
   b. A set of plans with a hardware schedule that includes the University-assigned room and door numbers, the manufacturer of locks, the manufacturer's lock number, the hand of locks, the type of trim, and the lock finish.
   c. Work Orders submitted without a set of plans or a hardware schedule shall be required to provide the UF-assigned room numbers, the manufacturer of locks, the manufacturer's lock number, the hand of locks, the type of trim, and the lock finish.
   d. On all projects, a current University small scale (usually 1"= 20') floor plan with UF-approved room numbers. Coordinate this requirement with the UF Project Manager.
2. Upon receipt of a Work Order and a sufficiently detailed hardware schedule, the PPD Facilities Department shall meet with the Users and develop a keying schedule for the project. The keying schedule shall be completed and provided to the UF Project Manager in a timely manner.
3. The builder shall purchase the cylinders, through the PPD Work Order system only from the PPD Facilities Department. These cylinders must be signed for and picked up at the Facilities key shop and shall be installed by the contractor.
4. Builder's keys shall be signed out (borrowed) from the PPD Facilities Department and returned at the end of the project. Failure to return borrowed keys may result in the re-keying of an entire project at the builder’s expense.
5. The builder shall provide any “construction” cylinders and keying required during construction.

2.5 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rating labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
2. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
3. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.6 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Notify Architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

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

3.2 PREPARATION

A. Steel Doors and Frames: For surface-applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with door and hardware manufacturers' written instructions.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Wood Doors: DHI's "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule, but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.
   1. Replace construction cores with permanent cores as directed by Owner.

E. Electrified Hardware Installation: Each item of electrified hardware shall be provided with Molex standardized plug connectors to accommodate up to 12 wires. Plug connectors shall be included with electric hinges and pivots, electric locksets, electric exit devices, and electric strikes, including through-door wiring harnesses and frame wiring harnesses specified in a Division 8 or 28 section.

F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment rooms. Verify location with Architect.
   1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 00 "Joint Sealants."

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   1. Do not notch perimeter gasketing to install other surface-applied hardware.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the Owner and Architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the Architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate selection for the material and application.

B. Abbreviations:

Manufacturer	Finishes	
AD - Adams Rite	626	Satin chrome plated / Brass, Bronze base
LC - LCN	628	Satin aluminum, clear coated
MK - McKinney	630	Satin stainless steel
PE - Pemko	US26D	Satin chrome
RF - Rixson	US32D	Satin stainless steel
RO - Rockwood	AL	Aluminum
SA - Sargent		
SU - Securitron		

C. Hardware Set 1: Each door to have:

Doors: 126

Description: EXT CORR - PR - ALUM

2	Pivot Set	195	626	RF
1	Intermediate Pivot	ML19	626	RF
1	Electrified Inter Pivot	EM19 QC-XX	626	RF
1	Concealed Vert Rod Exit, Exit Only	AD8410 EO	US32D	SA
1	Exit Device (nightlatch)	55 56 AD8410 106	US32D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
2	Door Pull	BF168	US32D	RO
2	Surface Closer	4040XP SCUSH	AL	LC
1	Threshold	2005AT		PE
1	Gasketing	by door / frame manufacturer		
1	ElectroLynx Harness	QC-C1500 (PS to hinge)		MK
1	ElectroLynx Harness	QC-CXXP (Lock / exit to hinge)		MK
1	Card Reader	SE RP40 / SE RP15 (as require)		
2	Position Switch	DPS-M/W-WH (as required)		SU
1	Power Supply	AQLX-E1 - Size as required		SU

D. Hardware Set 1.1: Each door to have the following:
Doors: 112, 131, 132
Description: EXT CORR - ALUM

1	Pivot Set	195	626	RF
1	Electrified Inter Pivot	EM19 QC-XX	626	RF
1	Exit Device (storeroom)	55 56 AD88504 less pull	US32D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Pull	BF168	US32D	RO
1	Surface Closer	4040XP SCUSH	AL	LC
1	Threshold	2005AT		PE
1	Gasketing	by door / frame manufacturer		
1	ElectroLynx Harness	QC-C1500 (PS to hinge)		MK
1	ElectroLynx Harness	QC-CXXP (Lock / exit to hinge)		MK
1	Card Reader	SE RP40 / SE RP15 as req		
2	Position Switch	DPS-M/W-WH (as required)		SU
1	Power Supply	AQLX-E1 - Size as required		SU

E. Hardware Set #2 – Each to have:
Doors: 131A, 132B
Description: EXT EGRESS

1	Continuous Hinge	CFMXXHD1		PE
1	Rim Exit Device, Classroom	HC 8813 ETL	US32D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Surface Closer	4040XP SCUSH	AL	LC
1	Threshold	2005AT		PE
1	Gasketing	S88D		PE
1	Sweep	315CN		PE

F. Hardware Set #3 – Each to have:
Doors: 105
Description: EXT MEP PR

6	Hinge, Full Mortise	TA2314 4-1/2" x 4-1/2"	US32D	MK
2	Flush Bolt	556WS	US26D	RO
1	Dormitory/Exit Lock	8225 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Surf Overhead Stop	9-336	630	RF
1	Surface Closer	4040XP SCUSH	AL	LC
1	Threshold	2005AT		PE
1	Gasketing	S88D		PE
1	Rain Guard	346C x LAR		PE
2	Sweep	315CN		PE
1	Astragal	357SP X S88D		PE

G. Hardware Set #4 – Each to have:
Doors: XX
Description: EXT COOLER

1	HBO	All hardware by Cooler manufacturer

H. Hardware Set #5 – Each to have:
Doors: 114
Description: BREAK

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	8215 WTL	US26D	SA
1	Door Closer	4040XP	AL	LC
1	Mop Plate	K1050 4" X 1" LDW 4BE CSK	US32D	RO
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

I. Hardware Set #6 – Each to have:
Doors: 111
Description: FRUIT INTAKE

3	Hinge, Full Mortise, Hvy Wt	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Closer	4040XP	AL	LC
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

J. Hardware Set #7 – Each to have:
Doors: 112B, 113
Description: EGRESS / CORR

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Passage	8815 ETL	US32D	SA
1	Surface Closer	4040XP CUSH	AL	LC
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

K. Hardware Set #8 – Each to have:
Doors: 109
Description: LAB PR

6	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt [Self latching top]	2905	US26D	RO
1	Classroom Lock	8237 WTL	US26D	SA
2	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Closer	4040XP	AL	LC
2	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
2	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88D		PE

L. Hardware Set #9 – Each to have:
Doors: 132A
Description: LAB SUPPORT

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88D		PE

M. Hardware Set #10 – Each to have:
Doors: 133, 134
Description: EXT - RESTROOM

3	Hinge, Heavy Weight	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Dormitory/Exit Lock	V20 8225 VN1L	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Closer	4040XP	AL	LC
1	Mop Plate	K1050 4" X 1" LDW 4BE CSK	US32D	RO
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Threshold	2005AT		PE
1	Gasketing	S88D		PE
1	Sweep	315CN		PE

N. Hardware Set #11 – Each to have:
Doors: 107, 110, 110A
Description: LAB

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Closer	4040XP	AL	LC
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88D		PE

O. Hardware Set #12 – Each to have:
Doors: 121, 122, 123, 128, 129, 130
Description: OFFICE

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	8204 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

P. Hardware Set #12.1 – Each to have:
Doors: 120
Description: OFFICE - ALUM

1	Pivot Set	195	626	RF
1	Intermediate Pivot	ML19	626	RF
1	Mortise Deadlock	MS1850S X 4066	628	AD
1	Roller Latch	592	US26D	RO
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
2	Door Pull	BF168	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	by door / frame mfg		

Q. Hardware Set #13 – Each to have:
Doors: 115
Description: CONF - ALUM

1	Pivot Set	195	626	RF
1	Intermediate Pivot	ML19	626	RF
1	Roller Latch	592	US26D	RO
2	Door Pull	BF168	US32D	RO
1	Door Closer	4040XP	AL	LC
2	Door Stop	409 / 446 as required	US26D	RO

1	Gasketing	by door / frame mfg		

R. Hardware Set #14 – Each to have:
Doors: 107A, 107B, 108, 108A, 124, 127
Description: STOR / MAINT

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	8204 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

S. Hardware Set #15 – Each to have:
Doors: 107A, 107B, 108, 108A, 124, 127
Description: STOR / MAINT

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	8204 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

T. Hardware Set #16 – Each to have:
Doors: 135
Description: EXT - JAN

3	Hinge, Hvy Wt	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Dormitory/Exit Lock	8225 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Surface Closer	4040XP CUSH	AL	LC
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Threshold	2005AT		PE
1	Gasketing	S88D		PE
1	Sweep	315CN		PE

U. Hardware Set #17 – Each to have:
Doors: 109A
Description:

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	8237 WTL	US26D	SA
1	Mortise Cylinder	as required - Match south-side system	US32D	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

V. Hardware Set #18 – Each to have:
Doors: 112A, 117, 118
Description: TOILET

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Privacy Lock	V20 8265 VN1L	US26D	SA
1	Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88D		PE

END OF SECTION 08 71 00

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SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Glass products.
   2. Insulating glass.
   3. Glazing sealants.
   4. Glazing tapes.
   5. Miscellaneous glazing materials.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products, if different than the Basis of Design products; 12 inches square.
   1. Insulating glass.

C. Glazing Accessory Samples: For sealants, in 12-inch lengths.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of fabricated glass units, if different from the Basis of Design.

B. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
   a. Wind Design Data: As indicated on Drawings.
   b. Basic Wind Speed: 135 mph.
   c. Building Risk Category: III.
   d. Wind Exposure Category: C.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
   3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
   2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   3. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on LBL's WINDOW 7 computer program, expressed as Btu/sq. ft. x h x deg F.
   4. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on LBL's WINDOW 7 computer program.
   5. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum.
   1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Tinted Annealed Float Glass: ASTM C1036, Type I, Class 2 (tinted), Quality-Q3.

C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

D. Low-E-Coated Vision Glass: ASTM C1376.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction] [Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
   1. EPDM with Shore A durometer hardness of 85, plus or minus 5.
   2. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:
   1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   2. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:
   1. EPDM with Shore A durometer hardness per manufacturer's written instructions.
   2. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
      a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

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

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch-minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 MONOLITHIC GLASS SCHEDULE

A. Clear Glass: Fully tempered float glass.

1. Locations: Interior doors and borrow lites.
2. Minimum Thickness: 6 mm.
3. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Tinted, Insulating Glass:

1. Locations: Exterior storefront and windows
2. Basis-of-Design Product: Viracon VNE30-63 with Bird Safety Silkscreen.
3. Overall Unit Thickness: 1-5/16 inch.
4. Minimum Thickness of Each Glass Lite: 6 mm.

5. Outdoor Lite: Tinted tempered float glass.
6. Tint Color: Gray.
7. Interspace Content: Air.
8. Indoor Lite: Clear fully tempered float glass.
9. Low-E Coating: Sputtered on second surface.
10. Visible Light Transmittance: 28%.
11. Winter Nighttime U-Factor: 0.29 maximum.
12. Summer Daytime U-Factor: 0.26 maximum.
13. Shading Coefficient: 0.20 Maximum.
14. Solar Heat Gain Coefficient: 0.17 maximum.
15. Safety glazing required.

END OF SECTION 08 80 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fixed extruded-aluminum louvers.
   2. Blank-off panels for louvers

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

C. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven-rain performance, as determined by testing according to AMCA 500-L.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
   1. Show weep paths, gaskets, flashings, sealants, and other means of preventing water intrusion.

1.5 INFORMATIONAL SUBMITTALS

A. Product Approval: For each louver or vent system in the exterior envelope provide the following:
   1. Proof that the system/products comply with Florida Product Approval Rule 9B-72.
   2. Installation instructions showing how the system/products are to be installed.

B. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.8 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: Five (5) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixed louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Product Approval: Exterior louvers that are incorporated into the Work shall comply with Florida Product Approval Rule 9B-72.
   1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

C. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Ruskin ELF6375DXD or comparable product by one of the following:
      a. Airolite Company, LLC (The).
      b. All-Lite Architectural Products.
      c. Greenheck Fan Corporation
   2. Louver Depth: 6 inches.
   3. Frame and Blade Nominal Thickness: Not less than 0.125 inch for blades and 0.080 inch for frames.
   4. Louver Performance Ratings
      a. Free Area: Not less than 9.0 sq. ft. for 48-inch-wide by 48-inch-high louver.
      b. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area intake velocity.
      c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 8 inches per hour and a wind speed of 50 mph at a core-area intake velocity of 975 fpm.
   5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.
   6. AMCA Rating: AMCA 540, AMCA 550.

2.4 LOUVER SCREENS

A. General: Provide insect screen at each exterior louver.

B. Secure screen frames to louver frames with stainless-steel machine screws, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.
   1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
   2. Finish: Mill finish unless otherwise indicated.
   3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:
   1. Insect Screening: Aluminum, 18-by-16 mesh, 0.012-inch wire.

2.5 BLANK-OFF PANELS

A. Insulated Blank-Off Panels: Laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver.
   1. Thickness: 2 inches.
   2. Metal Facing Sheets: Aluminum sheet, not less than 0.032-inch nominal thickness.
   3. Insulating Core: Rigid, glass-fiber-board insulation or extruded-polystyrene foam.
   4. Edge Treatment: Trim perimeter edges of blank-off panels with louver manufacturer's standard, with corners mitered and with same finish as panels.
   5. Seal perimeter joints between panel faces and louver frames with gaskets or sealant.
   6. Panel Finish: Same type of finish applied to louvers, but black color.
   7. Attach blank-off panels with sheet metal screws.

2.6 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.

D. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless-steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.7 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

C. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

D. Include supports, anchorages, and accessories required for complete assembly.

E. Provide subsills made of same material as louvers.

F. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, unless otherwise indicated.

2.8 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from Sherwin-Williams full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

E. Protect unpainted nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.3 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior partitions.
   2. Suspension systems for interior ceilings and soffits.
   3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking installed in metal framing for the support of items attached to metal framed partitions.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."
   2. Neoprene Sway Braces: Submit calculations of loads, isolator spacing and connection details necessary to prevent buckling or overturning of the isolated wall without direct rigid contact to the structural wall.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For embossed steel studs and runners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G60 (Z180).

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
   1. Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.0329 inch.
      b. Depth: 3-5/8 inches, unless otherwise indicated.
   2. Embossed Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.0190 inch
      b. Depth: 3-5/8 inches, unless otherwise indicated.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing 1-1/2-inch minimum vertical movement.
   2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
   3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
   1. Minimum Base-Metal Thickness: 0.0296 inch.
   2. Depth: 7/8 inch.

E. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
   1. Depth: 3/4 inch.
   2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
   3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch wide flanges.
   1. Depth: 1-1/2 inches.

E. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.0329 inch.
      b. Depth: As indicated on Drawings.
   3. Embossed Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.0190 inch.
      b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    a. Minimum Base-Metal Thickness: 0.0329 inch.

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

C. Partition Isolation Pad:
1. Products: Provide one of the following:
    a. Model KAI; Kinetics Noise Control, Dublin, Ohio 614-889-0480
    b. GenieMat FISW; Pliteq Inc., Vaughan, ON, L4H 1X9, Canada 416-449-0049

D. Sound Isolation Clips
1. Products: Provide one of the following:
    a. Type IsoMAX; Kinetics Noise Control, Dublin, Ohio 614-889-0480
    b. GenieClip RST; Pliteq Inc., Vaughan, ON, L4H 1X9, Canada 416-449-0049

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
1. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
2. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
   2. Multilayer Application: 24 inches o.c. unless otherwise indicated.
   3. Tile Backing Panels: 16 inches unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Sound-Rated Partitions:
      a. Install framing to comply with sound-rated assembly indicated.
      b. Provide Sound Isolation Clips spaced and sized as required to meet a maximum response frequency of 10 Hz under load for the composite wall/isolator construction, with a maximum spacing of 4'-0" on center.
      c. Provide Acoustical Isolation Pads at the following locations:
         1) Where studs abut masonry walls.
         2) At the base and top plate of the stud wall assembly from the non-isolated floor and/or ceiling deck where shown on drawings.
         3) Where indicated on the Drawings.
      d. Wallboard shall be installed to allow a 1/4” to 3/8” gap at the isolation joint for the installation of resilient non-hardening acoustical caulking.

E. Direct Furring:
   1. Attach to concrete or masonry with screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.
   3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

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SECTION 09 24 00 - CEMENT PLASTERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Exterior vertical plasterwork (stucco).

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

D. Samples: For each type of factory-prepared finish coat and for each color and texture specified.

E. Samples for Initial Selection: For each type of factory-prepared finish coat and for each color and texture specified.

F. Samples for Verification: For each type of factory-prepared finish coat and for each color and texture specified, 12 by 12 inches and prepared on rigid backing.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each substrate and finish texture indicated for cement plastering, including accessories.
    a. Size: 100 sq. ft. in surface area.
2. For interior plasterwork, simulate finished lighting conditions for review of mockups.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, moisture, direct sunlight, surface contamination, corrosion, construction traffic, and other causes.

1.7 FIELD CONDITIONS

A. Comply with ASTM C926 requirements.

B. Exterior Plasterwork:
   1. Apply and cure plaster to prevent plaster drying out during curing period. Use procedures required by climatic conditions, including moist curing, providing coverings, and providing barriers to deflect sunlight and wind.
   2. Apply plaster when ambient temperature is greater than 40 deg F.
   3. Protect plaster coats from freezing for not less than 48 hours after set of plaster coat has occurred.

C. Factory-Prepared Finishes: Comply with manufacturer's written recommendations for environmental conditions for applying finishes.

PART 2 - PRODUCTS

2.1 ACCESSORIES

A. General: Comply with ASTM C1063, and coordinate depth of trim and accessories with thicknesses and number of plaster coats required.

B. Metal Accessories:
   1. Cornerite: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
   2. External- (Outside-) Corner Reinforcement: Fabricated from metal lath with ASTM A653/A653M, G60, hot-dip galvanized-zinc coating.
   3. Cornerbeads: Fabricated from zinc.
      a. Smallnose cornerbead with expanded flanges; use unless otherwise indicated.
      b. Bullnose cornerbead, radius 3/4 inch minimum, with expanded flanges; use at locations indicated on Drawings.
   4. Casing Beads: Fabricated from zinc; square-edged style; with expanded flanges.
   5. Control Joints: Fabricated from zinc; one-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.
   6. Expansion Joints: Fabricated from zinc; folded pair of unperforated screeds in M-shaped configuration; with expanded flanges.
   7. Two-Piece Expansion Joints: Fabricated from zinc; formed to produce slip-joint and square-edged reveal that is adjustable from 1/4 to 5/8 inch wide; with perforated flanges.

C. Plastic Accessories: Manufactured from high-impact PVC.
   1. Cornerbeads: With perforated flanges.
      a. Smallnose cornerbead; use unless otherwise indicated.
   2. Casing Beads: With perforated flanges in depth required to suit plaster bases indicated and flange length required to suit applications indicated.
      a. Square-edge style; use unless otherwise indicated.
   3. Control Joints: One-piece-type, folded pair of unperforated screeds in M-shaped configuration; with perforated flanges and removable protective tape on plaster face of control joint.

2.2 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster: Potable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories.

B. Fiber for Base Coat: Alkaline-resistant glass or polypropylene fibers, 1/2 inch long, free of contaminants, manufactured for use in cement plaster.

C. Bonding Compound: ASTM C932.

D. Bonding Admixture: ACRYL 60 as manufactured by Thoro System Products.

2.3 PLASTER MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I.
   1. Color for Finish Coats: Gray.

B. Masonry Cement: ASTM C91, Type N.
   1. Color for Finish Coats: Gray.

C. Lime: ASTM C206, Type S; or ASTM C207, Type S.

D. Sand Aggregate: ASTM C897.
   1. Color for Job-Mixed Finish Coats: [White] [In color matching Architect's sample].

E. Ready-Mixed Finish-Coat Plaster: Mill-mixed portland cement, aggregates, and proprietary ingredients.

2.4 PLASTER MIXES

A. General: Comply with ASTM C926 for applications indicated.
   1. Fiber Content: Add fiber to base-coat mixes after ingredients have mixed at least two minutes. Comply with fiber manufacturer's written instructions for fiber quantities in mixes, but do not exceed 1 lb of fiber/cu. yd. of cementitious materials.

B. Base-Coat Mixes for Use over Unit Masonry and Concrete: Single base (scratch) coat for two-coat plasterwork on high-absorption plaster bases as follows:
   1. Portland Cement Mix: For cementitious material, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 2-1/2 to 4 parts aggregate per part of cementitious material.
   2. Masonry Cement Mix: Use 1 part masonry cement and 2-1/2 to 4 parts aggregate.
   3. Bonding Admixture: Add to mixing water in a ratio of one (1) part ACRYL 60 to three (3) parts water; comply with manufacturer’s written instruction.

C. Job-Mixed Finish-Coat Mixes:
   1. Portland Cement Mix: For cementitious materials, mix 1 part portland cement and 3/4 to 1-1/2 parts lime. Use 1-1/2 to 3 parts aggregate per part of cementitious material.
   2. Masonry Cement Mix: Use 1 part masonry cement and 1-1/2 to 3 parts aggregate.

D. Factory-Prepared Finish-Coat Mixes: For ready-mixed finish-coat plasters, comply with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Protect adjacent work from soiling, spattering, moisture deterioration, and other harmful effects caused by plastering.

3.3 INSTALLING ACCESSORIES

A. Install according to ASTM C1063 and at locations indicated on Drawings.
   1. At exterior locations use one of the following:
      a. Zinc-Alloy Components

b. Plastic Components.

B. Reinforcement for External (Outside) Corners:
1. Install cornerbead at exterior locations.
2. Install cornerbead at interior locations.

C. Control Joints: Locate as approved by Architect for visual effect as indicated.

3.4 PLASTER APPLICATION

A. General: Comply with ASTM C926.
1. Do not deviate more than plus or minus 1/4 inch in 10 feet from a true plane in finished plaster surfaces when measured by a 10-foot straightedge placed on surface.
2. Finish plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground unless otherwise indicated. Where casing bead does not terminate plaster at metal frame, cut base coat free from metal frame before plaster sets and groove finish coat at junctures with metal.

B. Plaster Thickness:
1. Two-coat Work:
a. Unit Masonry and Concrete
1) Vertical Applications: 5/8 inch.

C. Bonding Compound: Apply on unit masonry and concrete substrates for direct application of plaster.

D. Walls; Base-Coat Mix: For base (scratch) coat, for two-coat plasterwork and having 3/8-inch], as follows:
1. Portland cement mix.
2. Masonry cement mix.

E. Plaster Finish Coats: Apply to provide light dash finish.

F. Acrylic-Based Finish Coatings: Apply coating system, including primers, finish coats, and sealing topcoats, according to manufacturer's written instructions.

3.5 PLASTER REPAIRS

A. Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to substrate has failed.

3.6 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work after plastering is complete. Promptly remove plaster from door frames, windows, and other surfaces not indicated to be plastered. Repair floors, walls, and other surfaces stained, marred, or otherwise damaged during plastering.

END OF SECTION 09 24 00

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior gypsum board.
   2. Exterior gypsum board for ceilings and soffits.

B. Related Requirements:
   1. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Local Raw Materials Extraction: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   4. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.
   5. Insulation: Provide signed approved submittal for insulation materials and manufacturers catalog cut sheet for each insulation product used indicating that it contains no formaldehyde.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
   1. Build mockups for the following:
      a. Each level of gypsum board finish indicated for use in exposed locations.
      b. Each texture finish indicated.
   2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
   3. Simulate finished lighting conditions for review of mockups.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

B. Regional Materials: Manufacture products within 700 miles of Project site.

C. Regional Materials: Materials that have been extracted, harvested, or recovered, within 700 miles of Project site.

D. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Thickness: 5/8 inch.

2. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch.

2. Long Edges: Tapered.

C. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.

1. Core: 5/8 inch, Type X.

2. Surface Abrasion: Meets or exceeds Level 2 requirements.

3. Surface Indentation: Meets or exceeds Level 1 requirements.

4. Single-Drop Soft-Body Impact: Meets or exceeds Level 2 requirements.

5. Hard-Body Impact: Meets or exceeds Level 2 requirements according to test in Annex A1.

6. Long Edges: Tapered.

7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.4 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.

1. Core: 5/8 inch, Type X.

2.5 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
   1. Core: 5/8 inch, Type X.
   2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

B. Interior Trim: ASTM C 1047.
   1. Material: Rolled zinc or plastic.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. Expansion (control) joint.

C. Exterior Trim: ASTM C 1047.
   1. Material: Plastic or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

D. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
   2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
   3. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   3. Finish Coat: For third coat, use drying-type, all-purpose compound.

D. Joint Compound for Exterior Applications:
   1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

E. Joint Compound for Tile Backing Panels:
   1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 GLASS-MAT GYPSUM SHEATHING BOARD SOFFIT FINISH MATERIALS

A. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with Glass-Mat Gypsum Sheathing Board and Acrylic-Based Finish Coating, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. per ASTM E 2098; complying with ASTM D 578 and the following:

1. Intermediate-Impact Reinforcing Mesh: Not less than 12.0 oz./sq. yd.

B. Acrylic-Based Finish Coatings: Factory-mixed acrylic-emulsion coating systems, with enhanced mildew resistance, formulated with colorfast mineral pigments and fine aggregates. Include manufacturer's recommended primers and sealing topcoats for acrylic-based finishes.

C. Mixing: Comply with manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by manufacturer. Mix materials in clean containers. Use materials within time period specified by manufacturer or discard.

2.8 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Insulation shall be free of formaldehyde.

D. Acoustical Sealant: As specified in Section 07 92 19 " Acoustical Joint Sealants."

E. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

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

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated.
2. Ceiling Type: Ceiling surfaces.
3. Impact-Resistant Type: At high traffic areas, including corridors, lobbies, laboratories and classrooms to a minimum of 48 inches above the floor and where indicated on Drawings.
4. Glass-Mat, Water-Resistant Backing Board: Vertical surfaces finished with ceramic tile.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
2. Fasten with corrosion-resistant screws.

3.5 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.6 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings.

C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.

D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.7 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated on the Drawings.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At Laboratories, Offices, Conference Rooms, Classrooms, and Corridors.
4. Level 5: At Lobbies and where indicated on the Drawings.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.8 FINISHING GLASS-MAT GYPSUM SHEATHING BOARD:

A. General: Finish according to manufacturer's written instructions for use as exposed soffit board.

B. Base Coat: Apply to exposed surfaces of Glass-Mat Gypsum Sheathing Board in minimum thickness recommended in writing by manufacturer, but not less than 1/16-inch dry-coat thickness.

C. Reinforcing Mesh: Embed in wet base coat to produce wrinkle-free installation with mesh continuous at corners and overlapped not less than 2-1/2 inches or otherwise treated at joints to comply with ASTM C 1397 and manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are not visible.

D. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings extending 4 inches beyond perimeter. Apply additional 9-by-12-inch strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch wide strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches on each side of corners.

E. Finish-Coat Installation:

1. Primer: Apply over dry base coat according to manufacturer's written instructions.
2. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.
3. Texture: Float finish to match finish of Portland Cement Plaster.

F. Sealer Coat: Apply over dry finish coat, in number of coats and thickness required by manufacturer.

3.9 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

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SECTION 09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Waterproof membrane for thinset applications.
   3. Prefabricated shower waterproofing system.
   4. Metal edge strips.

B. Related Requirements:
   1. Section 09 29 00 "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1B, ANSI A108.5, ANSI A108.10, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

C. Samples for Verification:
   1. Full-size units of each type and composition of tile and for each color and finish required.
   2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
   3. Metal edge strips in 6-inch lengths.

1.5 INFORMATIONAL SUBMITTALS

A. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

B. Product Certificates: For each type of product.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockup of floor and wall tile installation in a single room.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type from single source or producer.
   1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
   1. Obtain setting and grouting materials from single manufacturer.
   2. Obtain crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
   1. Provide tile complying with Standard grade requirements.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.3 TILE PRODUCTS

A. Ceramic Tile Type (T-1): Glazed porcelain tile.
   1. Basis of Design: Crossville “Color Blox.”
   2. Composition: Porcelain.
   3. Face Size: 12 by 24 inches
   4. Face Size Variation: Rectified.
   5. Face: Plain with square edges.
   6. Install Method: Stacked grid
   7. Dynamic Coefficient of Friction: Not less than 0.42.
   8. Tile Color: “See the Moon,” #A1117.
   9. Grout Color: As selected by Architect from manufacturer's full range.

B. Ceramic Tile Type (T-2): Glazed porcelain tile.
   1. Basis of Design: Crossville “Color Blox.”
   2. Face Size: 3 by 3 inches
   3. Face Size Variation: Rectified.
   4. Face: Plain with square edges.
   5. Install Method: Stacked grid
   6. Tile Color: “See the Moon,” #A1117.
   7. Grout Color: As selected by Architect from manufacturer's full range.

C. Ceramic Tile Type (T-3): Glazed porcelain tile.
   1. Basis of Design: Crossville “Color Blox.”
   2. Face Size: 4 by 12 inches, bullnose.
   3. Face: Plain with square edges.
   4. Install Method: Stacked grid
   5. Tile Color: “See the Moon,” #A1117.
   6. Grout Color: As selected by Architect from manufacturer's full range.

D. Ceramic Tile Type (T-4): Glazed porcelain tile.
   1. Basis of Design: Crossville “Brilliant Deduction.”
   2. Composition: Porcelain.
   3. Face Size: 3 by 12 inches
   4. Face Size Variation: Rectified.
   5. Face: Plain with square edges.
   6. Install Method: Stacked grid
   7. Dynamic Coefficient of Friction: Not less than 0.42.
   8. Tile Color: “Cobalt.”
   9. Grout Color: As selected by Architect from manufacturer's full range.

2.4 PREFABRICATED SHOWER COMPONENTS

A. Basis of Design: Complete system as manufactured by Schluter Systems, including but not limited to the following.

B. Schluter® -KERDI-SHOWER:
   1. Description: Trapezoid-imprinted, prefabricated, sloped tiled shower tray base, made of lightweight, self-extinguishing expanded polystyrene, with 12-5/16 inch diameter removable recessed section and bonded Schluter KERDI Membrane 0.008 inch thick.
   2. Thin Tray: 38 inch by 38 inch by 29/32 inch.

C. Schluter® -SHOWERPROFILE:
   1. Description: two-part profile with an exposed brushed stainless steel tapered edge and recycled PVC support section with integrated trapezoid-perforated anchoring leg for lateral transitions between sloped shower floors and walls.
   2. Profile Height as required to coordinate with tile and tile setting system.

D. Schluter® -KERDI-BOARD:
   1. Description: Rigid extruded polystyrene foam building element panel, with reinforcement material and polypropylene fleece webbing laminated on both sides.
   2. Panel Thickness: ½ inch, minimum.

E. Schluter®-ALL-SET:
   1. Description: Sag-resistant modified thin-set mortar specifically formulated for use with Schluter membranes and boards.

2. Color: Grey

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.

2.6 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
2. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

B. Medium-Bed, Modified Dry-Set Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch.

1. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene-rubber liquid-latex additive at Project site.

2.7 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.8 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

C. Metal Edge Strips (MES): Heights to match tile and setting-bed thickness, designed specifically for tiling applications; aluminum, exposed-edge material.

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products manufactured by Schluter Systems or comparable product by the following:
   a. Blanke Corporation.

2.9 MIXING MORTARS

A. Mix mortars to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

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

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    a. Tile floors in wet areas.
    b. Tile floors consisting of tiles 8 by 8 inches or larger.
    c. Tile floors consisting of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
2. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Porcelain Tile: 1/4 inch.
2. Glazed Wall Tile: 1/8 inch.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Metal Edge Strips: Install at locations indicated.

1. Outside Vertical Corners: Schluter “QUADEC”
2. Exposed Vertical Edges : Schluter “QUADEC”
3. Tile to Resilient Tile: Schluter “RENO-U”
4. Tile to Carpet Transition: Schulter “RENO-TK”

3.4 INSTALLATION OF WATERPROOF MEMBRANE

A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Ceramic Tile Installation: TCNA F122A; thinset mortar on waterproof membrane.
      a. Ceramic Tile Type: Glazed porcelain tile T-1 and T-2.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.
   2. Ceramic Tile Installation: TCNA F113; thinset mortar.
      a. Ceramic Tile Type: Glazed porcelain tile CT-2.
      b. Thinset Mortar: Medium-bed, modified dry-set mortar.
      c. Grout: Water-Cleanable Epoxy Grout.

B. Interior Wall Installations, Metal Studs:
   1. Ceramic Tile Installation: TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.
      a. Ceramic Tile Type: Glazed porcelain tile T-4.
      b. Thinset Mortar: Modified dry-set mortar.
      c. Grout: Water-cleanable epoxy grout.

C. Shower Receptor and Wall Installations:
   1. Ceramic Tile Installation: TCNA B420; thinset mortar on waterproof membrane over coated glass-mat, water-resistant gypsum backer board.
      a. Waterproofing System: Schluter prefabricated shower system.
      b. Ceramic Tile Types:
         1) Walls: T-4.
         2) Floor: T-2
      c. Thinset Mortar: Schluter®-ALL-SET.
      d. Grout: Water-cleanable epoxy grout.

END OF SECTION 09 30 13

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SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.

C. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

D. Samples for Initial Selection: For components with factory-applied finishes.

E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Full size Sample of each type, color, pattern, and texture.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling where directed by the Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A according to ASTM E 1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

A. Basis-of-Design Product: Subject to compliance with requirements; Rockfon Tropic.

B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Classification: Provide panels as follows:

1. Type and Form: Type XX, high-density, mineral-base panels with scrubbable finish, resistant to heat, moisture, and corrosive fumes.
2. Pattern: G (smooth).

D. Color: White

E. Light Reflectance (LR): Not less than 0.85.

F. Ceiling Attenuation Class (CAC): Not less than 20.

G. Noise Reduction Coefficient (NRC): Not less than 0.85.

H. Edge/Joint Detail:

1. Tegular: At offices, conference rooms, laboratories, corridors, classrooms, and where indicated on the Drawings.
2. Square: At storage rooms, mechanical and electrical rooms, support spaces, restrooms and where indicated on the Drawings.

I. Thickness: 5/8 inch.

J. Modular Size: 24 by 24 inches.

K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

B. Wide-Face, Aluminum-Capped, Double-Web, Hot-Dip Galvanized, G60, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; hot-dip galvanized, G60 coating designation; with prefinished, 15/16-inch-wide aluminum caps on flanges.

1. Structural Classification: Heavy-duty system.
2. Face Design: Flat, flush.
3. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch diameter wire.

C. Hold-Down Clips: Manufacturer's standard hold-down.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.

2.7 ACOUSTICAL SEALANT

A. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

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

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
7. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.

2. Install hold-down clips according to panel manufacturer's written instructions unless otherwise indicated.
    a. Locations: Toilet rooms and other areas indicated on the Drawings
    b. Hold-Down Clips: Space 24 inches o.c. on all cross runners.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

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SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Vinyl base.
   2. Vinyl molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

D. Samples for Initial Selection: For each type of product indicated.

E. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

2.2 VINYL BASE (RB)

A. Basis of Design:
   1. Manufacturer: Roppe
   2. Color: #63 “Burnt Umber.”

B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
   1. Group: I (solid, homogeneous).
   2. Style: B, Cove.

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.
   1. Outside Corners: Form with returns not less than 3 inches or more than 6 inches in length. Form without producing discoloration (whitening) at bends.

F. Outside Corners: Job formed or preformed.
   1. Job Formed: Form with returns not less than 3 inches or more than 6 inches in length. Form without producing discoloration (whitening) at bends.

G. Inside Corners: Job formed, miter or cope, or preformed.

H. Colors: As selected from the by manufacturer's colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

C. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

2.4 VINYL MOLDING ACCESSORY

A. Description: Vinyl nosing for carpet, nosing for resilient floor coverings, reducer strip for resilient floor coverings, joiners for resilient floor coverings and carpet and transition strips.

B. Locations: Provide vinyl molding accessories, appropriate for the transitions between the flooring materials, in locations indicated on the Drawings.

C. Colors: As selected from the by manufacturer's standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

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

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths without seams on any wall and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Form with returns not less than 3 inches or more than 6 inches in length.

a. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Miter or cope at corners.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION 09 65 13

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Vinyl composition floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

C. Shop Drawings: For each type of resilient floor tile.
   1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   2. Show details of special patterns.

D. Samples for Initial Selection: For each type of floor tile indicated.

E. Samples for Verification: Full-size units of each color and pattern of floor tile required.

F. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Coordinate mockups in this Section with mockups specified in other Sections.
      a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations directed by Architect.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than [70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:
1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than [95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL COMPOSITION FLOOR TILE

A. Basis of Design: Armstrong World Industries, Inc.; Standard Excelon

B. Wearing Surface: Smooth.

C. Thickness: 0.125 inch, minimum.

D. Size: 12 by 12 inches.

E. Colors and Patterns:
1. VCT-1 Vinyl Composition Tile
a. Series: Imperial Texture
b. Color: 51861 Soft Warm Gray
2. VCT -2 Vinyl Composition Tile
a. Series: Imperial Texture
b. Color: 59240 Peat
3. VCT -3 Vinyl Composition Tile
a. Series: Imperial Texture
b. Color: 57508 Blue Dreams

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less.

C. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

D. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
   a. Colors: As selected by Architect from manufacturer's full range to contrast with floor tile.
2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.

E. Volatile Organic Compounds (VOC) shall meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

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

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
   a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles square with room axis.

C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
   1. Lay tiles with grain direction alternating in adjacent tiles (basket-weave pattern).

D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Modular carpet tile.

B. Related Requirements:
   1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, plans showing the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of installation.
   4. Pattern type, location, and direction.
   5. Pile direction.
   6. Type, color, and location of edge, transition, and other accessory strips.
   7. Transition details to other flooring materials.

C. Sustainable Design Submittals:
   1. Recycled Content: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   2. Local Manufacturing: Submit the completed materials checklist and supporting documentation of the percentages claimed including budget documentation.
   3. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

D. Samples for Initial Selection: For each type of carpet tile.
   1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.

E. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 1 percent of amount installed for each type and color indicated, but not less than 10 sq. yd.

2. This stock shall be designated for use by the Owner only, after completion of the Project and shall not be used for repair or replacement during warranty period.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104 Section 5 Storage and Handling.

B. Tile carpeting shall not be delivered or installed until building is enclosed, wet work completed and HVAC system is operating and maintaining temperature and humidity at occupancy level during remainder of construction period.

1.9 FIELD CONDITIONS

A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over surfaces that are sufficiently dry to bond with adhesive and have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, the following:

a. More than 10 percent edge raveling, snags, and runs.

b. More than ten percent (10%) loss of face fiber/yarn loss by weight

c. Dimensional instability.
d. Excess static discharge.
e. Loss of tuft-bind strength.
f. Loss of face fiber.
g. Delamination.

3. Warranty Period: 15 years from date of Substantial Completion.

B. Installer's Warranty: The Tile Carpeting Contractor (Installer) shall fully guarantee the installation against defects in workmanship, seaming and loss of adhesion to floor for a period of one (1) year from the date of Substantial Completion. Upon written notice, the Installer shall repair or replace the affected area at no cost to the Owner.

PART 2 - PRODUCTS

2.1 SUSTAINABILITY REQUIREMENTS

A. Local Manufacturing: Manufacture carpet tiles within 700 miles of project site.

B. Volatile Organic Compounds (VOC) shall meet the VOC limits listed in Section 01 81 13 "Sustainable Design Requirements – FGBC Version 3.

2.2 CARPET TILE, GENERAL

A. All carpet shall meet the testing and product requirements of the Carpet and Rug Institute's Green Label Plus Program.

B. All carpeting shall be equal to, or of greater quality than, the selection of carpet, which is currently available on "State Contract" through the University of Florida Purchasing Division (www.purchasing.ufl.edu).

C. Carpet shall be a type "6, 6 nylon" or type "6."

D. Fiber shall be a high quality nylon, no olefin fibers, solution-dyed, and be comprised of recycled material.

E. Carpet tile backing shall be impervious to liquids.

F. Anti-Static Control: Anti-static control shall be permanent (topical coatings are not acceptable).

G. Flammability:

1. Radiant Panel Test (ASTM E-648-78) average results shall exceed 0.22 Watts/cm2.
2. Methenamine Pill Test shall have been performed on both carpet surfaces (top pile face and under or backside) and be in compliance with ASTM D-2859-76 (or DOC-FF-1-70).

2.3 CARPET TILE

A. Basis-of-Design Product: Subject to compliance with requirements, provide the Interface, LLC product indicated in paragraph 2.3 B below or comparable product by one of the following:

1. J&J Invision; J&J Industries, Inc.
2. Milliken & Company.
3. Mohawk Group (The); Mohawk Carpet, LLC.
4. Shaw Contract Group; a Berkshire Hathaway company.

B. Colors / Patterns: As indicated in the Interior Finish Schedule, Sheet A407.

1. CPT-1: Ny+LON Streets: Broome Street 106216 "Blue Glass."
2. CPT-1: Ny+LON Streets: Broome Street 105768 "Slate Circle."
3. CPT-3: Step Repeat: SR799 104936 "Iron."

2.4 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, non-asbestos, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. Carpet adhesives shall be of low odor/solvent content.
2. Adhesives shall have a VOC content of 50 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Verify that finishes comply with requirements specified in Section 03 54 13 “Gypsum Cement Underlayment" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

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

3.2 PREPARATION

A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Stacked Grid, Glue-down.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

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SECTION 09 91 00 - PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on interior and exterior substrates.

B. Paint exposed surfaces whether or not indicated in schedules, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Sustainable Design Submittals:
   1. Product Data: For paints and coatings, indicating VOC content.

C. Samples for Initial Selection: For each type of topcoat product.

D. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 8 inches square.
   2. Apply coats on Samples in steps to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

E. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.5 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
      a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
      b. Other Items: Architect will designate items or areas required.
   2. Final approval of color selections will be based on mockups.
      a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Sherwin-Williams Company (The), unless otherwise indicated; as listed in the Interior Painting Schedule in Part 3 of this Section or comparable product by one of the following:
1. Benjamin Moore & Co.
2. PPG Paints.

2.2 PAINT, GENERAL

A. Sustainable Materials: Interior paints and coatings applied on site shall not exceed the volatile organic compound (VOC) content limits established in the South Coast Air Quality Management District (SCAQMD) Rule # 1113, effective February 5, 2016.

B. Material Compatibility:
1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: For field applications that are inside the weatherproofing system, verify paints and coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
1. Flat Paints and Coatings: 50 g/L.
2. Non-flat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Under-coaters: 200 g/L.
4. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.

D. Color Information for Estimating:
   1. Number of colors (of pigmented coating) for bidding purposes unless otherwise shown on Drawings:
      a. Colors for interior: Limited to 4
      b. Colors per room or space: Limited to 3
   2. Color strength for-estimating unless otherwise shown on Drawings:
      a. Light to medium paint hues: 80% of areas
      b. Strong dark paint hues: 20% of areas
   3. Approval of the in-place color against approved color chips shall be solely the right and judgment of the Architect.
   4. Each coat of paint/coating shall be tinted slightly lighter than next coat or finish coat in order to establish actual application of each coat did occur. The degree of tint difference shall be as determined by the Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (CMUs): 12 percent.
   3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" and "MPI Maintenance Repainting Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Surfaces to be painted shall be free from scratches thoroughly dry and well sanded / grinded, feathering edges (where appropriate) before painting work is started. Minor defects shall be corrected by the Paint/Coatings Sub-Contractor.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:

1. SSPC-SP 2.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint undercoats same color as topcoat but tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Exterior: Paint the following work where exposed to view:
    a. Uninsulated metal piping.
    b. Uninsulated plastic piping.
    c. Pipe hangers and supports.
    d. Metal conduit.
    e. Plastic conduit.
2. Interior: Paint the following work where exposed in occupied spaces:
    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Metal ducts.

h. Internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
   1. Contractor shall touch up and restore painted surfaces damaged by testing.
   2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 PAINTING SCHEDULE

A. Concrete Substrates
   1. Water-Based Concrete Floor Sealer System:
      a. First and Topcoat: H&C Hydro-Defend Concrete & Masonry Waterproofer Sealer.

B. CMU Substrates: ,
   1. Latex System for interior conditioned spaces:
      a. Block Filler: Block filler, latex, interior/exterior:
         1) S-W PrepRite Block Filler, at 75-125 sq. ft. per gal.
      b. Intermediate and Topcoat: Latex, interior, semi-gloss:
         1) S-W ProMar 200 Zero VOC Latex, at 4.0 mils wet, 1.7 mils dry, per coat.
   2. Latex System for exterior and non-conditioned spaces:
      a. Block Filler: Block filler, latex, interior/exterior:
         1) S-W Loxon Acrylic Block Surfacer, at 16 mils wet, 8.8 mils dry, per coat.
      b. Intermediate and Topcoat: Latex, exterior, low sheen.
         1) S-W A-100 Exterior Latex Low Sheen, A12 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Galvanized-Metal Substrates:
   1. Alkyd System:
      a. Prime Coat: Primer, water based.
         1) S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, 5.0 to 10.0 mils wet, 2.0 to 4.0 mils dry.
      b. Intermediate and Topcoat: Light industrial coating, exterior, water based, semi-gloss.
         1) S-W Pro Industrial Waterbased Alkyd Urethane Enamel, gloss, at 1.4 to 1.7 mils dry, per coat.

D. Gypsum Board Substrates:
   1. Latex System for interior spaces:
      a. Prime Coat: Primer, latex, interior:
         1) S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
      b. Intermediate and Topcoat: Latex, interior, eggshell:
         1) S-W ProMar 200 Zero VOC Latex, at 4.0 mils wet, 1.6 mils dry, per coat.
   2. Latex System at exterior locations and non-conditioned spaces
      a. Prime Coat: Primer, latex, interior, eggshell:
         1) S-W ProMar 200 Zero VOC Latex Primer, at 4.0 mils wet, 1.0 mils dry.
      b. Intermediate and Topcoat: Latex, interior:
         1) S-W A-100 Exterior Latex, at 4.0 mils wet, 1.5 mils dry, per coat.

END OF SECTION 09 91 00

SECTION 10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Visual display board assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Sustainable Design Submittals:
   1. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

C. Shop Drawings: For visual display units.
   1. Include plans, elevations, sections, details, and attachment to other work.
   2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
   3. Include sections of typical trim members.

D. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
   1. Samples of facings for each visual display panel type, indicating color and texture.
   2. Actual factory-finish color samples applied to aluminum substrate.
   3. Include accessory Samples to verify color selected.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 25 or less.
   2. Smoke-Developed Index: 50 or less.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Visual Display Board Assembly: Factory fabricated.
   1. Assembly: Markerboard and tackboard.
   2. Corners: Square
   3. Width: As indicated on Drawings.
   4. Height: As indicated on Drawings.
   5. Mounting Method: Direct to wall.

B. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
   1. Color: White.

C. Tackboard Panel: Plastic-impregnated-cork tackboard panel on core indicated.
   1. Color and Pattern: As selected by Architect from full range of industry colors.

D. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch-thick, extruded aluminum; standard size and shape.
   1. Field-Applied Trim: Manufacturer's standard, snap-on trim with no visible screws or exposed joints.
   2. Aluminum Finish: Clear anodic finish.

E. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.

F. Chalktray: Manufacturer's standard; continuous.
   1. Box Type: Extruded aluminum with slanted front, grooved tray, and cast-aluminum end closures.

G. Display Rail: Manufacturer's standard, extruded-aluminum display rail with plastic-impregnated-cork insert, end stops, designed to hold accessories.
   1. Size: 2 inches high by full length of visual display unit.

2. Map Hooks and Clips: One map hooks with flexible metal clips for every 48 inches of display rail or fraction thereof.
3. Tackboard Insert Color: Black.
4. Aluminum Color: Match finish of visual display assembly trim.

2.3 MARKERBOARD PANELS

A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with high-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
1. Face Sheet Thickness: 0.021 inch uncoated base metal thickness.
2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 TACKBOARD PANELS

A. Tackboard Panels:
1. Facing: 1/4-inch-thick, plastic-impregnated cork.
2. Core: Manufacturer's standard.
3. Core: 3/8-inch- thick fiberboard.

2.5 MATERIALS

A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.

B. Plastic-Impregnated-Cork Sheet: Seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto fabric backing; with washable vinyl finish and integral color throughout; with surface-burning characteristics indicated.

C. Hardboard: ANSI A135.4, tempered.

D. Particleboard: ANSI A208.1, Grade M-1.

E. MDF: ANSI A208.2, Grade 130.

F. Fiberboard: ASTM C208 cellulosic fiber insulating board.

G. Extruded Aluminum: ASTM B221, Alloy 6063.

H. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
1. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.

C. Examine walls and partitions for proper preparation and backing for visual display units.

D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

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

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.

C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings, or if not indicated, at heights indicated below.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 10 11 00

SECTION 10 14 23 – ROOM SIGNAGE

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.

1.2 SUMMARY

A. This Section includes the following:
   1. Panel signs.
   2. All building room number signs will be provided by Physical Plant Sign Shop.

PART 2 - PRODUCTS

2.1 SIGN MATERIALS

A. Sign Blades: Provide satin finish, flexible blended acrylic extruded sheet, 1/16" thick.
   1. Blades for raised text and Braille shall be similar to Gravo-tac as manufactured by New Hermes.
   2. Blades for inscribed text shall be similar to Gravo-ply, 2 ply, with cap and core permanently fused together.
   3. Color shall be blue for general signage.
   4. Color shall be red for warning and general utility instruction signs.

B. Blade Holders:
   1. Blade holders for signs shall be similar to New Hermes 722 series for 1/16" thick blade.

C. Graphics:
   1. Raised text (tactile) material shall be similar to Gravo-tac as manufactured by New Hermes. Material is a satin finish, 2 ply, flexible blended acrylic extruded sheet, with cap and core permanently fused together: 1/32" thick.
   2. Text color shall be white.

2.2 TEXT AND SIZES:

A. Room number signs shall be 4" long x 2" high with text 3/4" high.

B. Room occupant and title signs shall be 12" long x 2" high with text 3/4" high.

C. Pictogram (not blade) border dimension shall be 6". When other information or signs, other than room numbers, will be included, combine onto one sign blade.

D. Numerals shall be Arabic.

E. Text shall be white - letters, numerals, arrows, pictograms, etc.

F. Lettering shall be Palatino typeface where available. If Palatino is not available, Helvetica Medium will be accepted.

G. Text and pictograms for directories and tactile signs shall be plastic and shall be raised from background surface.

H. Arrow shape for all signs shall be as shown in the attached Drawing 10440-E.

I. Text and Pictograms shall be sized to be legible from the distance at which they will be viewed. All sizes and ratios shall meet minimum ADA requirements.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
   1. For exterior exposure, use stainless-steel devices.
   2. Exposed Metal-Fastener Components, General:
      a. Fastener Heads: Use oval countersunk tamper-resistant screws.
   3. Sign Mounting Fasteners:
      a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Verify that items, including anchor inserts, are sized and located to accommodate signs.

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

3.2 GENERAL:

A. Locate signs on the wall adjacent to the latch side of the door. Refer to the attached Drawing 10440-A. Do not put signs on doors.

B. If sign must be affixed to glass, provide a back-up panel the same size as the sign and holder on other side to cover adhesive.

C. Center all text and pictograms on the sign blade. Signs requiring Braille shall have it directly below text, all information centered.

D. Signs requiring pictograms shall have text directly below, and Braille directly below text, all information centered.

3.3 INSTALLATION:

A. Use mechanical attachment of the sign blade holder where possible, adhesives are not acceptable.
   1. Mechanically attach holder to wall and attach blade separately.
   2. Use Two-Face Tape for mounting on glass.
   3. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.

3.4 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.

3.5 SIGN SCHEDULES

A. Room Name and Number Signs: Locate at door number listed below:

Door Number	Sign Text	Comments
105	105 & Mechanical & Electrical	
106	106 & Equipment Room	
107	107 & Tissue Culture Lab	
107A	107A & Storage	
108	108 & Autoclave	
108A	108 & Autoclave	
109	109 & Molecular Biology Lab	
109A	109A & Fume Hood	
109B	109B & Storage	
110	110 & Fruit Quality Lab	Mount on glass
111	111 & Fruit Intake	Mount on glass
112A	112A & Shower	Accessibility symbol
113	113	Mount on glass
114	114	Mount on glass
115	115	Mount on glass
117	117 & Women	Accessibility symbol
118	118 & Men	Accessibility symbol
131	131	Mount on glass, exterior location
131A	131	Mount on glass, exterior location
132	132	Mount on glass, exterior location
132A	132A & Lab Support	
132B	132 & Teaching Lab	Mount on glass, exterior location
Door Numbers	Sign Text	Comments
133	133 & Men	Accessibility symbol, exterior location
134	134 & Women	Accessibility symbol, exterior location
135	135 & Custodial	Exterior location
136	136 & Storage	Exterior location
136B	Cooler #1	Exterior location
136C	Cooler #2	Exterior location
136D	Cooler #3	Exterior location

B. Occupancy Signs:

Room #	Sign Text	Location
131	Maximum Occupancy 85 People	Door 131
132	Maximum Occupancy 75 People	Door 132

C. Informational Sign Schedule:

1. Locations: Room Numbers 107, 109, 110, 111, 131, and 132.
2. Sign Text: NO EATING OR DRINKING

END OF SECTION 10 14 23

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SECTION 10 21 13 - PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-plastic toilet compartments configured as toilet enclosures and urinal screens.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for blocking.
   2. Section 10 28 00 "Toilet Room Accessories" for accessories mounted on toilet compartments.

1.2 COORDINATION

A. Coordinate requirements for overhead supports, blocking, reinforcing, and other supports concealed within wall and ceiling.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Solid-plastic toilet compartments:
      a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.

B. Shop Drawings: For solid-plastic toilet compartments.
   1. Include plans, elevations, sections, details, and attachment details.
   2. Show locations of cutouts for compartment-mounted toilet accessories.
   3. Show locations of centerlines of toilet fixtures.
   4. Show locations of floor drains.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of toilet compartment material indicated.
   1. Include Samples of hardware and accessories involving material and color selection.

D. Samples for Verification: Actual sample of finished products for each type of toilet compartment indicated.
   1. Size: Manufacturer’s standard size.
   2. Include each type of hardware and accessory.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements, and coordinate before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire Performance: Tested in accordance with, and pass the acceptance criteria of, NFPA 286.

B. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 2**5** percent.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Toilet-Enclosure Style: Overhead braced.

B. Urinal-Screen Style: Wall hung.

C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch thick, seamless, with eased edges and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, extruded-aluminum or stainless steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: Stainless (Scranton Products).
    a. Texture: Grip EX (Scranton Products).
4. Pilaster Shoes: Manufacturer's standard design; polymer.
5. Polymer Color and Pattern: Matching pilaster.

D. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters with sleeve (cap) matching that on the pilaster.

E. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; polymer.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories, Heavy Duty: Manufacturer's heavy-duty operating hardware and accessories.

1. Hinges: Manufacturer's minimum 0.062-inch thick stainless steel that swings to a closed or partially open position, allowing emergency access by lifting door.
    a. Hinges shall be integral, fabricated from the door and pilaster with no exposed metal parts
2. Latch and Keeper: Manufacturer's heavy-duty, surface-mounted, cast-stainless steel latch unit, designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through bolts.
3. Door Bumper: Manufacturer's heavy-duty, rubber-tipped, cast-stainless steel bumper at out-swinging doors. Mount with through bolts.
4. Door Pull: Manufacturer's heavy-duty, cast-stainless steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through bolts.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel.

2.4 MATERIALS

A. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

B. Stainless Steel Castings: ASTM A743/A743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. Ceiling-Hung Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at tops of posts. Provide sleeves (caps) at posts to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide, in-swinging doors for standard toilet compartments and 36-inch-wide, out-swinging doors with a minimum 32-inch-wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

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

3.2 INSTALLATION OF PLASTIC TOILET COMPARTMENTS

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:
   a. Pilasters and Panels: 1/2 inch.
   b. Panels and Walls: 1 inch.
2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
   a. Locate bracket fasteners, so holes for wall anchors occur in masonry or tile joints.
   b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes at posts to conceal anchorage.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on inswinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.19

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SECTION 10 26 00 - WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Corner guards.
   2. End-wall guards.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For each type of impact-resistant wall-protection unit indicated, in each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic materials out of direct sunlight.
   3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
      a. Store corner-guard covers in a vertical position.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
      b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.
   2. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

A. Surface-Mounted, Stainless Steel Corner Guard (CG): Manufacturer's standard assembly consisting of snap-on, stainless steel cover installed over retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Cover: Stainless steel, minimum 0.100-inch wall thickness; as follows:
    a. Profile: Nominal 3 inch by 3 inch with and 1/8-inch corner radius.
    b. Height: 4 feet.
    c. Color: Brushed Stainless Steel.
2. Continuous Retainer: One-piece extruded stainless steel.
3. Retainer Clips: Manufacturer's standard impact-absorbing clips.
4. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.4 END-WALL GUARDS

A. Surface-Mounted, Stainless Steel, End-Wall Guard (EWG): Manufacturer's standard, assembly consisting of snap-on, stainless steel cover installed over continuous retainer; including mounting hardware.

1. Cover: Stainless steel, minimum 0.100-inch wall thickness; as follows:
    a. Profile: Nominal 3 inch long legs and 1/8-inch corner radius.
    b. Height: 4 feet.
    c. Color and Texture: Match corner guards.
2. Retainer: Minimum 0.060-inch-thick, one-piece, extruded aluminum.
3. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.5 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D256, Test Method A.

C. Fasteners: Aluminum or nonmagnetic stainless-steel screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection product manufacturer.

2.6 FABRICATION

A. Fabricate wall protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.7 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

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

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Accessories: Provide splices, mounting hardware, anchors, trim, joint moldings, and other accessories required for a complete installation.

1. Provide anchoring devices and suitable locations to withstand imposed loads.
2. Adjust top caps as required to ensure tight seams.

3.4 CLEANING

A. Immediately after completion of installation, clean covers and accessories.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

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SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Public-use shower room accessories.
   3. Underlavatory guards.
   4. Custodial accessories.

B. Related Requirements:
   1. Section 06105 “Miscellaneous Carpentry" for blocking for toilet and bath accessories mounted on or in wood or metal framed partitions or walls.

1.3 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

B. Delegated-Design Submittal: For grab bars and shower seats.
   1. Include structural design calculations indicating compliance with specified structural-performance requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS (OFCI)

A. Owner-Furnished Materials: The accessories listed below will be issued to at no cost. Contact Facilities Services Building Services with the required number of each accessory and they will be set aside for pickup by the Contractor. A cut sheet of these items is available upon request.
   1. Paper Towel Dispensers (TA-1).
   2. Soap Dispensers (TA-2).
   3. Toilet Paper Dispensers (TA-3).
   4. Sanitary-Napkin Disposal Unit (TA-4):

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
   1. Grab Bars: Installed units are able to resist 250 lbf concentrated load applied in any direction and at any point.
   2. Shower Seats: Installed units are able to resist 360 lbf applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.

B. Waste Receptacle (TA-5):
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-3644 or comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation.
   2. Mounting: Recessed.
   3. Minimum Capacity: 12 gallons.
   4. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Grab Bar (TA-6):
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-6806 or comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation.
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin) on ends and slip-resistant texture in grip area.
   4. Outside Diameter: 1-1/2 inches.
   5. Configuration and Length: As indicated on Drawings.

D. Framed Mirror Unit (TA-7):
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-290 or comparable product by one of the following:
      a. American Specialties, Inc.
      b. Bradley Corporation.
   2. Frame: Stainless steel angle.
      a. Corners: Welded and ground smooth.
   3. Size: As indicated on Drawings.
   4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.

E. Frameless Mirror Unit (TB-8):
   1. Tempered Clear Glass: Mirror Glazing Quality, for blemish requirements; and comply with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied.
   2. Nominal Thickness: 6.0 mm.
   3. Size: As indicated on the drawings.

F. Coat Hook (TB-9)

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-211 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.

2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.

B. Shower Curtain Rod (TA-10):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-207 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Description: 1 inch-outside diameter, straight rod.
3. Configuration: As indicated on Drawings
4. Mounting Flanges: Concealed in material and finish matching rod.
5. Rod Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

C. Shower Curtain (TA-11):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. #204 with #204-1, Hooks, or comparable products by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Size: Minimum 6 inches wider than opening by 72 inches high.
3. Material: Nylon-reinforced vinyl, minimum 0.008-inch-thick vinyl, with integral antibacterial and flame-retardant agents.
4. Color: White.
5. Grommets: Corrosion resistant at minimum 6 inches o.c. through top hem.
6. Shower Curtain Hooks: Stainless steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod. Provide one hook per curtain grommet.

D. Folding Shower Seat (TA-12):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-5193 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Configuration: Rectangular seat.
3. Seat: Phenolic or polymeric composite of slat-type or one-piece construction in color as selected by Architect.
4. Mounting Mechanism: Stainless steel, ASTM A480/A480M No. 4 finish (satin)] .
5. Dimensions: 25.5 inches

E. Soap Dish (TA-13):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-4390 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Description: Recessed mounted, with the following features:
   a. Washcloth bar.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

F. Clothes Hook (TA-14):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-211 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Description: Single-prong unit.
3. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.5 CHILDCARE ACCESSORIES

A. Diaper-Changing Station (TA-15):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Koala Kare Products; a Division of Bobrick, KB110-SSRE or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
   a. Engineered to support minimum of 250-lb static load when opened.
3. Mounting: Semirecessed, with unit projecting not more than 1 inch from wall when closed].
4. Operation: By pneumatic shock-absorbing mechanism.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin), with replaceable insulated polyethylene tray liner and rounded plastic corners; HDPE interior in manufacturer's standard color.
6. Liner Dispenser: Provide built-in dispenser for disposable sanitary liners.

2.6 UNDERLAVATORY GUARDS

A. Underlavatory Guard (TA-16):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Truebro by IPS Corporation “LavShield.”
2. Material and Finish: Antimicrobial, molded plastic, white.

2.7 CUSTODIAL ACCESSORIES

A. Custodial Mop and Broom Holder (TA-17):

1. Basis-of-Design Product: Subject to compliance with requirements, provide Bobrick Washroom Equipment, Inc. B-239 or comparable product by one of the following:
   a. American Specialties, Inc.
   b. Bradley Corporation.
2. Description: Unit with shelf, hooks, and holders.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, ASTM A480/A480M No. 4 finish (satin).

2.8 MATERIALS

A. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304, 0.031-inch-minimum nominal thickness unless otherwise indicated.

B. Galvanized-Steel Sheet: ASTM A653/A653M, with G60 hot-dip zinc coating.

C. Galvanized-Steel Mounting Devices: ASTM A153/A153M, hot-dip galvanized after fabrication.

D. Fasteners: Screws, bolts, and other devices of same material as accessory unit, unless otherwise recommended by manufacturer or specified in this Section, and tamper and theft resistant where exposed, and of stainless or galvanized steel where concealed.

E. Mirrors: ASTM C1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.9 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

1. Remove temporary labels and protective coatings.

B. Grab Bars: Install to comply with specified structural-performance requirements.

C. Shower Seats: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 10 28 00

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SECTION 10 43 13 - DEFIBRILLATOR CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Defibrillator cabinets, accessories, and their installation.

1.3 PREINSTALLATION CONFERENCE

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to defibrillator cabinets, including, but not limited to, the following:
      a. Schedules and coordination requirements.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For Defibrillator cabinets.
   1. Include plans, elevations, sections, details, defibrillator mounting, and attachments to other work.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For defibrillator cabinets to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of Defibrillator cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain defibrillator cabinets, accessories, and fire extinguisher cabinets from a single manufacturer.

2.2 DEFIBRILLATOR CABINET

A. Cabinet Material: Aluminum sheet
   1. Shelf: Same metal and finish as cabinet.

B. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

C. Cabinet Trim Material: Aluminum sheet.

D. Door Material: Aluminum sheet.

E. Door Style: Solid opaque panel with frame.

F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide Vandal resistant.
   2. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

G. Accessories:
   1. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
   2. Alarm: Ensure 85 dB horn sounds for 2 minutes minimum when door is opened and stops when door closes.
      a. Keyed Alarm: On/Off.
      b. Horn Power: 9 Volt DC battery with low power indicator.
   3. Identification: Lettering complying with authorities having jurisdiction and ANSI/NFPA 10 for letter style, size, spacing, and location.
      a. Identify Defibrillator cabinet with the words "DEF and a heart symbol."
         1) Location: Applied to cabinet door.
         2) Application Process: Decals or Pressure-sensitive vinyl letters.
         3) Graphics Color: Red.
         4) Orientation: Horizontal.

H. Materials:
   1. Aluminum: ASTM B221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
      a. Finish: Clear anodic

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed defibrillator cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install defibrillator cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:
   1. Defibrillator Cabinets: 42 inches above finished floor to top of defibrillator.

B. Defibrillator Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of defibrillator cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as defibrillator cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust defibrillator cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of defibrillator cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace defibrillator cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by Defibrillator cabinet and mounting bracket manufacturers.

E. Replace defibrillator cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

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SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for portable fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers and fire blankets indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 FIRE EXTINGUISHER CABINETS

A. Cabinet Types:

1. Fire Extinguisher Cabinet: Suitable for Multipurpose Dry-Chemical Type in Steel Container UL-rated 2-A:10-B:C, 5-lb.
2. Fire Blanket / Extinguisher Cabinet: Suitable for a fire blanket and Multipurpose Dry-Chemical Type, in steel container, UL-rated 2-A:10-B:C, 5-lb fire extinguisher.
    a. Provide a fire blanket with each cabinet.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Aluminum sheet.
   1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface, with exposed trim face and wall return at outer edge (backbend).
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Material: Aluminum sheet.

G. Door Style: Solid opaque panel with frame.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide recessed door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
   2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
      a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet door.
         2) Application Process: Decal.
         3) Lettering Color: Black.
         4) Orientation: Vertical.

J. Materials:
   1. Aluminum: ASTM B 221 for extruded shapes and aluminum sheet, with strength and durability characteristics of not less than Alloy 6063-T5 for aluminum sheet.
      a. Finish: Clear anodic.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   1. Weld joints and grind smooth.
   2. Miter corners and grind smooth.
   3. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
   1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

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

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated below.
   1. Fire-Protection Cabinets: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Fire Extinguishers: Install Owner furnished extinguishers. Extinguishers are located in the basement.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

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SECTION 10 73 26 – WALKWAY COVERS

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.

1.2 SCOPE

A. Work required under this Section consists of providing and installing necessary services, tools, equipment, material and labor to do all aluminum covered walkway work.

1.3 QUALITY ASSURANCE

A. Submit evidence of having operated a successful business of providing, erecting, and installing complete aluminum covered walkway system.

B. Submit a list of successfully completed aluminum covered walkways, within the State of Florida, of similar size and complexity, complete with names, titles, addresses and telephone number of knowledgeable representatives of the owners of such facilities.

C. Submit complete shop drawings depicting in floor plan, elevation, section and details all aluminum covered walkway work to be included in this Contract. Such shall depict necessary dimensions, sizes, thickness, gauges, configurations, finishes, of aluminum extrusions and flashings. Show directions of water flow.

D. Submit complete details with structural properties (Moment of Inertia, Section Modulus, Modulus of Elasticity, etc.) of all beams, columns, decks and other structural members.

E. Submit complete structural calculations of the proposed aluminum covered walkways signed and sealed by a professional engineer registered in the State of Florida, who professes his discipline to be structural engineering.

F. Submit samples of the following:

1. Finishes
2. Extrusions
3. Submit four (4) copies of warranty signed by Contractor and Manufacturer.

1.4 SUBSTITUTIONS

A. Comply with the requirements pertaining to substitutions as set forth in Division One, Section 00 21 13 Instructions to Bidders.

1.5 DELIVERY AND STORAGE

A. Comply with the manufacturer’s recommendation as to handling, delivery and storage of materials. Aluminum covered walkway materials shall be stored free of the earth, slab or floor in a dry place free from risk of damage.

1.6 WARRANTY

A. The Contractor and the aluminum covered walkway manufacturer shall warrant the entire installation against defects in labor and materials for a period of one (1) year commencing on the Date of Substantial completion as established in Division One of these Specifications

B. Intention of this warranty is the Contractor and deck system manufacturer will come onto the job site and do all necessary work to effect corrections of any deficiencies.

C. Prima facie evidence of defects in labor or material may include, but is not limited to, one or more of the following:
   1. Leaks
   2. Metal failure including excessive deflection
   3. Fastener failure
   4. Finish failure

1.7 ACTION SUBMITTALS

A. Product Data: Include manufacturer's product specifications, standard details, certified product test results, and general recommendations, as applicable to materials and finishes for each component and for total panel assemblies.

B. Shop Drawings: Show layouts of structural components and roof panels, details of edge conditions, joints, panel profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work.
   1. For installed products indicated to comply with certain design loadings, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in the project state. Design calculations shall state that the protective cover system design complies with the wind requirements of the Florida Building code and ASCE 7-95, the stability criteria of applicable building code, and all other governing criteria.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed metal protective cover projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Florida and who is experienced in providing engineering services of the kind indicated.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify location of structural members and openings in substrates by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MAUFACTURERS / PRODUCTS

A. The following products are approved, subject to compliance with these specifications:
   1. Ditt-Deck as manufactured by:
      Dittmer Architectural Aluminum
   2. Span Deck
      Architectural Metal Systems, Inc.
   3. Protective Covers as manufactured by:
      Peachtree Protective Covers
   4. RIGID-ROLL-LOCK SYSTEM as manufactured by:
      Perfection Architectural Systems Inc.

2.2 PERFORMANCE REQUIREMENTS

A. General: Provide manufactured protective covers complying with performance requirements indicated and capable of withstanding structural movement, thermally induced movement, and exposure to weather without failure or infiltration of water.

1. Design Walkways in accordance with The Aluminum Design Manual 2000.
2. Comply with the wind requirements of the Florida Building Code and ASCE 7.
3. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

B. Structural Performance: Provide manufactured protective cover assemblies capable of safely supporting design loads indicated under in-service conditions with vertical deflection no greater than the following, based on testing manufacturer's standard units according to ASTM E 1592 by a qualified independent testing and inspecting agency.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.

D. Water Penetration: Provide manufactured roof panel assemblies with no water penetration as defined in the test method when tested according to ASTM E 1646 at a minimum differential pressure of 20 percent of inward acting, wind-load design pressure of not less than 6.24 lb./sq. ft. and not more than 12.0 lb./sq. ft..

2.3 MATERIALS

A. General: Provide materials and accessories required for a complete protective cover assembly and as recommended by system manufacturer, unless otherwise indicated.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063 heat-treated to a T-6 temper, but not less than 22,000-psi ultimate tensile strength, not less than 16,000-psi minimum yield strength.

C. Roof deck construction: All wet pans shall have serrated bottoms exposed to the underside of the walk.

D. Fasteners:

1. Deck Screws: Type 18-8 stainless steel, sealed with neoprene “O” ring beneath flat washers.
2. Fascia rivets: Size 3/16” by ½” grip range, aluminum rivets, with aluminum mandrel.
3. Bolts: Stainless steel, 18-8, or 3/8” or ½” size as necessary for structural requirements..
4. Other Fasteners: Stainless steel, size and type recommended by manufacturer for specific condition.
5. Reinforcement: Where fasteners screw-anchor into aluminum less than 0.125 inch thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads, or provide standard, noncorrosive, pressed-in, splined grommet nuts.

E. Sheet Aluminum:

1. Shall be .040 satin anodized aluminum with a finish to match the metal canopy.
2. Form in lengths not less than 10’ in length.
3. Comply with SMACNA whenever possible when fabricating and installing flat sheet aluminum.

F. Sealant:

1. Silicone sealant designed specifically for application between metals. Color shall be clear.

2. Approved products and manufacturers:
   a) DOW Coming 790 or 795
   b) GE Silpruf

G. Accessories: Unless otherwise specified, provide components required for a complete protective cover assembly including trim, copings, fasciae, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of deck panels.

1. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat, unless otherwise indicated. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 FABRICATION

A. General:

1. Fabricate and finish protective cover components at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.
2. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
3. Bent Construction: Beams and columns shall be factory welded with neatly mitered corners into one-piece rigid bents. All welds shall be smooth and uniform using an inert gas shielded arc. Suitable edge preparation shall be performed to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints shall be used when shipping limitations prohibit the shipment of fully welded bents.
4. Deck Construction: Deck shall be extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 8" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

B. Under structure shall consist of shop heli-arc welded one-piece rigid bents and the deck of interlocking anodized aluminum extrusions. Grind welds down smooth. The corners of all bends shall have rounded corners of no less than 1/25” radius. (When size of the bent system does not permit shipment as a welded unit, concealed mechanical joints may be utilized. Mechanical joints in such situations shall be of stainless steel bolts with a minimum of two bolts per fastening (bolts and nuts shall be installed in a concealed manner utilizing ½” thick by 1-1/2” aluminum bolt bars welded to members).

C. Apply a shop applied dip-coat of clear acrylic enamel at each column end to terminate in concrete to insulate from electrolytic reaction.

D. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column are not acceptable.

1. Grout Key: Provide two 1-1/2 inch diameter holes in column base, one each in opposite sides.
2. Provide protection coating on surfaces in contact with grout.

E. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner. Provide structural ties in tops of all beams.

F. Deck: Extruded self-flashing sections interlocking into a composite unit.
   1. Provide welded endplate water dams where sections terminate at other than drainage channels.

G. Fascia: Manufacturer’s standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non vertical surfaces.

2.5 ALUMINUM FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

D. Satin Anodic 204-R1 Finish: AA-M12C22A1 (Mechanical Finish: nonspecular as fabricated; Chemical Finish) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements indicated for conditions affecting performance of protective covers.
   1. Do not proceed with protective cover installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with protective cover manufacturer's written instructions and recommendations for installation, as applicable to project conditions and supporting substrates.
   1. Anchor columns, bents and other components of the Work securely in place, with provisions for thermal and structural movement.
   2. Field cutting of system components by torch is not permitted.
   3. Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.
   4. Erect protective cover true to line, level, and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.
   5. Provide hairline miters and fitted joints.
   6. Sleeves (Styrofoam block-outs) shall be furnished by the aluminum deck subcontractor and set by the Contractor. Authorized installer shall be scheduled to erect after all adjacent roofing and masonry have been completed. Concrete footings, anchor bolts and/or flashing, where required, shall be by the Contractor.
   7. Bents shall be carefully aligned prior to grouting; downspout column interiors shall be grouted to lower edge of “weephole”; deflectors shall be installed after grouting.
   8. All deck ends at beam joints shall be capped as detailed. Butt and miter joints shall be executed in a workmanlike manner.

9. All columns shall be set true and plumb. All bents shall be set true and level. Elevations of top bents shall be as designated on the Drawings (as may be otherwise required) to provide the required deck slope.
10. All fascia cuts shall be accurately made and tightly fit.
11. Accessories: Install components required for a complete protective cover assembly including trim, copings, fasciae, closures, clips, flashings, gutters, sealants, gaskets, fillers, and similar items.

B. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, or by other permanent separation as recommended by manufacturers of dissimilar metals.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance. Provide types of gaskets, fillers, and sealants indicated or, if not otherwise indicated, types recommended by manufacturer.

1. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weatherproof to driving rains.

3.3 CLEANING AND PROTECTING

A. Damaged Units: Replace panels and other components of the Work that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films, if any, as soon as each panel is installed. On completion of installation, clean finished surfaces as recommended manufacturer and maintain in a clean condition during construction.

END OF SECTION 10 73 26

SECTION 11 13 13 - LOADING DOCK BUMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes loading dock bumpers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of loading dock bumper.

B. Shop Drawings: For dock bumpers. Include plans, elevations, sections, and attachment details.

PART 2 - PRODUCTS

2.1 LOADING DOCK BUMPERS

A. General: Surface-mounted bumpers; of type, size, and construction indicated; designed to absorb kinetic energy and minimize damage to loading dock structure.

1. Source Limitations: Obtain from single source from single manufacturer.

B. Laminated-Tread Loading Dock Bumper: Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch-diameter, steel supporting rods that are welded at one end to 1/4-inch-thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.

1. Thickness: 4-1/2 inches
2. Horizontal Style: 10 inches high by 24” long.

C. Anchorage Devices: Galvanized-steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated. Hot-dip galvanized according to ASTM A153/A153M or ASTM F2329/F2329M.

D. Materials: ASTM A36/A36M for steel plates, shapes, and bars. Hot-dip galvanize according to ASTM A123/A123M.

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

3.2 INSTALLATION, GENERAL

A. Loading Dock Bumpers: Attach loading dock bumpers to face of loading dock in a manner that complies with requirements indicated for spacing, arrangement, and position relative to top of platform and anchorage.

1. Bolted Attachment: Attach dock bumpers to preset anchor bolts embedded in concrete or to cast-in-place inserts or threaded studs welded to embedded-steel plates or angles. If preset anchor bolts, cast-in-place inserts, or threaded studs welded to embedded-steel plates or angles are not provided, attach dock bumpers by drilling and anchoring with expansion anchors and bolts.

3.3 ADJUSTING

A. After completing installation of exposed, factory-finished dock bumpers, inspect exposed finishes and repair damaged finishes.

END OF SECTION 11 13 13

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes: Manually operated roller shades with single rollers.

B. Related Requirements:

1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc; Classic Mecho/5 Standard System or a comparable product by one of the following:
   1. Hunter Douglas Contract.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
   1. Bead Chains: Stainless steel.
      a. Loop Length: Full length of roller shade.
      b. Limit Stops: Provide upper and lower ball stops.
      c. Chain-Retainer Type: Clip, jamb mount.
   2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
      a. Provide for shadebands that weigh more than 10 lb. or for shades as recommended by manufacturer, whichever criterion is more stringent.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
   1. Roller Drive-End Location: Right side of interior face of shade, unless otherwise indicated.
   2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
   3. Shadeband-to-Roller Attachment: Removable spline fitting into integral channel in tube.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.

F. Shadebands:
   1. Shadeband Material: Light-Filtering Fabric.
   2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
      a. Type: Enclosed in sealed pocket of shadeband material.

G. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open.
2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
   a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open.
3. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
4. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller-shade manufacturer.
2. Type: PVC-coated polyester.
3. Weave: Basketweave.
4. Thickness: 32 mil.
5. Weight: 16.8 oz./sq. yd.
6. Roll Width: 126 inches.
7. Orientation on Shadeband: Railroaded.
8. Openness Factor: 10 percent.
9. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances and other conditions affecting performance of the Work.

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

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Roller Shade Locations:

1. At exterior windows, install between the jambs.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 36 53 LABORATORY COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Epoxy resin countertops, sinks and accessories.
   2. Setting materials.

B. Related Requirements:
   1. Section 22 40 00 “Plumbing Fixtures, Equipment, Trim & Schedule " for plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop, sinks and accessories.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Recycled Content: Certify percentages of post-consumer and pre-consumer recycled content.
   3. Regional Materials: Certify products extracted, processed, and manufactured within 700 mile radius of Project site.
   4. Low-Emitting Materials: Certify volatile organic compound (VOC) content.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Submit plan, section, elevation and perspective drawings necessary to describe and convey layout, profiles, and product components, including edge conditions, joints, fitting and fixture locations, anchorage, accessories, and finish colors.

D. Samples for Verification: For the following products:
   1. Countertop material, 6 inches square.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For epoxy countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Primary products furnished by single manufacturer with minimum 10 years documented experience in work of this Section.

B. Fabricator Qualifications: Shop with a minimum 5 years documented experience in work of this Section that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

C. Installer Qualifications: Fabricator of countertops.

D. Test Reports: Certified test reports or recognized evaluation reports showing compliance with specified performance characteristics and physical properties.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 STORAGE, AND HANDLING

A. Storage:

1. Store products in enclosed area protected from ultraviolet.
2. Store products in manufacturer's unopened packaging until ready for installation.
3. Store panels using protective dividers to avoid damage to surfaces.
4. For horizontal storage, store sheets on pallets of equal or greater size than sheets with protective layer between pallet and sheet and on top of uppermost sheet.
5. Do not store sheets or fabricated panels vertically.

B. Handling:

1. If protective film is provided, do not remove until panel has been installed.
2. Handle sheets to prevent damage.
3. Remove stickers immediately after installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

B. Do not install products under environmental conditions outside manufacturer's limits.

C. Avoid direct exposure of products to sunlight.

D. Do not use worksurfaces as bench, ladder, or seating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Durcon, Incorporated, 206 Allison Drive, Taylor, TX 76574, 512-595-8000, www.durcon.com.

2.2 MATERIALS

A. Solid Epoxy Resin:

1. Sheets cast from modified epoxy resin and non-asbestos inert fillers; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
2. Sheets cast from modified epoxy resin and non-asbestos inert fillers with 10 percent of filler certified as post-consumer glass by SCS; compounded mixture cured and thermoset specifically from formulation to provide exceptional physical and chemical resistance required in medium to heavy duty laboratory environments.
3. Sheets monolithic throughout without surface coating application.
4. Physical properties; minimum acceptable physical performance in accordance with SEFA 3 testing procedures:
    a. Density/specific gravity: Tested to ASTM D792; minimum test rating of 134.8 PSF or 2.16 gcm.
    b. Rockwell hardness: Tested to ASTM D785; minimum M scale rating of 110.

c. Fire resistance: tested to ASTM D635; classified as self-extinguishing.
d. Surface burning characteristics: Tested to ASTM E84; flame spread index less than 25 and smoke develop index less than 400.
e. Heat deflection: Tested to ASTM D648; maximum 205 degrees F or 96 degrees C.
f. Flexural strength: Tested to ASTM D790; minimum rating 14.9 KPSI or 103 Mpa.
g. Flexural modulus: Tested to ASTM D790; 2,777,501 PSI or 19.2 Gpa.
h. Water absorption, 24 hours: tested to ASTM D570; maximum 0.008 percent by weight.
i. Compression strength: Tested to ASTM D695; minimum 38.4 kpsi.
j. Chemical resistance; minimum acceptable chemical resistance performance in accordance with SEFA 3

5. Color: Black.

2.3 ACCESSORIES

A. Provide solid epoxy resin pegboards where indicated.

B. Installation Materials: Manufacturer's joint adhesive, panel adhesive, and sealants as required to suit project conditions.

2.4 FABRICATION

A. Fabricated tops and accessories in accordance with manufacturer's recommendations, approved Shop Drawings.

B. Epoxy Resin Countertops:
1. Thickness:
a. 1-1/4 inches unless otherwise indicated.
b. Check each sheet at factory for required thickness.
c. Maximum variation in thickness: plus or minus 1/16 inch from corner to corner.
2. Warpage:
a. Inspect tops for warpage prior to fabrication by placing on true flat surface.
b. Maximum allowable warpage: 1/16 inch in 36 inch span or 3/16 inch in 96 inch span.
3. Fabrication:
a. Shop fabricate in longest practical lengths.
b. Bond joints with highly chemical resistant cement with properties and color similar to base material.
c. Provide 1/8 inch drip groove at underside of exposed edges, set back 1/2 inch from face.
d. Finish exposed edges.
4. Fabricate tops flat with 1/4 inch raised marine edge at epoxy sink locations.
5. Edge treatment: Standard 1/8 inch chamfered edge.
6. Corner treatment: exposed corners shall be eased slightly for safety.
7. Back and end splashes:
a. Straight, slightly eased at corner.
b. Same material and thickness as worksurfaces.
c. Four (4) inches high unless otherwise indicated.
d. Top-mounted end splash where worksurfaces abut adjacent construction at and locations indicated on Drawings.

8. Joints:
    a. Joint Locations: Not within 18 inches of a sink and not where a countertop section less than 36 inches long would result, unless unavoidable.
9. Sink cutouts: Routed for drop-in sink.
10. Allowable tolerances:
    a. Square: Plus or minus 1/64 inch for each 12 inches of length.
    b. Location of cutouts and drilled openings: Plus or minus 1/8 inch of design dimension.
    c. Size of cutouts and drilled openings: Plus 1/8 inch or minus 0 inches.

C. Cutouts and Holes:
1. Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
2. Fittings: Drill countertops in shop for plumbing fittings and similar items.

D. Epoxy Resin Sinks:
1. Mold sinks from thermosetting epoxy resin.
2. Mold interior corners to radius. Slope sink base to drain outlet.
3. Provide 1-1/2 inch outlet with open ended standpipe; standpipe overflow 2 inches shorter than depth of sink.
4. Unless otherwise indicated, fabricate sinks of drop-in design supported by upper flange from worksurface.
5. Color: To match adjacent worksurface.

2.5 INSTALLATION MATERIALS

A. Adhesive: Product recommended by epoxy manufacturer.
1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive epoxy countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

C. Confirm that surfaces to receive tops are plumb and level, with maximum deflection of 1/4 inch in 20 feet.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Scribe to adjacent surfaces in accordance with manufacturer's recommendations.

C. Secure countertops with adhesive according to epoxy manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with epoxy manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Form field joints using manufacturer's recommended adhesive. Form joints to be inconspicuous and nonporous.

E. Install pegboards using fasteners and adhesive appropriate for use with adjoining construction and as recommended by manufacturer.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

3.3 PROTECTION

A. Protect installed products until completion of Project.

B. Touch up, repair, or replace damaged products.

END OF SECTION 12 36 53

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SECTION 12 36 61 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Solid surface material countertops.
   2. Solid surface material backsplashes.
   3. Solid surface material end splashes.
   4. Solid surface material apron fronts.

B. Related Requirements:
   1. Section 22 40 00 "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials and sinks.

B. Sustainable Design Submittals:
   1. Composite Wood:
      a. Provide signed approved submittal for installed products and manufacturers catalog cut sheet for each composite wood product used in the building indicating that the bonding agent used in each product contains no added urea-formaldehyde.
      b. Provide photos of installed wood products.
   2. Adhesives and Sealants: Submit Materia Safety Data Sheets (MSDS) highlighting the stated VOC emissions for each adhesive and sealant used.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:
   1. Countertop material, 6 inches square.
   2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.

1. Build mockup of typical countertop as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.

1. Type: Provide Standard type or Veneer type made from material complying with requirements for Standard type, as indicated unless Special Purpose type is indicated.
2. Colors and Patterns: As selected by the Architect from manufacturer's full range.

B. Composite Wood Products: Products shall be made without urea formaldehyde.

C. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

D. Solid Surface

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top with separate apron, 6 inches high, recessed 1/4-inch behind front edge.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops: 1/2-inch thick, solid surface material with front edge built up with same material.

D. Backsplashes: 3/4-inch thick, solid surface material.

E. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

F. Joints: Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.

2.3 INSTALLATION MATERIALS

A. Adhesives and Sealants: Volatile Organic Compounds (VOC) and meet the VOC limits listed in Section 01 81 13 “Sustainable Design Requirements – FGBC Version 3.”

B. Adhesive: Product recommended by solid surface material manufacturer.

C. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

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

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

H. Apply sealant to gaps at walls; comply with Section 07 92 00 "Joint Sealants."

END OF SECTION 12 36 61

SECTION 12 56 53 - LABORATORY FURNITURE

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.

1.2 SUMMARY

A. This Section includes the following:
   1. Flammable Storage Cabinet

1.3 SUBMITTALS

A. Product Data: Include material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: Cold rolled, ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Metallic-Coated Steel Sheet: Galvanized steel sheet, ASTM A 653/A 653M, G60 (Z180) coating designation; or electrolytic zinc-coated steel sheet, ASTM A 591/A 591M, Class C coating.

C. Stainless-Steel Sheet: ASTM A 666, Type 304.

D. Steel Anchor Bolts, Nuts, and Washers: ASTM F 1554, Grade 36 or 55, hot-dip galvanized.

E. Stainless-Steel Anchor Bolts, Nuts, and Washers: ASTM A 193/A 193M, Grade B8M, Type 316.

2.2 FLAMMABLE STORAGE CABINETS

A. Flammable Chemical Storage Cabinet:
   1. Basis of Design: Condor Item #491M89.
   2. Capacity 30 gallons.
   3. Size: Height 44 inches, Width 43 inches, Depth 18 inches.:
   4. Number of Cabinet Shelves: One.
   5. Number of Doors: Two.
   6. Color: Red.

2.3 FINISHES, GENERAL

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.4 STEEL FINISHES

A. Unless otherwise indicated, finish steel surfaces exposed to view with baked-enamel or powder-coated finish.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard 2-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

C. Powder-Coated Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard baked-polymer finish consisting of a thermosetting polyester or acrylic urethane powder topcoat. Comply with paint manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, roughing-in openings, clearances, and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

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

3.2 INSTALLATION

A. General: Install equipment level and plumb, according to manufacturer's written instructions and roughing-in drawings.

1. Metal Protection: Where aluminum and copper alloys will contact grout, concrete, masonry, wood, or dissimilar metals, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturers of dissimilar metals.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as equipment is installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust doors to operate easily without binding. Verify that integral locking devices operate properly.

C. Touch up marred finishes or replace educational specialties that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.

D. Replace equipment that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 12 56 53

SECTION 21 00 00 - FIRE PROTECTION GENERAL

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 Related Documents:

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

1.2.2 This is a Basic Fire protection Requirements Section. Provisions of this section apply to work of all Division 21 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
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1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale fire protection drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed

within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on fire protection drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Approval Submittals:

1.9.1 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.

1.9.2 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 and the following.

1.9.2.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.9.2.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.9.2.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.9.2.4 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.

1.9.2.5 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 cover sheet.

1.9.2.6 Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number 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.

1.9.2.7 The electrical design shown on the drawings supports the fire protection equipment basis of design specifications at the time 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, breaker 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 change 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.

1.9.2.8 Submittals shall be in searchable PDF format and not a scanned copy.

1.9.2.9 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.9.3 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.

1.9.4 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.

1.9.5 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 ¼" 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. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 The label of the approving agency, such as UL or ASME by which a standard has been established for the particular item shall be in full view.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.4 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.

2.3.5 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.

2.3.6 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:

2.3.6.1 Principal of operation.

2.3.6.2 Materials of construction or finishes.

2.3.6.3 Thickness of gauge of materials.

2.3.6.4 Weight of item.

2.3.6.5 Deleted features or items.

2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 The Contractor shall be responsible for full coordination of the fire protection systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any additional steel supports required for the installation of any fire protection equipment or piping shall be furnished and installed under the section of the specifications requiring the additional supports.

3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves 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.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for

servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

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, 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: Contractor shall provide 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 foundations, 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 21. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. 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 and leave premises free from debris and in a 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 Record (As Built) Drawings:

3.11.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

3.11.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1.

3.11.3 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model

with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.12 Acceptance:

3.12.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.12.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.12.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.12.3.1 Submit training syllabi prior to training for owner review.

3.12.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.12.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.12.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and organized and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.12.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.12.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.12.4.1.2 Complete wiring and control diagrams.

3.12.4.1.3 Routine maintenance operations.

3.12.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.12.4.1.5 Copies of final approved version of Approval Submittals.

3.12.4.1.6 Copies of all manufacturer's warranties.

3.12.4.1.7 Copies of Test Reports and Verification Submittals.

3.12.4.2 All included information shall comply with the following:

3.12.4.2.1 Remove all non-related information from O&Ms.

3.12.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.12.5 Record Drawings: Submit "Record Drawings".

3.12.6 Control Diagrams: Laminate and mount on equipment room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses Engineering

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Fire protection

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 2/12/17

Use whatever standard headings you want here

SECTION: 21 11 14/Building Sprinkler and Standpipe

1. Pipe & Fittings
2. Basic Valves
3. Special Valves
4. Dry Pipe Compressor

List each item separately

Typical - list mfr name & model number

General Contractor's <u>APPROVAL</u> stamp must be on this sheet.

END OF SECTION

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SECTION 21 00 10 - CODES AND STANDARDS

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 Fire Protection Requirements section. Provisions of this section apply to work of all Division 21 sections.

2 CODES

2.1 All work under Division 21 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 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.

2.3 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.

2.4 Additional codes or standards applying to a specific part of the work may be included in that section.

2.5 The following codes govern the work:

2.5.1 Florida Building Code - Building - Seventh Edition (2020).

2.5.2 Florida Fire Prevention Code - Seventh Edition (2020).

2.5.2.1 Uniform Fire Code (NFPA 1) - 2018 Florida Edition.

2.5.2.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

2.5.3 National Electric Code (NFPA 70) - 2017

2.5.4 Installation of Sprinkler Systems (NFPA 13) - 2016.

2.5.5 Standard on Fire Protection for Laboratories Using Chemicals (NFPA 45) - 2011.

2.5.6 FAC 69A-47 The Uniform Fire Safety Standard for Elevators.

2.5.7 FAC 61C-5 Florida Elevator Safety Code.

3 STANDARDS

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

3.1.1 Underwriters' Laboratories (UL)

3.1.2 American National Standards Institution (ANSI)

3.1.3 American Society of Testing Materials (ASTM)

3.1.4 National Fire Protection Association (NFPA)

END OF SECTION

SECTION 21 05 00 - FIRE PROTECTION RELATED WORK

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 Fire protection Requirements section. Provisions of this section apply to work of all Division 21 sections.

1.3 Coordinate all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 33 - SITE WORK

2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 21 05 05.

2.2 The following work is part of Division 21:

2.2.1 All site fire protection piping.

3 DIVISION 3 - CONCRETE

3.1 Refer to Division 3, Concrete for:

3.1.1 Rough grouting in and around fire protection work.

3.1.2 Patching concrete cut to accommodate fire protection work.

3.2 The following is part of Division 21 work, complying with the requirements of Division.3

3.2.1 Curbs, foundations and pads for fire protection equipment.

4 DIVISION 4 - MASONRY

4.1 Refer to Division 4, Masonry for:

4.1.1 Installation of access doors in walls.

5 DIVISION 5 - METALS

5.1 Refer to Division 5, Metals for:

5.1.1 Framing openings for fire protection equipment.

5.2 The following is part of Division 21 work.

5.2.1 Supports for fire protection work.

6 DIVISION 6 - WOOD AND PLASTIC

6.1 Refer to Division 6, Wood for:

6.1.1 Framing openings for fire protection equipment

7 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

7.1.1 Caulking and waterproofing of all wall and roof mounted fire protection work.

7.2 The following is part of Division 21 work, complying with the requirements of Division 7.

7.2.1 Fire barrier penetration seals.

8 DIVISION 9 - FINISHES

8.1 Refer to Division 9, Finishes for:

8.1.1 Painting exposed piping and equipment.

8.1.2 Painting structural metal and concrete for fire protection work.

8.1.3 Painting color-coded fire protection work indicated for continuous painting. See color schedule in Division 21 section, "Fire protection Identification".

8.1.4 Installation of access doors in gypsum drywall.

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

8.3 Perform the following as part of Division 21 work:

8.3.1 Touch up painting of factory finishes.

8.3.2 Painting of all hangers.

9 DIVISION 10 - SPECIALTIES

9.1 Refer to Division 10 - Specialties for:

9.1.1 Fire extinguishers and fire extinguisher cabinets and accessories.

10 DIVISION 26 - ELECTRICAL

10.1 Contractor 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 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.

10.2 Contractor shall provide disconnect switches, starters, and contactors for fire protection equipment under Division 26 unless specifically noted as being furnished as part of fire protection equipment.

10.3 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.

END OF SECTION

SECTION 21 05 05 - EXCAVATION & BACKFILL

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-21 Basic Fire Protection Materials and Methods section, and is part of each Division-21 section making reference to or requiring excavation and backfill specified herein.

1.3 Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are not known. Use extreme caution when excavating. Contact Physical Plant Division for more information on utility location.

1.4 Refer to other Division-21 sections and/or drawings for specific requirements of the particular piping system being installed. Where another Division-21 section or the drawings conflict with requirements of this section, the other Division-21 section or the drawings shall take precedence over the general requirements herein.

1.5 OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements. Contractor shall also erect barriers, provide shoring and maintain excavations as required to protect the public and adjacent traffic.

1.6 Trench Safety Act: Contractor shall comply with all requirements of Florida Statutes Chapter 553, including the requirement to provide a separate line item to identify the cost to comply on a per lineal foot of trench and per square foot of shoring. Comply with UF Trenching and Excavation Safety Policy. Refer to www.ehs.ufl.edu/general/trench02.pdf.

1.7 Dig Permit: A Dig Permit must be obtained from the University of Florida Physical Plant prior to any excavation. In case of conflicts between this specification and the Dig Permit requirements, the most stringent will govern.

2 PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand.

2.2 Gravel: Clean, well graded hard stone or gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Fill free of clay, muck, stones, wood, roots or rubbish.

2.4 Identification Tape: Polyethylene 6 inches wide, 3.5 mil solid core encased in a 1 mil thick protective plastic jacket continuously printed with "CAUTION" in large black letters and type of pipe below. Tape shall conform to APWA specifications.

2.5 Copper Identification Wire: 14-gauge, single conductor, type UF.

3 EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever there is a possibility of encountering obstacles or any existing utility lines of any nature whatsoever. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavators within the limits of the building lines.

3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, muck, or roots, subcut

and bring bed up to proper elevation with clean, new sand (as described in paragraph 2.1), deposited in 6" layers and tamped. Notify Architect/Engineer if subcut exceeds 12", or if bed is of an unstable nature. In this case a 6" minimum layer of gravel will be required before sand bedding begins. Submit cost proposal if the earth conditions require subcut in excess of 12" or if gravel is required to achieve proper bedding.

3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping.

3.4 Backfilling: Deposit clean new sand (as described in paragraph 2.1) to 6" above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support, especially on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.

3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. De-watering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.

3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and18" to 30" above buried pipe. Tape copper wire to non-metallic pipes.

3.7 Depth of Cover: Minimum cover for underground piping is 48 inches unless indicated otherwise.

3.8 Existing Pavement: Where new piping passes below existing streets, driveways, parking lots, or other paved areas, the pavement shall be saw cut. Backfill shall be compacted to 95% density and the pavement shall be patched to match existing pavement. Provide compaction tests and reports as required.

3.9 Landscape Restoration:

3.9.1 Lawn or Unpaved Areas: The soil shall be replaced according to the original profile. Compact the top 6" of subgrade and each 6" layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

If additional soil is required, the Contractor shall supply weed free topsoil of a type to match existing topsoil.

3.9.2 Grass: Fine grade and solid sod with the type of grass to match the existing species and cultivar.

3.9.3 Landscape Maintenance: Contractor shall be responsible for watering and other grounds maintenance in the area of construction until the project is accepted.

3.9.4 UF: If there are any questions regarding type of grass or landscape restoration in general, Contractor should contact one of the campus landscape architects by calling 392-1155 or 392-1118.

END OF SECTION

SECTION 21 05 19 - PIPING SPECIALTIES

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-21 Basic Fire Protection Materials and Methods section, and is part of each Division-21 section making reference to or requiring piping specialties specified herein.

1.3 Approval Submittals:

1.3.1 Product Data: Submit product data with installation instructions and UL listing for:

1.3.1.1 Fire barrier sealants.

2 PRODUCTS

2.1 General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 Fire Barrier Penetration Seals:

2.2.1 Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for fire protection components such as piping in accordance with the requirements of Division 7.

2.2.2 Cracks, Voids, or Holes Up to 4" Diameter: Use putty or calking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

2.2.3 Openings 4" or Greater: Use sealing system capable of passing 3-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.

2.3 Fabricated Piping Specialties:

2.3.1 Pipe Sleeves: Provide pipe sleeves of one of the following:

2.3.1.1 Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.

2.3.1.2 Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

2.3.1.3 Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.3.2 Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

2.3.2.1 Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

3 EXECUTION

3.1 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.

3.2 Pipe Sleeves: Install pipe sleeves of types 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 will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than piping run. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves ¼" above level floor finish, and ¾" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

3.2.1 Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire barrier sealant.

3.2.2 Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.

3.2.3 Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.

3.2.4 Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations; both above and below grade. Fill annular space with caulking or mechanical sleeve seals.

END OF SECTION

SECTION 21 05 20 - METERS AND GAUGES

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-21 Basic Fire protection Materials and Methods section, and is part of each Division-21 section making reference to or requiring meters and gauges specified herein.

1.3 Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-21 sections.

1.4 UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

1.5 ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.6 Approval Submittals:

1.6.1 Product Data: When required by other Division-21 sections, submit manufacturer's technical product data for each type of meter and gauge. Submit with Division-21 section using meters and gauges, not as a separate submittal. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit for:

1.6.1.1 Pressure gauges

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit calibration curves and operating instructions for each type of gauge. Include this data in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers (Pressure Gauges): Subject to compliance with requirements, Ashcroft, Ernst Gauge Company, Weksler, Marshalltown Instruments, Trerice, Weiss Instruments, Wheatley, Fluidyne or approved equal.

2.2 Pressure Gauges:

2.2.1 General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for the use in service indicated.

2.2.2 Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

2.2.3 Case: Drawn steel or brass, glass lens, 4-1/2" diameter.

2.2.4 Connector: Brass with 1/4" male NPT.

2.2.5 Scale: White coated aluminum with black scale.

2.2.6 Range: Select so that highest possible pressure does not exceed 75% of full scale.

2.3 Pressure Gauge Cocks:

2.3.1 General: Provide 1/4" ball valves for use as pressure gauge cocks.

2.3.2 Snubber: 1/4" brass bushing with corrosion resistance porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

3 EXECUTION

3.1 Installation of Pressure Gauges:

3.1.1 General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position .

3.1.2 Locations: Install where required by code.

3.1.3 Pressure Gauge Cocks: Install in piping tee with snubber.

3.1.4 Adjusting: Adjust faces of gauges to proper angle for best visibility.

3.1.5 Cleaning: Clean windows of gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 21 05 23 - VALVES

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-21 Basic Materials and Methods section, and is part of each Division-21 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-15 sections.

1.4 Quality Assurance:

1.4.1 Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.

1.4.2 Valve Types: Provide valves of same type by same manufacturer.

1.4.3 Valve Listing: For valves on fire protection piping, provide UL listing.

1.5 Approval Submittals: When required by other Division-21 sections, submit product data, catalog cuts, specifications, and dimensioned drawings for each type of valve. Submit valves with Division-21 section using the valves, not as a separate submittal. Submit valve comparison chart with applicable valves clearly marked if valves other than basis-of-design are to be used. For each valve, identify systems where the valve is intended for use.

1.5.1 Gate Valves. Type FPGA.

1.5.2 Check Valves. Type FPCK.

1.5.3 Ball Valves. Type FPBA.

1.5.4 Butterfly Valves. Type FPBF.

1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data and spare parts lists for each type of valve. Include this data in the O&M Manual.

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. Other valve manufacturers list names are also acceptable. 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 Gate Valves:

2.3.1 Packing: Select valves designed for repacking under pressure when fully opened, equipped with non-asbestos packing suitable for intended service. Select valves designed so back seating protects packing and stem threads from fluid when valve is fully opened, and equipped with gland follower.

2.3.2 Comply with the following standards:

Cast Iron Valves: MSS SP-70. Cast Iron Gate Valves, Flanged and Threaded Ends.
Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.
Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

2.3.3 Types of gate (FPGA) valves:

1 Threaded Ends 2" and Smaller (FPGA 1): 175 WWP, bronze body, screwed bonnet, rising stem, OS&Y, solid wedge, UL-listed. Stockham B-133. Nibco T-104-0.

2 Flanged Ends 2" and Larger (FPGA 2): 175 WWP, iron body, bolted bonnet, rising stem, OS&Y, solid wedge, UL-listed. Stockham G-634. Nibco T-104-0.

3 Threaded Ends 2" and Smaller (FPGA 3): Class 300, bronze body, union bonnet, rising stem, OS&Y, solid wedge, renewable seat. Stockham B-145. Nibco T-74-SS. Crane 634E. Milwaukee 1184.

4 Flanged Ends 2½" and Larger (FPGA 4): 300 WWP, iron body, bolted bonnet, bronze mounted, rising stem, OS&Y, solid wedge, UL-listed. Stockham F-670. Nibco F-697-0.

2.5 Check Valves:

2.5.1 Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40º to 45º, 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.

2.5.2 Comply with the following standards:

Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.
Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.
Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

2.5.3 Types of check (FPCK) valves:

1 Threaded Ends 2" and Smaller (FPCK 1): 200 WWP, bronze body, screwed cap, horizontal swing, regrinding type bronze disc, for fire sprinkler use. Nibco KT-403-W.

2 Flanged Ends 2½" and Larger (FPCK 2): 175 WWP, iron body, bolted cap, bronze mounted, composition disc, UL listed, with ball drip if required. Stockham G-940. Nibco F-908-W.

3 Flanged Ends 2½" and Larger (FPCK 3): Class 250, iron body, bronze mounted, bolted cap, cast-iron disc. Stockham F-947. Nibco F-968-B. Crane 39E. Milwaukee F2970.

2.6 Ball Valves:

2.6.1 General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

2.6.2 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, chrome-plated ball and reinforced teflon seats. Valves 2" and smaller shall be full port design. Valves 2½" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

2.6.3 Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

2.6.4 Types of ball (FPBA) valves:

1 Threaded Ends 2" and Smaller (FPBA 1): 175 WWP, bronze two-piece body, UL listed for fire protection service. Nibco KT-585-70-UL and KT-580-70-UL.

2 Threaded Ends 2½" and Smaller (FPBA 2): 300 WWP, bronze three-piece body, gear operator with handwheel, indicator flag, accepts tamper switch, for fire protection, UL listed. Nibco KT-505-8 and KG-505-8.

2.7 Butterfly Valves:

2.7.1 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.

2.7.2 Types of butterfly (FPBF) valves:

1 Lug Type 4" and Larger (FPBF 1): 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.

2 Grooved Type 4" and Larger (FPBF 2): 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.

2.8 Valve Features:

2.8.1 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

2.8.2 Valve features specified or required shall comply with the following:

1 Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2 Threaded: Provide valve ends complying with ANSI B1.20.1.

3 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.

4 Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.

5 Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

3 EXECUTION

3.1 Installation:

3.1.1 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.

3.1.2 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.

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:

3.2.1 Pipe Size 2" and Smaller: Threaded valves.

3.2.2 Pipe Size 2½" 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

SECTION 21 05 29 - SUPPORTS, ANCHORS, AND SEALS

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-21 Basic Materials and Methods section, and is a part of each Division-21 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-21 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:

1.5.1 Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

1.5.2 Select and apply pipe hangers and supports, complying with MSS SP-69.

1.5.3 Fabricate and install pipe hangers and supports, complying with MSS SP-89.

1.5.4 Terminology used in this section is defined in MSS SP-90.

1.6 UL Compliance: Provide products which are Underwriters Laboratories listed.

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. Select size of hangers and supports to exactly fit pipe size.

2.2.1 Adjustable Steel Clevises: MSS Type 1.

2.2.2 Steel Double Bolt Pipe Clamps: MSS Type 3.

2.2.3 Adjustable Steel Band Hangers: MSS Type 7.

2.2.4 Steel Pipe Clamps: MSS Type 4.

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.

2.3.1 Two-Bolt Riser Clamps: MSS Type 8.

2.3.2 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.

2.4.1 Steel Turnbuckles: MSS Type 13.

2.4.2 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.

2.5.1 Center Beam Clamps: MSS Type 21.

2.5.2 C-Clamps: MSS Type 23.

2.5.3 Malleable Beam Clamps: MSS Type 30.

2.5.4 Side Beam Brackets: MSS Type 34.

2.5.5 Concrete Inserts: MSS Type 18.

2.6 Miscellaneous Materials:

2.6.1 Metal Framing: Provide products complying with NEMA STD ML 1.

2.6.2 Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

2.6.3 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.

2.6.4 Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

3 EXECUTION

3.1 Preparation

3.1.1 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.

3.1.2 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:

3.2.1 Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete

with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.3 Installation of Hangers and Supports:

3.3.1 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 NFPA standards. 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.

3.3.2 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.3.3 Paint all black steel hangers with black enamel. Galvanized steel hangers do not require paint.

3.3.4 Provision for Movement:

3.3.4.1 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.

3.3.4.2 Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.3.5 Support fire protection piping independently of other piping.

3.4 Equipment Bases:

3.4.1 Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Prime and paint with black enamel.

END OF SECTION

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SECTION 21 05 53 - FIRE PROTECTION IDENTIFICATION

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-21 Basic Fire Protection Materials and Methods section, and is part of each Division-21 section making reference to or requiring identification devices specified herein.

1.3 Extent of fire protection identification work required by this section is indicated on drawings and/or specified in other Division-21 sections.

1.4 Refer to Division-26 sections for identification requirements of electrical work; 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.

2 PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-21 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 Plastic Pipe Markers

2.2.1 Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

2.2.1.1 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.

2.2.1.2 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:

2.3.1 Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" diameter tags, except as otherwise indicated.

2.3.2 Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" square black tags with white lettering, except as otherwise indicated.

2.4 Engraved Plastic-Laminate Signs:

2.4.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2.4.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; ⅛" for larger units.

2.4.3 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.

3 EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require 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 Piping System Identification:

3.2.1 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:

3.2.1.1 Plastic pipe markers.

3.2.2 Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

3.2.2.1 Near each valve and control device.

3.2.2.2 Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.

3.2.2.3 At access doors and similar access points which permit view of concealed piping.

3.2.2.4 Near major equipment items and other points of origination and termination.

3.2.2.5 Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.2.2.6 On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.2.3 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.

Fire protection piping - Red

3.3 Valve Identification: Provide coded valve tag on every valve, cock and control device in each piping system; exclude check valves and valves within factory-fabricated equipment units. Coordinate code with operating instructions.

3.4 Valve Charts: Provide framed, glass covered valve charts in each mechanical room. Identify coded valve number, valve function, and valve location for each valve.

3.5 Fire Protection Equipment Identification: Install engraved plastic laminate sign on or near each major item of fire protection equipment and each operational device. Label shall indicate type of system and area served. For concealed devices, sign shall be affixed in an exposed location to allow UF personnel to determine the location of the device without removing the concealing material. If several small devices are located on one concealed unit, only the main unit need be identified with an exposed tag. Provide signs for the following general categories of equipment and operational devices:

3.5.1 Main control and operating valves, including safety devices.

3.6 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all

major equipment items such as motors, pumps, 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.

3.7 Adjusting and Cleaning:

3.7.1 Adjusting: Relocate any fire protection identification device which has become visually blocked by work of this division or other divisions.

3.7.2 Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

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SECTION 21 11 00 - PIPES AND PIPE FITTINGS

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-21 Basic Fire protection Materials and Methods section, and is part of each Division-21 section making reference to pipes and pipe fittings specified herein.

1.3 Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-21 sections.

1.4 Codes and Standards:

1.4.1 Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

1.5 Test Report and Verification Submittals:

1.5.1 Submit welding certification for all welding installers prior to commencing work.

2 PRODUCTS

2.1 Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. All piping provided for a particular system shall be by the same manufacturer.

2.2 Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.3 Piping Materials/Products:

2.3.1 Pipe Thread Tape: Teflon tape.

2.3.2 Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast iron flanges; raised-face for steel flanges, unless otherwise noted.

2.3.3 Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials. Materials shall be determined by installer to comply with installation requirements.

2.4 Steel Pipes and Pipe Fittings

2.4.1 Pipes:

2.4.1.1 Black or Galvanized Steel Pipe: ASTM A53, ASTM A795, ASTM 135.

2.4.1.2 All pipe shall be manufactured in the United States and labeled accordingly.

2.4.2 Pipe Fittings:

2.4.2.1 Threaded Malleable Iron: ANSI B16.3; plain or galvanized as indicated.

2.4.2.2 Malleable Iron Threaded Unions: ANSI B16.39; selected by installer for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

2.4.2.3 Threaded Pipe Plugs: ANSI B16.14.

2.4.2.4 Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing.

2.4.2.5 Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns, rated to match connected pipe.

2.4.2.6 Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than schedule 80 pipe where length remaining unthreaded is less than 1 ½ inches, and where pipe size is less than 1 ½ inches, and do not thread nipples full length (no close-nipples).

3 EXECUTION

3.1 Installation

3.1.1 General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings, not bushings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.1.2 Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building.

3.1.3 Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.

3.1.3.1 Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

3.2 Piping System Joints: Provide joints of the type indicated in each piping system.

3.2.1 Thread pipe in accordance with ANSI B1.20.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.

3.2.2 Flanged Joints: Match flanges within piping system, and at connection with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets. Bolts shall project 1/8" to 3/8" beyond nut face when tight.

3.2.3 Weld pipe joints in accordance with recognized industry practice and as follows. Be guided by ANSI B.31.

3.2.3.1 Weld pipe joints only when ambient temperature is above 0°F.

3.2.3.2 Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag,

metal particles and dirt.

3.2.3.3 Use pipe clamps or tack-weld joints; 4 welds for pipe sizes to 10". All welds shall be open-butt.

3.2.3.4 Build up welds with root pass, followed by filler pass and then a cover pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

3.2.3.5 Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

3.2.3.6 At Installer's option, install forged branch-connection fittings wherever branch pipe is less than 3" and at least two pipe sizes smaller than main pipe indicated; or install regular "T" fitting. Weld-O-Let or equal.

3.2.3.7 Limit the use of welded piping to shop-fabricated only. Neither welding nor cutting with oxygen-acetylene methods will be permitted within the envelope of the hospital building.

3.3 Underground Piping:

3.3.1 Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18" above piping.

3.3.2 Coat the following underground (uninsulated) pipes with a heavy coat of bitumastic or provide an 8 mil polyvinyl sleeve: black steel pipe, galvanized steel pipe.

END OF SECTION

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SECTION 21 11 11 - SITE FIRE WATER SYSTEMS

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-21 Basic Fire Protection Requirements and Basic Fire Protection Materials and Methods sections apply to work of this section.

1.3 Extent of fire water systems work is indicated on drawings and schedules, and by requirements of this section. All piping and devices from (and including) the post indicator valve to the floor flange shall be provided by a licensed sprinkler contractor.

1.4 Refer to Division-3 sections for concrete work (thrust blocks) required for fire water systems which is work of this section.

1.5 Refer to other Division-21 sections for interior building systems including sprinklers and standpipes; not work of this section.

1.6 Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire water system's products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.7 Codes and Standards:

1.7.1 NFPA Compliance: Install fire water systems in accordance with NFPA 24 "Standard for the Installation of Private Fire Service Mains and Their Appurtenances".

1.7.2 Local Fire Department/Marshal Regulations: Comply with governing regulations pertaining to hydrants, including hose unit threading and similar matching of connections.

1.7.3 Local Utility: Comply with local utility regulations.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data and installation instructions for:

1.8.1.1 Gate valves.

1.8.1.2 Indicator posts.

1.8.1.3 Backflow preventers.

1.8.1.4 Tapping sleeves and valves.

1.8.2 Working (Shop) Drawings: Submit working (shop) drawings for fire water systems, showing piping materials, size, locations, and elevations. Include details of underground structures, connections, thrust blocks, and anchors. Show interface and spatial relationship between piping and proximate structures. Submittal shall show all requirements per NFPA-13. P.E. seal is not required.

1.9 Test Reports and Verification Submittals:

1.9.1 Certificate: Submit Certificate of Underground Installation per NFPA 13.

1.9.2 Submit backflow preventer test report.

1.10 O&M Data Submittals:

1.10.1 Record Drawings: At project closeout, submit record drawings of installed fire water system piping and products.

1.10.2 Maintenance Data: Submit a copy of approval submittals. Submit maintenance data and parts lists for gate valves, indicator posts, backflow preventers. Include these data in O&M Manual.

2 PRODUCTS

2.1 Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide blue tape with black printing reading "CAUTION WATER LINE BURIED BELOW".

2.2 Pipes and Pipe Fittings:

2.2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 24 where applicable. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire water piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2.2 Piping: Provide pipes of one of the following materials, of weight/class indicated. Provide pipe fittings and accessories of same materials and weight/class as pipes, with joining method as indicated.

2.2.2.1 Ductile-Iron Pipe: AWWA C151, with cement mortar lining complying with AWWA C104; Class 51 unless otherwise indicated.

Fittings: Ductile-iron complying with AWWA C110, cement lined, with rubber gaskets conforming to AWWA C111.

2.3 Valves:

2.3.1 Gate Valves: Provide gate valves, UL-listed, 175 psi working pressure for 12" and smaller. Provide threaded, flanged, hub, or other end configuration to suit size of valve and piping connection. Provide inside screw type for use with indicator post, iron body bronze mounted, non-rising stem, solid wedge disc.

Acceptable Manufacturers: Subject to compliance with requirements, provide gate valves of one of the following:

American-Darling Valve
Clow Corp.; Valve Div.
Kennedy Valve
Mueller
Nibco
Stockham Valves & Fittings Inc.
United States Pipe and Foundry Co.
Waterous Co.

2.3.2 Indicator Posts: Provide indicator posts, UL-listed, designed for use with underground gate valves to provide aboveground means for operating valves and indicating position of valves. Provide telescopic barrel type with indicating target, intended for use with gate valves 4" through 14", with operating wrench.

Acceptable Manufacturers: Subject to compliance with requirements, provide indicator posts of one of the following:

American-Darling Valve

Clow Corp.; Valve Div.
Kennedy Valve
Mueller
Nibco
Stockham Valves & Fittings Inc.
United States Pipe and Foundry Co.
Waterous Co.

2.3.3 Backflow Preventers: Provide backflow preventer with inlet and outlet OS&Y gate valves of the following type.

Double check type

Acceptable Manufacturers: Subject to acceptance by the local utility, provide backflow preventers of one of the following:

Watts
Hersey
Febco
Wilkins

2.3.4 Tapping Sleeves and Valves:

2.3.4.1 General: All tapping sleeves shall have a test plug. The tapping or drilling machine shall have the following: automatic feed indicator to show the exact position of the drill, automatic overtravel protection, automatic disengagement protection, and shell cutters that are undersized ½".

2.3.4.2 Sleeves:

PVC (any size) and iron pipe 12" and smaller: Use stainless steel full circle tapping sleeve with 304 stainless steel lugs, nuts, bolts and washers. Bolt spacing shall not exceed 3".

2.3.4.3 Valves: Use a double disc tapping valve or a wedge type tapping valve. Subject to compliance with requirements, the following are acceptable: Clow F6103 (2" and 3" only), Clow F6114, American Darling 865, Waterous Series 500 TV, and Mueller H-687.

2.4 Accessories:

2.4.1 Anchorages: Provide anchorages for tees, wyes, crosses, plugs, caps, bends, valves, and hydrants. After installation, apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of ferrous anchorages.

2.4.2 Clamps, Straps, and Washers: Steel, ASTM A 506.

2.4.3 Rods: Steel, ASTM A 575.

2.4.4 Rod Couplings: Malleable-iron, ASTM A 197.

2.4.5 Bolts: Steel, ASTM A 307.

2.4.6 Cast-Iron Washers: Gray-iron, ASTM A 126.

2.4.7 Thrust Blocks: Concrete, 2,500 psi.

3 EXECUTION

3.1 General: During back-filling/top-soiling of underground fire water piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade.

3.2 Installation of Pipe and Pipe Fittings:

3.2.1 Ductile-Iron Pipe: Install in accordance with AWWA C600 "Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances."

3.2.2 Depth of Cover: Provide 48" minimum depth of cover over underground piping and under paved areas.

3.2.3 Anchoring: Install thrust blocks as detailed on the drawings. Provide clamps and tie rods in accordance with NFPA 24 to properly restrain the system.

3.3 Installation of Valves:

3.3.1 General: Install valves as indicated. Provide post indicator for control valves.

3.3.2 Control Valves: Install post indicator valve at each connection into building, locate 40' from building outside wall, or as indicated.

3.3.3 Installation of Backflow Preventers: Install in accordance with manufacturer's printed instructions with adequate space for servicing. Install 12" - 36" AFF with 12" clear in back and 24" clear in front. Provide proper restraints. Provide test and report by State of Florida Certified Backflow Preventer Specialist.

3.3.4 Wet Taps: Install in accordance with manufacturer's printed instructions. Pressure test as required.

3.3.5 Shutoff Valves: Install shutoff valve ahead of each hydrant.

3.4 Notify Engineer, EH&S, and PPD Utilities 48 hours prior to backfilling underground piping. EH&S will notify the State Fire Marshal of the date and time of the inspection. Contact EH&S at 352-392-1591.

3.5 Field Quality Control:

3.5.1 Piping Tests: Conduct piping tests before joints are covered, and after thrust blocks have sufficiently hardened. Fill pipeline with water 24 hours prior to testing, and apply test pressure to stabilize system.

3.5.2 Hydrostatic Tests: Test at not less than 200 psi for 2-hrs, or at 50 psi above maximum static pressure if it is greater than 150 psi. Test fails if leakage exceeds 2-qts per hour per 100 gaskets or joints irrespective of pipe diameter.

Increase pressure in 50 psi increments and inspect each joint between increments. Hold at test pressure for one hour, decrease to 0 psi. Slowly increase again to test pressure and hold for one more hour.

3.5.3 EH&S shall witness all hydrostatic testing of underground piping. Contact EH&S @ 352-392-1591 at least 24 hours in advance of desired date to arrange for witnessing of the test.

3.5.4 Operating Tests: Open and close all valves under system water pressure

3.5.5 Flushing: Flush underground mains and lead-in connections to sprinkler risers before connection is made to sprinklers, standpipes, or other fire protection system piping.

Flush at flow rate not less than that indicated in NFPA 24, or at hydraulically calculated water demand rate of the system, whichever is greater.

3.5.6 O&M Training: Provide four hours in one session.

END OF SECTION

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SECTION 21 11 13 - TESTING AND CLEANING OF FIRE PROTECTION SYSTEMS

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-21 Basic Fire Protection Materials and Methods section, and is part of each Division-21 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.

2 PRESSURE TESTS

2.1 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.

2.2 Required test period is 2 hours.

2.3 No piping 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.

2.4 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.

2.5 Check of systems during application of test pressures should include visual check for water leakage.

2.6 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.

2.7 Pressure Test Requirements:

2.7.1 Fire Sprinkler System: Perform hydrostatic test at 200 psig.

3 CLEANING

3.1 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 before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

3.2 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.

END OF SECTION

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SECTION 21 11 14 - BUILDING SPRINKLER SYSTEMS

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-21 Basic Fire Protection Requirements and Basic Fire Protection Materials and Methods sections apply to work of this section.

1.3 Extent of fire protection work is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-21 sections for site fire protection piping and appurtenances; not work of this section.

1.5 Refer to Division-9 sections for painting of fire protection piping; not work of this section.

1.6 Refer to Division-26 sections for the following work; not work of this section.

1.6.1 Fire alarm connections for all flow switches, pressure switches, and supervisory (tamper) switches.

1.7 Codes and Standards:

1.7.1 NFPA Compliance: Install fire protection systems in accordance with NFPA 13 "Standard for the Installation of Sprinkler Systems".

1.7.2 UL Compliance: Provide fire protection products in accordance with UL standards; provide UL label on each product.

1.7.3 Fire Department/Marshal Compliance: Install fire protection systems in accordance with local regulations of fire department or fire marshal.

1.7.4 Screw Thread Connections: Comply with local Fire Department/Fire Marshal regulations for sizes, threading and arrangement of connections for fire department equipment to sprinkler systems.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data and installation instructions for:

1.8.1.1 Pipe and fittings

1.8.1.2 Basic pipe supports and hangers

1.8.1.3 Basic valves

1.8.1.4 Special valves

1.8.1.5 Pressure gauges

1.8.1.6 Automatic sprinklers

1.8.1.7 Siamese connections

1.8.2 Working (Shop) Drawings: Prepare working (shop) drawings of fire protection systems indicating pipe sizes, pipe locations, pipe elevations, fittings, shutoffs, hangers, equipment, and coordination with other building systems. Submittal shall show all requirements per NFPA-13. P.E. seal is not required.

1.9 Test Reports and Verification Submittals:

1.9.1 Certificate: Submit certificate of Aboveground Installation upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13, and that system is operational, complete, and has no defects.

1.9.2 Tag: Submit a copy of the sprinkler system tag. The installing fire sprinkler contractor shall be licensed in accordance with State Fire Marshal (SFM) Rule 69A-46. At the conclusion of the project and prior to the final inspection by the SFM the Contractor shall tag the fire sprinkler system in accordance with 69A-46.041.

1.10 O&M Data Submittals:

1.10.1 Record Drawings: At project closeout, submit record drawings of installed fire protection piping and products.

1.10.2 Maintenance Data: Submit a copy of all approval submittals. Submit maintenance data and parts lists for basic valves, special valves. Include these data in O&M manual.

1.10.3 NFPA 25: Provide a copy of NFPA 25, 2014 edition in each O&M Manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems. Where more than one type of material or products are indicated, selection is Installer's option.

2.2 Basic Identification: Provide identification complying with Division-21 Basic Fire protection Materials and Methods section "Fire protection Identification", in accordance with the following listing:

Fire Protection Piping: Plastic pipe markers. Fire piping exposed in mechanical and electrical rooms shall be painted red.

Fire Protection Valves: Plastic or brass valve tags

Fire Protection Signs: Provide the following signs:

At each sprinkler valve, sign indicating what portion of system valve controls and hydraulic design data.

At each outside alarm device, sign indicating what authority to call if device is activated.

At each auxiliary drain, a sign indicating location.

2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings complying with Division-21 Basic Fire protection Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing. Where multiple listings are made for a particular type system, the material is the Installer’s option.

2.3.1 Wet Pipe: Seamless or welded black steel pipe; Schedule 40. Fittings and joints shall be as follows.

1 Class 125, cast-iron threaded fittings with threaded joints.

2 Mechanical grooved pipe coupling and fittings; cut-groove type with mechanical joints.

3 Wrought steel buttwelding fittings with welded joints.

2.3.2 Wet Pipe: Seamless or welded black steel pipe; Schedule 10 for 5" and smaller; 0.134" wall thickness for 6"; and 0.188" wall thickness for 8" and 10".

1 Class 125, cast-iron threaded fittings with threaded joints, sizes 2½" and larger.

2 Mechanical grooved pipe couplings and fittings; roll-groove mechanical locking type with mechanical joints.

3 Wrought steel buttwelding fittings with welded joints.

2.3.4 Wet Pipe: CPVC specifically manufactured and UL-listed for fire protection service. Use in accordance with its listing.

2.4 Basic Piping Specialties: Provide piping specialties complying with Division-21 Basic Fire protection Materials and Methods section "Piping Specialties".

2.5 Basic Supports and Anchors: Provide supports and anchors complying with Division-21 Basic Fire protection Materials and Methods section "Supports and Anchors", in accordance with the following listing:

Adjustable steel clevis hangers or adjustable steel band hangers for horizontal-piping hangers and supports.

Two-bolt riser clamps for vertical piping supports.

Steel turnbuckles and malleable iron sockets for hanger-rod attachments.

Concrete inserts, top-beam C-clamps, side beam or channel clamps or center beam clamps for building attachments.

2.6 Basic Valves: Provide interior valves complying with Division-21 Basic Fire protection Materials and Methods section "Valves", in accordance with the following listing:

2.6.1 Standard Service Code-Required OS&Y Valves: FPGA2.

2.6.2 Standard Service Sectional Valves: FPBF1, FPBF2.

2.6.3 Standard Service Indicating Valves: FPBA2.

2.6.4 Standard Service Trim Valves: FPBA1.

2.6.5 Standard Service Check Valves: FPCK-1, FPCK-2.

2.7 Special Valves:

2.7.1 General: Provide valves, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

2.7.2 Alarm Check Valve: Provide cast-iron water flow alarm check valve, 175 psi working pressure, with retard chamber.

2.7.3 Hose Outlet Valves: Provide angle hose valves, 2-1/2" size where not otherwise indicated. Provide chrome plated with escutcheons where mounted in cabinet. Provide chain and cap.

2.7.4 Ball Drip Check Valve: Provide fire department connection iron swing check valve, 175 psi rated working pressure, of size and end type indicated, with ball drip.

2.7.5 Acceptable Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

Reliable
Viking Corporation

2.8 Basic Meters and Gauges: Provide meters and gauges complying with Division-21 Basic Fire protection Materials and Methods section "Meters and Gauges", in accordance with the following listing:

2.8.1 Pressure gauges, 0-250 psi range, UL Listed. Pressure gauge should be stamped with a manufacturer date of current year.

2.9 Fire Protection Specialties: Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

2.9.1 Water Flow Indicators: Provide vane type water flow switches. Provide adjustable retard if allowed by code. Do not use adjustable retard for flow switches serving elevator equipment rooms or hoistways.

2.9.2 Electric Bell: Provide 10" weatherproof bell with red enameled finish, 90 db.

2.9.3 Supervisory Switches: Provide products recommended by manufacturer for use in service indicated.

2.9.4 Acceptable Manufacturers: Subject to compliance with requirements, provide fire protection specialties of one of the following:

Reliable
Viking corporation

2.10 Automatic Sprinklers: Provide automatic sprinklers and escutcheons of type indicated on drawings. Provide fusible links for 165°F unless otherwise indicated. Sprinkler shall be stamped by manufacturer for current year.

2.10.1 Finish: White Chrome-plated for recessed heads in occupied areas. Chrome-plated for pendant heads in occupied areas. Cast brass for unoccupied areas.

2.10.2 Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store 10 sprinklers and wrench sized to sprinklers.

2.10.3 Acceptable Manufacturers: Subject to compliance with requirements, provide automatic sprinklers of one of the following:

Reliable
Viking Corp.

2.11 Siamese Connections:

2.11.1 Wall Type Siamese Connections: Provide wall type cast brass siamese connections and escutcheon plate assembly, with 2, 2-1/2" fire department inlets with female hose connections, fire hose connection screw thread (size and threads approved in writing by fire department), equipped with individual drop clapper valves, equipped with caps and chains, construction features as indicated, and constructed with the following additional construction features:

Finish: Chrome plate.

Inlet Pipe: As shown on the drawings.

Cast Lettering: "AUTO. SPKR."

Escutcheon: Rectangular.

Siamese Connection: Flush, adjacent inlets.

Basis of Design: Potter Roemer Figure 5020.

2.11.2 Acceptable Manufacturers: Subject to compliance with requirements, provide siamese connections of one of the following:

Allen (W.D.) Mfg. Div.
Croker-Standard
Elkhart Brass Mfg. Co., Inc.
Potter-Roemer Co.

3 EXECUTION

3.1 General: Examine areas and conditions under which fire protection materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer. Any installation, modification, or alteration of the sprinkler system shall be performed only by a person under a certificate of competency issued by the State Fire Marshal.

3.2 Installation of Basic Identification: Install fire protection identification in accordance with Division-21 Basic Fire Protection Materials and Methods section "Fire Protection Identification." Install fire protection signs on piping in accordance with NFPA 13 requirements. Continuously paint exposed fire piping red in mechanical and electrical rooms.

3.3 Installation of Pipes and Pipe Fittings:

3.3.1 General: Install pipes and pipe fittings in accordance with Division-21 Basic Fire Protection Materials and Methods section "Pipes and Pipe Fittings."

3.3.2 Comply with requirements of NFPA 13 for installation of fire protection piping materials. Install piping products where indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that piping systems comply with requirements and serve intended purposes.

3.3.3 Coordinate with other work as necessary to interface components of fire protection piping properly with other work.

3.3.4 Install drain piping at low points of piping system. Provide dry drum drips where indicated.

3.3.5 Install sectional valves in inlet piping, at bottom of each riser, and in loops as indicated.

3.3.6 Install fire department connection valves in piping where fire department connections are indicated.

3.3.7 Install water flow indicators where indicated.

3.3.8 Mount supervisory switches on each sectional valve.

3.3.9 Install manual shutoff at each audible alarm station.

3.3.10 Install valved hose connections of sizes indicated, or ¾" size if not otherwise indicated, on sprinkler at ends of branch lines and cross mains and at locations where indicated. The intent is to meet

the requirements of NFPA 13 and to achieve a fully drainable system.

3.3.11 Install Inspector's test connection where indicated, or at most remote point from riser.

3.4 Installation of Piping Specialties: Install piping specialties in accordance with Division-21 Basic Fire Protection Materials and Methods section "Piping Specialties."

3.5 Installation of Supports and Anchors: Install supports and anchors, in accordance with Division-21 Basic Fire Protection Materials and Methods section, "Supports and Anchors."

3.6 Installation of Valves: Install valves in accordance with Division-21 Basic Materials and Methods section "Valves." Provide valves to isolate each riser and elsewhere as required by NFPA 13.

3.7 Installation of Meters and Gauges: Install meters and gauges in accordance with Division-21 Basic Fire Protection Materials and Methods section "Meters and Gauges."

3.8 Installation of Fire Protection Specialties: Install fire protection specialties as indicated, and in accordance with NFPA 13. Furnish wiring requirements to electrical Installer for electrical wiring of supervisory switches.

3.9 Field Quality Control:

3.9.1 Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.9.2 Hydrostatic Testing: After flushing system, test fire sprinkler piping hydrostatically, for period of 2 hours, at not less than 200 psi or at 50 psi in excess of maximum static pressure when maximum static pressure is in excess of 150 psi. Check system for leakage of joints. Measure hydrostatic pressure at low point of each system or zone being tested.

3.9.3 Repair or replace piping system as required to eliminate leakage in accordance with NFPA standards for "little or no leakage" and retest as specified to demonstrate compliance.

3.9.4 EH&S shall witness all hydrostatic testing of the above ground sprinkler piping. Contact EH&S @ 352-392-1591 at least 24 hours in advance of desired test date to arrange for witnessing of the test.

3.10 Cleaning and Inspecting: Clean and inspect fire protection systems in accordance with requirements of Division-21 Basic Fire protection Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems".

3.11 Extra Stock:

3.11.1 Heads: For each style and temperature range required, furnish at least two additional sprinkler heads, in accordance with NFPA 13 and NFPA 25, and not less than 6 sprinklers.

3.11.2 Wrenches: Furnish 2 spanner wrenches for each type and size of valve connection and fire hose coupling. Obtain receipt from Owner that extra stock has been received.

3.12 Owner Instruction: Provide technical services for one 4-hour period to instruct Owner’s personnel in operation and maintenance of building sprinkler systems. Schedule training date with Owner. Provide at least 7-day notice to Engineer and Owner of training date.

END OF SECTION

SECTION 21 30 00/HYDRAULIC CALCULATIONS

1 GENERAL

1.1 The hydraulic calculations for the fire protection system are included in this section for review by the Authority Having Jurisdiction.

1.2 Nothing in this section shall be used by any Contractor in preparing his bid or in performing the work.

1.3 Hydraulic nodes are indicated on the drawings with a hexagonal symbol.

2 PRODUCTS - N/A

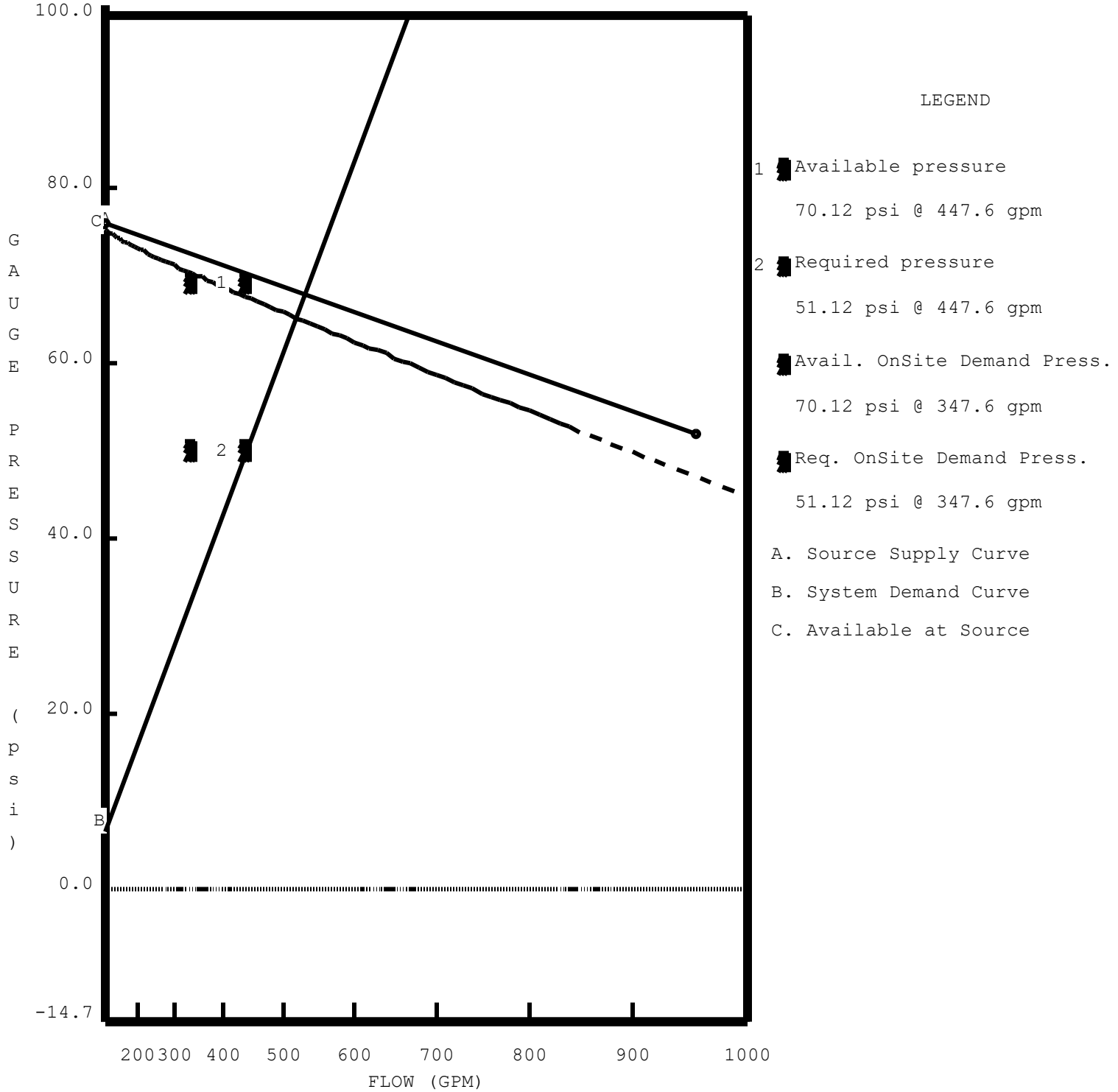
3 EXECUTION - N/A

4 Appendix A:

DATE: 11/3/2020LUEBERRY BLDG\2 DESIGN\ENGINEERING\P FP\CALCS\AREA 2FF.SDF
JOB TITLE: IFAS Blueberry Research facility

WATER SUPPLY ANALYSIS

Static: 76.00 psi Resid: 52.00 psi Flow: 957.0 gpm



Note: (1) Dashed Lines indicate extrapolated values from Test Results

(2) On Site pressures are based on hose stream deduction at the source

DATE: 11/3/2020LUEBERRY BLDG\2 DESIGN\ENGINEERING\P FP\CALCS\AREA 2FF.SDF
JOB TITLE: IFAS Blueberry Research facility

NFPA WATER SUPPLY DATA

SOURCE NODE TAG	STATIC PRESS. (PSI)	RESID. PRESS. @ (PSI)	FLOW (GPM)	AVAIL. PRESS. @ (PSI)	TOTAL DEMAND (GPM)	REQ'D PRESS. (PSI)
SOURCE	76.0	52.0	957.0	70.1	447.6	51.1

AGGREGATE FLOW ANALYSIS:

TOTAL FLOW AT SOURCE	447.6 GPM
TOTAL HOSE STREAM ALLOWANCE AT SOURCE	100.0 GPM
OTHER HOSE STREAM ALLOWANCES	0.0 GPM
TOTAL DISCHARGE FROM ACTIVE SPRINKLERS	347.6 GPM

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
101	9.3	K= 5.60	13.4	20.5	
102	9.3	K= 5.60	14.0	21.0	
103	9.3	K= 5.60	16.6	22.8	
104	9.3	K= 5.60	13.4	20.5	
105	9.3	K= 5.60	14.4	21.2	
106	9.3	K= 5.60	14.0	21.0	
107	9.3	K= 5.60	14.7	21.4	
108	9.3	K= 5.60	17.1	23.2	
109	11.3	K= 5.60	13.8	20.8	
110	11.3	K= 5.60	15.0	21.7	
111	11.3	K= 5.60	15.7	22.2	
112	11.3	K= 5.60	12.3	19.6	
113	11.3	K= 5.60	13.3	20.4	
114	9.3	K= 5.60	19.2	24.6	
115	9.3	K= 5.60	17.0	23.1	
116	9.3	K= 5.60	17.9	23.7	
40	12.8	- - - -	13.4	- - -	
37	12.8	- - - -	14.5	- - -	
34	12.8	- - - -	17.4	- - -	
21	12.8	- - - -	20.6	- - -	
44	12.8	- - - -	12.6	- - -	
43	12.8	- - - -	13.7	- - -	
23	12.8	- - - -	21.4	- - -	
50	12.8	- - - -	13.7	- - -	
47	12.8	- - - -	14.8	- - -	
45	12.8	- - - -	17.5	- - -	
25	12.8	- - - -	20.9	- - -	
55	12.8	- - - -	13.7	- - -	
54	12.8	- - - -	15.3	- - -	
52	12.8	- - - -	17.4	- - -	
27	12.8	- - - -	20.6	- - -	
57	12.8	- - - -	12.1	- - -	
56	12.8	- - - -	13.5	- - -	
29	12.8	- - - -	20.0	- - -	

DATE: 11/3/2020LUEBERRY BLDG\2 DESIGN\ENGINEERING\P FP\CALCS\AREA 2FF.SDF
JOB TITLE: IFAS Blueberry Research facility

NODE ANALYSIS DATA

NODE TAG	ELEVATION (FT)	NODE TYPE	PRESSURE (PSI)	DISCHARGE (GPM)	NOTES
60	12.8	- - - -	18.6	- - -	
20	12.8	- - - -	21.9	- - -	
24	12.8	- - - -	21.2	- - -	
26	12.8	- - - -	20.8	- - -	
28	12.8	- - - -	20.6	- - -	
30	12.8	- - - -	19.9	- - -	
31	12.8	- - - -	19.7	- - -	
32	12.8	- - - -	19.0	- - -	
33	12.8	- - - -	18.9	- - -	
11	12.8	- - - -	34.9	- - -	
10	12.8	- - - -	35.8	- - -	
9	7.3	- - - -	38.8	- - -	
8	6.3	- - - -	40.0	- - -	
7	2.0	- - - -	42.1	- - -	
6	2.0	- - - -	47.1	- - -	
5	0.9	- - - -	47.6	- - -	
4	0.9	- - - -	47.6	- - -	
3	12.0	- - - -	42.9	- - -	
2	-4.0	- - - -	50.2	- - -	
1	-4.0	- - - -	50.9	- - -	
SOURCE	-4.0	SOURCE	51.1	347.6	

NFPA PIPE DATA

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 1		5.60	20.5	Disch			4.77	120	-0.0	
40	12.8	13.4	0.0		1.000	3E: 6.0	6.00		-1.5	
101	9.3	13.4	20.5		1.049		10.77	0.136	1.5	
Pipe: 2		5.60	21.0	Disch			4.77	120	0.5	
37	12.8	14.5	0.0		1.000	2E: 4.0	9.00		-1.5	
102	9.3	14.0	21.0		1.049	T: 5.0	13.77	0.142	2.0	
Pipe: 3		5.60	22.8	Disch			4.77	120	0.8	
34	12.8	17.4	0.0		1.000	2E: 4.0	9.00		-1.5	
103	9.3	16.6	22.8		1.049	T: 5.0	13.77	0.166	2.3	
Pipe: 4		0.0	0.0				8.00	120	1.1	
37	12.8	14.5	20.5		1.000	----	0.00		-0.0	
40	12.8	13.4	20.5		1.049		8.00	0.136	1.1	
Pipe: 5		0.0	20.5	40			5.83	120	2.9	
34	12.8	17.4	21.0	102	1.000	----	0.00		-0.0	
37	12.8	14.5	41.5		1.049		5.83	0.502	2.9	
Pipe: 6		0.0	41.5	37			4.83	120	3.2	
21	12.8	20.6	22.8	103	1.250	T: 6.0	6.00		-0.0	
34	12.8	17.4	64.3		1.380		10.83	0.297	3.2	
Pipe: 7		0.0	0.0				4.17	120	1.2	
20	12.8	21.9	64.3	34	1.250	----	0.00		-0.0	
21	12.8	20.6	64.3		1.380		4.17	0.297	1.2	
Pipe: 8		5.60	23.7	Disch			5.08	120	0.7	
60	12.8	18.6	0.0		1.000	E: 2.0	7.00		-1.5	
116	9.3	17.9	23.7		1.049	T: 5.0	12.08	0.178	2.2	
Pipe: 9		0.0	0.0				1.50	120	0.4	
33	12.8	18.9	23.7		1.250	T: 6.0	6.00		-0.0	
60	12.8	18.6	23.7		1.380		7.50	0.047	0.4	
Pipe: 10		0.0	0.0				1.75	120	0.1	
32	12.8	19.0	23.7	60	1.250	----	0.00		-0.0	
33	12.8	18.9	23.7		1.380		1.75	0.047	0.1	
Pipe: 11		5.60	23.1	Disch			13.75	120	2.0	
32	12.8	19.0	0.0		1.000	E: 2.0	7.00		-1.5	
115	9.3	17.0	23.1		1.049	T: 5.0	20.75	0.170	3.5	
Pipe: 12		0.0	23.7	33			8.67	120	0.7	
31	12.8	19.7	23.1	115	1.500	----	0.00		-0.0	
32	12.8	19.0	46.8		1.610		8.67	0.078	0.7	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 13		0.0	0.0				2.17	120	0.2	
30	12.8	19.9	46.8	32	1.500	----	0.00		-0.0	
31	12.8	19.7	46.8		1.610		2.17	0.078	0.2	
Pipe: 14		5.60	24.6	Disch			4.17	120	0.6	
30	12.8	19.9	0.0		1.000	E: 2.0	7.00		-1.5	
114	9.3	19.2	24.6		1.049	T: 5.0	11.17	0.190	2.1	
Pipe: 15		0.0	46.8	31			2.25	120	0.1	
29	12.8	20.0	24.6	114	2.000	----	0.00		-0.0	
30	12.8	19.9	71.4		2.067		2.25	0.050	0.1	
Pipe: 16		5.60	19.6	Disch			1.42	120	-0.2	
57	12.8	12.1	0.0		1.000	E: 2.0	2.00		-0.6	
112	11.3	12.3	19.6		1.049		3.42	0.125	0.4	
Pipe: 17		5.60	20.4	Disch			1.42	120	0.3	
56	12.8	13.5	0.0		1.000	T: 5.0	5.00		-0.6	
113	11.3	13.3	20.4		1.049		6.42	0.135	0.9	
Pipe: 18		0.0	0.0				11.50	120	1.4	
56	12.8	13.5	19.6		1.000	----	0.00		-0.0	
57	12.8	12.1	19.6		1.049		11.50	0.125	1.4	
Pipe: 19		0.0	19.6	57			8.83	120	6.5	
29	12.8	20.0	20.4	113	1.000	T: 5.0	5.00		-0.0	
56	12.8	13.5	40.0		1.049		13.83	0.469	6.5	
Pipe: 20		0.0	40.0	56			4.92	120	0.6	
28	12.8	20.6	71.4	30	2.000	----	0.00		-0.0	
29	12.8	20.0	111.3		2.067		4.92	0.115	0.6	
Pipe: 21		0.0	0.0				4.92	120	0.1	
27	12.8	20.6	111.3	29	3.000	----	0.00		-0.0	
28	12.8	20.6	111.3		3.068		4.92	0.017	0.1	
Pipe: 22		5.60	20.8	Disch			1.42	120	-0.1	
55	12.8	13.7	0.0		1.000	E: 2.0	2.00		-0.6	
109	11.3	13.8	20.8		1.049		3.42	0.140	0.5	
Pipe: 23		5.60	21.7	Disch			1.42	120	0.4	
54	12.8	15.3	0.0		1.000	T: 5.0	5.00		-0.6	
110	11.3	15.0	21.7		1.049		6.42	0.151	1.0	
Pipe: 24		5.60	22.2	Disch			7.50	120	1.7	
52	12.8	17.4	0.0		1.000	E: 2.0	7.00		-0.6	
111	11.3	15.7	22.2		1.049	T: 5.0	14.50	0.158	2.3	
Pipe: 25		0.0	0.0				11.42	120	1.6	
54	12.8	15.3	20.8		1.000	----	0.00		-0.0	
55	12.8	13.7	20.8		1.049		11.42	0.140	1.6	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 26		0.0	20.8	55			3.92	120	2.1	
52	12.8	17.4	21.7	110	1.000	----	0.00		-0.0	
54	12.8	15.3	42.5		1.049		3.92	0.524	2.1	
Pipe: 27		0.0	42.5	54			4.92	120	3.3	
27	12.8	20.6	22.2	111	1.250	T: 6.0	6.00		-0.0	
52	12.8	17.4	64.7		1.380		10.92	0.300	3.3	
Pipe: 28		5.60	21.0	Disch			4.00	120	-0.3	
50	12.8	13.7	0.0		1.000	2E: 4.0	4.00		-1.5	
106	9.3	14.0	21.0		1.049		8.00	0.142	1.1	
Pipe: 29		5.60	21.4	Disch			4.00	120	0.1	
47	12.8	14.8	0.0		1.000	E: 2.0	7.00		-1.5	
107	9.3	14.7	21.4		1.049	T: 5.0	11.00	0.148	1.6	
Pipe: 30		5.60	23.2	Disch			4.00	120	0.4	
45	12.8	17.5	0.0		1.000	E: 2.0	7.00		-1.5	
108	9.3	17.1	23.2		1.049	T: 5.0	11.00	0.171	1.9	
Pipe: 31		0.0	0.0				7.92	120	1.1	
47	12.8	14.8	21.0		1.000	----	0.00		-0.0	
50	12.8	13.7	21.0		1.049		7.92	0.142	1.1	
Pipe: 32		0.0	21.0	50			5.25	120	2.7	
45	12.8	17.5	21.4	107	1.000	----	0.00		-0.0	
47	12.8	14.8	42.4		1.049		5.25	0.523	2.7	
Pipe: 33		0.0	42.4	47			4.92	120	3.4	
25	12.8	20.9	23.2	108	1.250	T: 6.0	6.00		-0.0	
45	12.8	17.5	65.6		1.380		10.92	0.308	3.4	
Pipe: 34		5.60	20.5	Disch			3.42	120	-0.7	
44	12.8	12.6	0.0		1.000	E: 2.0	2.00		-1.5	
104	9.3	13.4	20.5		1.049		5.42	0.136	0.7	
Pipe: 35		5.60	21.2	Disch			3.42	120	-0.7	
43	12.8	13.7	0.0		1.000	E: 2.0	2.00		-1.5	
105	9.3	14.4	21.2		1.049		5.42	0.145	0.8	
Pipe: 36		0.0	0.0				7.83	120	1.1	
43	12.8	13.7	20.5		1.000	----	0.00		-0.0	
44	12.8	12.6	20.5		1.049		7.83	0.136	1.1	
Pipe: 37		0.0	20.5	44			10.25	120	7.7	
23	12.8	21.4	21.2	105	1.000	T: 5.0	5.00		-0.0	
43	12.8	13.7	41.7		1.049		15.25	0.506	7.7	
Pipe: 38		0.0	64.7	52			4.08	120	0.2	
26	12.8	20.8	111.3	28	3.000	----	0.00		-0.0	
27	12.8	20.6	176.0		3.068		4.08	0.039	0.2	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) (Pe) (Pf)	Notes
Pipe: 39		0.0	0.0				2.92	120	0.1	
25	12.8	20.9	176.0	27	3.000	----	0.00		-0.0	
26	12.8	20.8	176.0		3.068		2.92	0.039	0.1	
Pipe: 40		0.0	176.0	26			4.67	120	0.3	
24	12.8	21.2	65.6	45	3.000	----	0.00		-0.0	
25	12.8	20.9	241.6		3.068		4.67	0.070	0.3	
Pipe: 41		0.0	0.0				2.17	120	0.2	
23	12.8	21.4	241.6	25	3.000	----	0.00		-0.0	
24	12.8	21.2	241.6		3.068		2.17	0.070	0.2	
Pipe: 42		0.0	241.6	24			5.17	120	0.5	
20	12.8	21.9	41.7	43	3.000	----	0.00		-0.0	
23	12.8	21.4	283.3		3.068		5.17	0.094	0.5	
Pipe: 43		0.0	283.3	23			94.67	120	13.0	
11	12.8	34.9	64.3	21	3.000	----	0.00		-0.0	
20	12.8	21.9	347.6		3.068		94.67	0.138	13.0	
Pipe: 44		0.0	0.0				5.83	120	0.9	
10	12.8	35.8	347.6	20	4.000	T:20.0	20.00		-0.0	
11	12.8	34.9	347.6		4.026		25.83	0.037	0.9	
Pipe: 45		0.0	0.0				5.42	120	2.9	
9	7.3	38.8	347.6	11	4.000	E:10.0	10.00		2.3	
10	12.8	35.8	347.6		4.026		15.42	0.037	0.6	
Pipe: 46		0.0	0.0				1.00	120	1.3	
8	6.3	40.0	347.6	10	4.000	C:22.0	22.00		0.4	
9	7.3	38.8	347.6		4.026		23.00	0.037	0.8	
Pipe: 47		0.0	0.0				4.33	120	2.0	
7	2.0	42.1	347.6	9	4.000	----	0.00		1.9	
8	6.3	40.0	347.6		4.026		4.33	0.037	0.2	
Pipe: 48			0.0	Fixed Pressure Loss Device						
6	2.0	47.1	347.6	8	5.0 psi, 347.6 gpm					
7	2.0	42.1	347.6							
Pipe: 49		0.0	0.0				1.08	120	0.5	
5	0.9	47.6	347.6	7	6.000	E:14.0	14.00		0.5	
6	2.0	47.1	347.6		6.065		15.08	0.005	0.1	
Pipe: 50		0.0	0.0				1.92	120	0.0	
4	0.9	47.6	347.6	6	6.000	----	0.00		-0.0	
5	0.9	47.6	347.6		6.065		1.92	0.005	0.0	
Pipe: 51		0.0	0.0				11.08	120	-4.7	
3	12.0	42.9	347.6	5	6.000	E:14.0	14.00		-4.8	
4	0.9	47.6	347.6		6.065		25.08	0.005	0.1	

Pipe Tag / Frm Node / To Node	El (ft)	K-fac / PT	Add Fl (q) / Tot.(Q)	Add Fl To Node/ Disch	Nom ID / Act ID	Fit: Eq.Ln. (ft.)	L / F / T	C / Pf/ft.	(Pt) / (Pe) / (Pf)	Notes
Pipe: 52		0.0	0.0				56.75	140	7.3	
2	-4.0	50.2	347.6	4	D6.000	2E:44.0	44.00		6.9	
3	12.0	42.9	347.6		6.280		100.75	0.003	0.3	
Pipe: 53		0.0	0.0				77.33	140	0.7	
1	-4.0	50.9	347.6	3	D6.000	6E132.0	132.00		-0.0	
2	-4.0	50.2	347.6		6.280		209.33	0.003	0.7	
Pipe: 54		Source	0.0				34.33	140	0.3	
SOURCE	-4.0	51.1	347.6	2	D6.000	2E:44.0	49.00		-0.0	
1	-4.0	50.9	347.6		6.280	G: 5.0	83.33	0.003	0.3	

NOTES (HASS):

(1) Calculations were performed by the HASS 2020 D computer program
in accordance with NFPA13 (2016)
under license no. 64622029 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.003 gpm and a maximum
imbalance at any node of 0.157 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 15.8 ft/sec at pipe 26.

(4) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(5) Available pressure at source node SOURCE under full flow conditions is
0.00 psi with a flow of 0.00 gpm.

(6) PIPE FITTINGS TABLE

HASS Pipe Table Name: standard.pip

DATE: 11/3/2020LUEBERRY BLDG\2 DESIGN\ENGINEERING\P FP\CALCS\AREA 2FF.SDF
JOB TITLE: IFAS Blueberry Research facility

PAGE: A MATERIAL: S40 HWC: 120

Diameter (in)	Equivalent Fitting Lengths in Feet								
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	A AlmChk	D DPVlv	N NTee
	F F45Ell								
1.049	2.00 1.00	5.00	2.00	5.00	6.00	1.00	10.00	2.00	5.00
1.380	3.00 1.50	6.00	2.00	7.00	6.00	1.00	10.00	10.00	6.00
1.610	4.00 2.00	8.00	2.00	9.00	6.00	1.00	10.00	10.00	8.00
2.067	5.00 2.50	10.00	3.00	11.00	6.00	1.00	10.00	10.00	10.00
3.068	7.00 3.50	15.00	5.00	16.00	10.00	1.00	13.00	13.00	15.00
4.026	10.00 5.00	20.00	6.00	22.00	12.00	2.00	20.00	20.00	20.00
6.065	14.00 7.00	30.00	9.00	32.00	10.00	3.00	28.00	28.00	30.00

PAGE: D MATERIAL: DIRON HWC: 140

Diameter (in)	Equivalent Fitting Lengths in Feet							
	E Ell	T Tee	L LngEll	C ChkVlv	B BfyVlv	G GatVlv	N NPTee	F F45Ell
6.280	22.00	47.00	14.00	51.00	16.00	5.00	47.00	11.00

END OF SECTION

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SECTION 21 99 15 - ACCESS DOORS

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-21 Basic Fire Protection Materials and Methods section, and is part of each Division-21 section making reference to or requiring access panels specified herein.

1.3 Approval Submittals:

1.3.1 Product Data: When required by other Division-21 sections, submit product data for access doors. Submit with Division-21 section using access doors, not as a separate submittal. Include rating data.

1.4 O&M Data Submittals: Submit a copy of approval submittal. Include this data in O&M Manuals.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Milcor, Jay R. Smith, Zurn, BOICO, Elmdor, or approved equal.

2.2 General: Where floors, walls and ceilings must be penetrated for access to fire protection work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

2.3 Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gauge frames and 14-gauge flush panel doors; 175° swing with concealed spring hinges; flush screw-driver-operated cam locks; factory-applied rust-inhibitive prime-coat paint finish.

2.4 Locks: Where indicated, provide flat pass key type individually keyed unless otherwise indicated, 2 keys.

2.5 Fire Rated Access Doors: Where required furnish with 20-gauge insulated sandwich panel, automatic closing mechanism, cylinder type lock (self-latching with inside release mechanism), and continuous concealed steel hinge pin. Access doors shall carry the UL 1-½ hour "B" label.

3 EXECUTION

3.1 Access doors shall be installed to operate and service all fire protection equipment including valves, and other items requiring maintenance that are concealed above or behind finished construction. Access doors shall be installed in walls, chase and floors as necessary, but are not required in accessible suspended ceiling systems. Access doors shall have factory applied protective phosphate coating and baked enamel primer suitable for field painting.

3.2 Access doors shall be installed by the Division installing the substrate construction. However, responsibility for furnishing and determining location of access doors is part of this Division's work. The style of access door shall be suitable for construction into which installed.

3.3 Access doors shall be sized and located as required to provide proper maintenance and service access in accordance with the manufacturer's recommendations and code authority requirements for all devices and equipment.

END OF SECTION

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SECTION 22 00 00 - PLUMBING GENERAL

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 plumbing work as herein called for and shown on the drawings.

1.2 Related Documents:

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

1.2.2 This is a Basic Plumbing Requirements Section. Provisions of this section apply to work of all Division 22 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
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1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale plumbing drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed

within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on plumbing drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Approval Submittals:

1.9.1 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.

1.9.2 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 and the following.

1.9.2.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.9.2.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.9.2.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.9.2.4 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.

1.9.2.5 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 cover sheet.

1.9.2.6 Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number 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.

1.9.2.7 The electrical design shown on the drawings supports the plumbing equipment basis of design specifications at the time 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, breaker 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 change 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.

1.9.2.8 Submittals shall be in searchable PDF format and not a scanned copy.

1.9.2.9 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.9.3 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.

1.9.4 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.

1.9.5 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 ¼" 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. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 The label of the approving agency, such as UL, IBR, ASME by which a standard has been established for the particular item shall be in full view.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.4 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.

2.3.5 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.

2.3.6 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:

2.3.6.1 Principal of operation.

2.3.6.2 Materials of construction or finishes.

2.3.6.3 Thickness of gauge of materials.

2.3.6.4 Weight of item.

2.3.6.5 Deleted features or items.

2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 The Contractor shall be responsible for full coordination of the plumbing systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any additional steel supports required for the installation of any plumbing equipment or piping shall be furnished and installed under the section of the specifications requiring the additional supports.

3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves 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.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for

servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

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, 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: Contractor shall provide 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 foundations, 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 22. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. 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 and leave premises free from debris and in a 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 Record (As Built) Drawings:

3.11.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

3.11.2 Upon completion of the work, record drawings shall be prepared as described in the General Conditions, Supplementary Conditions, and Division 1.

3.11.3 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model

with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.12 Acceptance:

3.12.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.12.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.12.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.12.3.1 Submit training syllabi prior to training for owner review.

3.12.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.12.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.12.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and organized and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.12.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.12.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.12.4.1.2 Complete wiring and control diagrams.

3.12.4.1.3 Routine maintenance operations.

3.12.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.12.4.1.5 Copies of final approved version of Approval Submittals.

3.12.4.1.6 Copies of all manufacturer's warranties.

3.12.4.1.7 Copies of Test Reports and Verification Submittals.

3.12.4.2 All included information shall comply with the following:

3.12.4.2.1 Remove all non-related information from O&Ms.

3.12.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.12.5 Record Drawings: Submit "Record Drawings".

3.12.6 Control Diagrams: Laminate and mount on equipment room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses Engineering

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Plumbing

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 2/12/17

SECTION: 22 13 13/ Soil, Waste and Vent System

Use whatever standard headings you want here

1. Cleanouts

2. Floor Drains

3. Oil Separators

4. Grease Traps

5. Etc.

List each item separately

Typical - list mfr name & model number

General Contractor's <u>APPROVAL</u> stamp must be on this sheet.

END OF SECTION

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SECTION 22 00 10 - CODES AND STANDARDS

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 plumbing work as herein called for and shown on the drawings.

1.2 This is a Basic Plumbing Requirements section. Provisions of this section apply to work of all Division 22 sections.

2 CODES

2.1 All work under Division 22 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 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.

2.3 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.

2.4 Additional codes or standards applying to a specific part of the work may be included in that section.

2.5 The following codes govern the work:

2.5.1 Florida Building Code - Building - Seventh Edition (2020).

2.5.2 Florida Building Code - Plumbing - Seventh Edition (2020).

2.5.3 Florida Building Code - Fuel Gas - Seventh Edition (2020).

2.5.4 National Electric Code (NFPA 70) - 2017.

2.5.5 Florida Fire Prevention Code - Seventh Edition (2020).

2.5.5.1 Uniform Fire Code (NFPA 1) - 2018 Florida Edition.

2.5.5.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

3 STANDARDS

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

3.1.1 Underwriters' Laboratories (UL)

3.1.2 American National Standards Institution (ANSI)

3.1.3 American Society of Testing Materials (ASTM)

3.1.4 National Electrical Manufacturers Association (NEMA)

END OF SECTION

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SECTION 22 05 00 - PLUMBING RELATED WORK

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 Plumbing Requirements section. Provisions of this section apply to work of all Division 22 sections.

1.3 Coordinate all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 33 - SITE WORK

2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 22 05 05.

2.2 Refer to Division 33, Sitework for:

2.2.1 All water, sewer, and storm water piping greater than five feet from the building.

2.2.2 Manholes and catch-basins.

3 DIVISION 3 - CONCRETE

3.1 Refer to Division 3, Concrete for:

3.1.1 Rough grouting in and around plumbing work.

3.1.2 Patching concrete cut to accommodate plumbing work.

3.2 The following is part of Division 22 work, complying with the requirements of Division.3

3.2.1 Curbs, foundations and pads for plumbing equipment.

3.2.2 Basins, sumps, and vaults of plumbing work.

3.2.3 Inertia bases.

4 DIVISION 4 - MASONRY

4.1 Refer to Division 4, Masonry for:

4.1.1 Installation of access doors in walls.

5 DIVISION 5 - METALS

5.1 Refer to Division 5, Metals for:

5.1.1 Framing openings for plumbing equipment.

5.2 The following is part of Division 22 work.

5.2.1 Supports for plumbing work.

6 DIVISION 6 - WOOD AND PLASTIC

6.1 Refer to Division 6, Wood for:

6.1.1 Framing openings for plumbing equipment

7 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

7.1.1 Installation of all roof curbs and roof supports for plumbing work.

7.1.2 Caulking and waterproofing of all wall and roof mounted plumbing work.

7.1.3 Providing all roof curbs and all vent flashing for metal roofs.

7.2 The following is part of Division 22 work, complying with the requirements of Division 7.

7.2.1 Fire barrier penetration seals.

8 DIVISION 9 - FINISHES

8.1 Refer to Division 9, Finishes for:

8.1.1 Painting exposed piping and equipment.

8.1.2 Painting structural metal and concrete for plumbing work.

8.1.3 Painting access panels.

8.1.4 Painting color-coded plumbing work indicated for continuous painting. See color schedule in Division 22 section, "Plumbing Identification".

8.1.5 Installation of access doors in gypsum drywall.

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

8.3 Perform the following as part of Division 22 work:

8.3.1 Touch up painting of factory finishes.

8.3.2 Painting of all hangers.

9 DIVISION 11 - EQUIPMENT

9.1 Refer to Division 11 - Equipment for all laboratory equipment including cabinets, casework, student stations, demonstration desks, safety stations, eyewashes, and all related fixtures, fittings, and trim.

9.2 Provide the following as part of Division 22 work:

9.2.1 All trim not furnished by Division 11 including drains, wastes, continuous wastes, tailpieces, traps and similar devices necessary to make fixtures operational. Provide rough-in for all fixtures. Provide final connections for all fixtures.

9.2.2 Provide all fixtures specified in Section 22 40 00.

10 DIVISION 26 - ELECTRICAL

10.1 Contractor 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 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.

10.2 Contractor shall provide disconnect switches, starters, and contactors for plumbing equipment under Division 26 unless specifically noted as being furnished as part of plumbing equipment.

10.3 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.

END OF SECTION

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SECTION 22 05 05 - EXCAVATION & BACKFILL

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to or requiring excavation and backfill specified herein.

1.3 Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are not known. Use extreme caution when excavating. Contact Physical Plant Division for more information on utility location.

1.4 Refer to other Division-22 sections and/or drawings for specific requirements of the particular piping system being installed. Where another Division-22 section or the drawings conflict with requirements of this section, the other Division-22 section or the drawings shall take precedence over the general requirements herein.

1.5 OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements. Contractor shall also erect barriers, provide shoring and maintain excavations as required to protect the public and adjacent traffic.

1.6 Trench Safety Act: Contractor shall comply with all requirements of Florida Statutes Chapter 553, including the requirement to provide a separate line item to identify the cost to comply on a per lineal foot of trench and per square foot of shoring. Comply with UF Trenching and Excavation Safety Policy. Refer to www.ehs.ufl.edu/general/trench02.pdf.

1.7 Dig Permit: A Dig Permit must be obtained from the University of Florida Physical Plant prior to any excavation. In case of conflicts between this specification and the Dig Permit requirements, the most stringent will govern.

2 PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand.

2.2 Gravel: Clean, well graded hard stone or gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Fill free of clay, muck, stones, wood, roots or rubbish.

2.4 Identification Tape: Polyethylene 6 inches wide, 3.5 mil solid core encased in a 1 mil thick protective plastic jacket continuously printed with "CAUTION" in large black letters and type of pipe below. Tape shall conform to APWA specifications.

2.5 Copper Identification Wire: 14-gauge, single conductor, type UF.

3 EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever there is a possibility of encountering obstacles or any existing utility lines of any nature whatsoever. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavators within the limits of the building lines.

3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, muck, or roots, subcut

and bring bed up to proper elevation with clean, new sand (as described in paragraph 2.1), deposited in 6" layers and tamped. Notify Architect/Engineer if subcut exceeds 12", or if bed is of an unstable nature. In this case a 6" minimum layer of gravel will be required before sand bedding begins. Submit cost proposal if the earth conditions require subcut in excess of 12" or if gravel is required to achieve proper bedding.

3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping. Pipe which is handled with insulation in place, coated pipe, and jacketed pipe shall have special handling slings as required to prevent damage to the material.

3.4 Backfilling: Deposit clean new sand (as described in paragraph 2.1) to 6" above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support, especially on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.

3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. De-watering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.

3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and18" to 30" above buried pipe. Tape copper wire to non-metallic pipes.

3.7 Depth of Cover: Minimum cover for underground piping is 48 inches unless indicated otherwise.

3.8 Existing Pavement: Where new piping passes below existing streets, driveways, parking lots, or other paved areas, the pavement shall be saw cut. Backfill shall be compacted to 95% density and the pavement shall be patched to match existing pavement. Provide compaction tests and reports as required.

3.9 Landscape Restoration:

3.9.1 Lawn or Unpaved Areas: The soil shall be replaced according to the original profile. Compact the top 6" of subgrade and each 6" layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

If additional soil is required, the Contractor shall supply weed free topsoil of a type to match existing topsoil.

3.9.2 Grass: Fine grade and solid sod with the type of grass to match the existing species and cultivar.

3.9.3 Landscape Maintenance: Contractor shall be responsible for watering and other grounds maintenance in the area of construction until the project is accepted.

3.9.4 UF: If there are any questions regarding type of grass or landscape restoration in general, Contractor should contact one of the campus landscape architects by calling 392-1155 or 392-1118.

END OF SECTION

SECTION 22 05 10 - ELECTRIC MOTORS

1 GENERAL

1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Section apply to work of this Section.

1.2 This section is a Division 22 Basic Plumbing Materials and Methods section, and is part of each Division 22 section making reference to motors specified herein.

1.3 Extent of motors required by this section is indicated on drawings and/or specified in other Division-22 sections.

1.4 Comply with the requirements of Division 26.

1.5 UL Compliance: Comply with applicable UL standards pertaining to motors.

1.6 Approval Submittals:

1.6.1 Product Data: When required by other Division-22 sections, submit manufacturers standard product data sheets for each type of motor provided. Submit with Division-22 section using the motors, not as a separate submittal. Mark data sheet with arrows indicating product being supplied and list by unique descriptive name all motors to which each data sheet applies. Clearly indicate type, service factor, rpm, duty cycle, voltage, phase, nominal full load efficiency, power factor and insulation class. Field verify and coordinate mounting and frame requirements for matching the drive.

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit operation and maintenance data for each type of motor. Include these data in O&M Manual. Submit two copies of nameplate data sheet for each motor. One copy shall be included with the O&M Manual and a second copy shall be inserted in a waterproof pouch or bag and attached to the motor. Nameplate data sheets shall be typed or neatly printed and shall include all data on the motor nameplate plus a unique motor description such as "AHU-3 Fan Motor", "Distribution Pump #1" or similar description.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, General Electric, Baldor, US Electric, or approved equal.

2.2 General:

2.2.1 Motors shall conform to applicable portions of NEMA Standard MG-1, Motors and Generators.

2.2.2 Motors shall be sized for the application such that when the driven equipment is operated at rated capacity the motor current will not exceed the full-load nameplate current. Service factor shall not be used in normal operation.

2.3 Motor Design:

2.3.1 Integral Horsepower Motors:

2.3.1.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 22 section requiring motors. Provide cast-iron frame and mounting feet.

2.3.1.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200 volts for 208 volt systems, 230 volts for 240 volt systems and 460 volts for 480 volt systems.

2.3.1.3 Motors shall be NEMA Design B and shall have 1.15 service factor or greater at 60 hertz.

2.3.1.4 Insulation Systems

2.3.1.4.1 In fixed speed applications, motors shall have Class B insulation with 80°C rise over 40°C ambient.

2.3.1.4.2 For variable frequency drive (VFD) applications, motors shall have Class F insulation with 105°C rise over 40°C ambient. Motor manufacturer shall identify motors being used for VFD applications by marking the motor with a stainless steel name-plate “Inverter Duty”. Motors shall be provided with one set of thermostatic sensors.

2.3.1.5 Motor efficiencies shall be based on IEEE-112, 1984, Test Method B, as specified in NEMA Standard MG1-12.53. NEMA motor efficiency and power factor shall be clearly shown on the motor nameplate. Inverter duty motors shall have a CIV rating based on NEMA.

2.3.1.6 Motors shall be premium efficiency type and shall meet or exceed the following minimum nominal efficiencies at rated voltage. Motors must be labeled “PREMIUM EFFICIENCY” Standard efficiency motors meeting the indicated minimum efficiencies are not acceptable.

230/460 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	78.0 pct.
1.5 hp	86.5 pct.	78.0 pct.
2 hp	86.5 pct.	83.0 pct.
3 hp to 5 hp	89.5 pct.	80.0 pct.
7.5 hp	91.7 pct.	81.0 pct.
10 hp	91.7 pct.	82.0 pct.
15 hp	92.4 pct.	82.0 pct.
20 hp	93.0 pct.	86.0 pct.
25 hp	93.6 pct.	84.0 pct.
30 hp	93.6 pct.	83.0 pct.
40 hp	94.1 pct.	86.0 pct.
50 hp	94.5 pct.	87.0 pct.
60 hp	95.0 pct.	86.0 pct.
75 hp	95.4 pct.	87.0 pct.
100 hp	95.4 pct.	90.0 pct.
125 hp	95.8 pct.	88.0 pct.
150 hp	96.2 pct.	86.0 pct.
200 hp	96.2 pct.	87.0 pct.
Over 200 hp	96.2 pct.	87.0 pct.

200 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	78.0 pct.
1.5 hp	86.5 pct.	78.0 pct.
2 hp	86.5 pct.	83.0 pct.
3 hp to 5 hp	89.5 pct.	80.0 pct.
7.5 hp	91.7 pct.	81.0 pct.

10 hp	91.7 pct.	82.0 pct.
15 hp	92.4 pct.	82.0 pct.
20 hp	93.0 pct.	86.0 pct.
25 hp	93.6 pct.	84.0 pct.

2.3.1.7 Motors 25 hp and larger which are to be installed outdoors or in other high humidity areas shall be equipped with silicone rubber space heaters. Space heaters shall be energized when motor is de-energized.

2.3.1.8 Shaft Grounding: Provide shaft grounding brushes to prevent electrical bearing damage equal to Aegis SGR by Electro Static Technology.

2.3.2 Fractional Horsepower Motors one-half hp and above:

2.3.2.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 22 section requiring motors.

2.3.2.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200, 230 or 460 volts as shown on the drawings.

2.3.2.3 Motors shall be NEMA Design B with class B insulation, unless used with variable frequency drives.

2.3.3 Fractional Horsepower Motors less than one-half hp:

2.3.3.1 Motors shall be single phase, 60 hertz, rated at 120 volts with integral thermal protection.

2.4 Overload Protection: Properly sized overload protection shall be provided for each motor. This protection may be an integral part of the motor or may be part of the motor controller and shall interrupt each ungrounded conductor.

3 EXECUTION

3.1 Motor Size and Location:

3.1.1 Size and location of motors shown on the drawings are based on a particular design and may change with a different manufacturer. Submittal of shop drawings or product literature indicating motor sizes or locations different from that designed indicates that Contractor has fully coordinated any required changes to the electrical system with other trades. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

3.1.2 Contractor shall verify and make any necessary adjustments to electrical service, branch circuit wiring, branch circuit protection, overload protection, disconnect and controller (starter), or VFD based on actual nameplate data of the motors supplied prior to installation. Where applicable, connect motor winding thermostat to VFD.

3.2 Motor Voltages: Contractor shall field verify system voltage prior to ordering or installing any motors. Submittal of shop drawings or product literature indicating motor voltages indicates that Contractor has fully coordinated the motor with the electrical system and that any discrepancies have been resolved. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

3.3 Motor Mounting: Adjust motor mounting as required to adjust the drive train for proper belt operation and to accommodate sheave changes or other requirements of the test and balance work.

END OF SECTION

SECTION 22 05 12 - FUSES 600 VOLTS AND BELOW

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-22 Basic Plumbing Materials and Methods Sections apply to work of this Section.

1.3 Approval Submittals:

1.3.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

2 PRODUCTS

2.1 Acceptable Producers: Buss, Farraz Shamut, Littlefuse, Siemens.

2.2 General: Products listed herein are common to various Mechanical Specification Sections for this project and as shown on this project's Drawings.

2.3 All fuses furnished for a particular item of equipment shall be by the same producer.

2.4 Voltage Rating:

2.4.1 Provide 600 volt fuses for 277/480 volt systems.

2.4.2 Provide 250 volt fuses for 120, 208 and 240 volt systems.

2.5 Ampere Ratings: Ampere ratings of fuses shall be as required by the equipment manufacturer.

2.6 Interrupting Ratings: Interrupting ratings of fuses shall be as required by the equipment manufacturer.

2.7 Current Limitation: Current limiting fuses shall be provided where required by the equipment manufacturer.

2.8 Rejection Fuse Clips: Provide fuse with rejection feature for switches required to have the rejection feature as required by the equipment manufacturer.

3 EXECUTION

3.1 Coordinate fuse type and ampacity with fuse holder.

3.2 Provide one set of spare fuses for each item of equipment requiring fuses. Spare fusing shall be provided within weatherproof containers for long-term storage. Spray paint container with the wording “Spare Fuses” and “Name of Equipment” on the side.

END OF SECTION

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SECTION 22 05 19 - PIPING SPECIALTIES

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to or requiring piping specialties specified herein.

1.3 Approval Submittals:

1.3.1 Product Data: Submit product data with installation instructions and UL listing for:

1.3.1.1 Fire barrier sealants.

2 PRODUCTS

2.1 General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 Escutcheons:

2.2.1 General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

2.2.2 Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

2.2.3 Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 Dielectric Waterways: Provide standard products recommended by manufacturer Victaulic Style 47 dielectric waterways for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action and stop corrosion. Dielectric unions are not acceptable.

2.4 Fire Barrier Penetration Seals:

2.4.1 Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for plumbing components such as piping or ductwork in accordance with the requirements of Division 7.

2.4.2 Cracks, Voids, or Holes Up to 4" Diameter: Use putty or calking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

2.4.3 Openings 4" or Greater: Use sealing system capable of passing 3-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.

2.5 Fabricated Piping Specialties:

2.5.1 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 ¼" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

2.5.2 Pipe Sleeves: Provide pipe sleeves of one of the following:

2.5.2.1 Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.

2.5.2.2 Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

2.5.2.3 Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.5.3 Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

2.5.3.1 Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

2.6 Low Pressure Y-Type Pipeline Strainers:

2.6.1 General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide Type 304 stainless steel screens.

2.6.1.1 Water Strainers: Select for 200 psi working pressure (water, oil or gas). Provide 20 mesh screens through 2" size and 1/16" perforations for 2½" size and larger.

2.6.2 Select from the following types:

2.6.2.1 Soldered Ends, 2" and Smaller: Bronze body, screwed screen retainer with centered blowdown fitted with pipe plug.

2.6.2.2 Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

2.6.2.3 Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

2.6.2.4 Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

3 EXECUTION

3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

3.2 Dielectric Waterways: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.3 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.

3.4 Drip Pans: Locate drip pans under piping passing over or within 3' 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.

3.5 Pipe Sleeves: Install pipe sleeves of types 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 2 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 ¼" above level floor finish, and ¾" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

3.5.1 Install sleeves in fire-rated assemblies in accordance with the listing of the assembly and the fire barrier sealant.

3.5.2 Install sheet-metal sleeves at interior partitions and ceilings other than suspended ceilings. Fill annular space with caulking or fire barrier sealant as required.

3.5.3 Install steel-pipe sleeves at floor penetrations. Fill annular space with caulking or fire barrier sealant as required.

3.5.4 Install iron-pipe sleeves at all foundation wall penetrations and at exterior penetrations; both above and below grade. Fill annular space with caulking or mechanical sleeve seals.

3.6 Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers ¾" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.

3.7 Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:

Pumps
Pressure reducing valves.
Backflow preventers.

END OF SECTION

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SECTION 22 05 20 - METERS AND GAUGES

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to or requiring meters and gauges specified herein.

1.3 Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-22 sections.

1.4 UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

1.5 ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.6 Approval Submittals:

1.6.1 Product Data: When required by other Division-22 sections, submit manufacturer's technical product data for each type of meter and gauge. Submit with Division-22 section using meters and gauges, not as a separate submittal. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit for:

1.6.1.1 Thermometers

1.6.1.2 Pressure gauges

1.6.1.3 Gauge connector plugs

1.6.1.4 Calibrated balance valves

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit calibration curves and operating instructions for each type of meter or gauge. Include this data in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers (Thermometers and Pressure Gauges): Subject to compliance with requirements, Ashcroft, Ernst Gauge Company, Weksler, Marshalltown Instruments, Trerice, Weiss Instruments, Wheatley, Fluidyne or approved equal.

2.2 Glass Thermometers:

2.2.1 General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2.2.2 Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9" long.

2.2.3 Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

2.2.4 Tube and Capillary: Mercury filled, magnifying lens, 1% scale range accuracy, shock mounted.

2.2.5 Scale: Satin faced, non-reflective aluminum, permanently etched markings.

2.2.6 Stem: Copper-plated steel or brass for separable socket, length to suit installation.

2.2.7 Range: Conform to the following:

2.2.7.1 Hot Water: 30°- 240°F with 2°F scale divisions.

2.3 Thermometer Wells: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well. Same manufacturer as thermometers.

2.4 Pressure Gauges:

2.4.1 General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2.4.2 Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

2.4.3 Case: Drawn steel or brass, glass lens, 4-½" diameter.

2.4.4 Connector: Brass with ¼" male NPT.

2.4.5 Scale: White coated aluminum with black scale.

2.4.6 Range: Select so that highest possible pressure does not exceed 75% of full scale.

2.5 Pressure Gauge Cocks:

2.5.1 General: Provide ¼" ball valves for use as pressure gauge cocks.

2.5.2 Snubber: ¼" brass bushing with corrosion resistance porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.6 Calibrated Balance Valves:

2.6.1 General: Provide as indicated, lead-free calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Equip each readout valve with 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 seals to prevent leakage around rotating element. Provide balance valves with preformed polyurethane insulation suitable for use on heating and cooling systems.

2.6.2 Acceptable Manufacturers: Bell and Gossett, Taco, Nibco.

3 EXECUTION

3.1 Installation Of Temperature Gauges:

3.1.1 General: Install temperature gauges in vertical upright position, and tilt so as to be easily read by observer standing on floor.

3.1.2 Locations: Install in the following locations, and elsewhere as indicated:

3.1.2.1 At inlet and outlet of each thermal storage tank.

3.1.3 Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Thermometers shall have at least 75% of stem in moving fluid.

3.2 Installation of Pressure Gauges:

3.2.1 General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

3.2.2 Locations: Install in the following locations, and elsewhere as indicated:

3.2.2.1 At suction and discharge of each pump.

3.2.2.2 At discharge of each water pressure reducing valve.

3.2.3 Pressure Gauge Cocks: Install in piping tee with snubber.

3.3 Installation of Flow Measuring Meters:

3.3.1 General: Install flow measuring meters on piping systems located in accessible locations at most readable position.

3.3.2 Locations: Install in domestic hot water return piping where shown on the drawings.

3.3.3 Calibrated Balance Valves: Install on piping with readout valves in vertical upright position. Maintain minimum length of straight unrestricted piping equivalent to three pipe diameters upstream of valve.

3.4 Adjusting And Cleaning:

3.4.1 Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

3.4.2 Cleaning: 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.

END OF SECTION

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SECTION 22 05 23 - VALVES

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-22 Basic Materials and Methods section, and is part of each Division-22 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-22 sections.

1.4 Quality Assurance:

1.4.1 Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.

1.4.2 Valve Types: Provide valves of same type by same manufacturer.

1.5 Approval Submittals: When required by other Division-22 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-22 section using the valves, not as a separate submittal. For each valve, identify systems where the valve is intended for use.

1.5.1 Check Valves. Type PCK.

1.5.2 Ball Valves. Type PBA.

1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data and spare parts lists for each type of valve. Include this data in the O&M Manual.

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.

2.4 Check Valves:

2.4.1 Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40º to 45º, 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.

2.4.2 Comply with the following standards:

Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.
Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.
Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

2.4.3 Types of check (CK) valves:

1 Threaded Ends 2" and Smaller (PCK1): 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 (PCK2): Class 125, bronze body, screwed cap, horizontal swing, bronze disc. Stockham B-309. Nibco S-413-B. Crane 1707S. Milwaukee 1509.

3 Flanged Ends 2½" and Larger (PCK3): 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.

2.5 Ball Valves:

2.5.1 General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

2.5.2 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, chrome-plated ball and reinforced teflon seats. Valves 2" and smaller shall be full port design. Valves 2½" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

2.5.3 Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

2.5.4 Types of ball (BA) valves:

1 Threaded Ends 2" and Smaller (PBA1):Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70-66. Apollo 77-140.

2 Soldered Ends 2" and Smaller (PBA2): Bronze two-piece full port body with adjustable stem packing. Nibco S-585-70-66. Apollo 77-240.

3 Threaded Ends 1" and Smaller (PBA3): Bronze two-piece full port body, UL listed (UL 842) for use with flammable liquids and LP gas. Nibco T-585-70-66-UL.

2.6 Valve Features:

2.6.1 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

2.6.2 Valve features specified or required shall comply with the following:

1 Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2 Threaded: Provide valve ends complying with ANSI B1.20.1.

3 Solder-Joint: Provide valve ends complying with ANSI B16.18.

4 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.

5 Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance

with manufacturer's published literature.

6 Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

7 Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

3 EXECUTION

3.1 Installation:

3.1.1 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.

3.1.2 Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

3.1.3 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.

3.1.4 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:

3.2.1 Tube Size 2" and Smaller: Threaded valves. Soldered-joint valves may also be used.

3.2.2 Pipe Size 2" and Smaller: Threaded valves.

3.2.3 Pipe Size 2½" 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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SECTION 22 05 29 - SUPPORTS, ANCHORS, AND SEALS

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-22 Basic Materials and Methods section, and is a part of each Division-22 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-22 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:

1.5.1 Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

1.5.2 Select and apply pipe hangers and supports, complying with MSS SP-69.

1.5.3 Fabricate and install pipe hangers and supports, complying with MSS SP-89.

1.5.4 Terminology used in this section is defined in MSS SP-90.

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.

2.2.1 Adjustable Steel Clevises: MSS Type 1.

2.2.2 Steel Double Bolt Pipe Clamps: MSS Type 3.

2.2.3 Adjustable Steel Band Hangers: MSS Type 7.

2.2.4 Steel Pipe Clamps: MSS Type 4.

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.

2.3.1 Two-Bolt Riser Clamps: MSS Type 8.

2.3.2 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.

2.4.1 Steel Turnbuckles: MSS Type 13.

2.4.2 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.

2.5.1 Center Beam Clamps: MSS Type 21.

2.5.2 C-Clamps: MSS Type 23.

2.5.3 Malleable Beam Clamps: MSS Type 30.

2.5.4 Side Beam Brackets: MSS Type 34.

2.5.5 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.

2.6.1 Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6.2 Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation matching adjoining insulation.

2.7 Miscellaneous Materials:

2.7.1 Metal Framing: Provide products complying with NEMA STD ML 1.

2.7.2 Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

2.7.3 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.

2.7.4 Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

3 EXECUTION

3.1 Preparation

3.1.1 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.

3.1.2 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:

3.2.1 Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.3 Installation of Hangers and Supports:

3.3.1 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, Florida Building Code-Plumbing, 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.

3.3.1.1 Horizontal steel pipe and copper tube 1 ½" diameter and smaller: support on 6 foot centers.

3.3.1.2 Horizontal steel pipe and copper tube over 1 ½" diameter: support on 10 foot centers.

3.3.1.3 Vertical steel pipe and copper tube: support at each floor.

3.3.1.4 PVC pipe: support in accordance with manufacturer's recommendations, but not less than 4 foot centers.

3.3.1.5 CPVC pipe: support in accordance with manufacturer’s recommendations, but not less than 3 foot centers for pipe 1" or smaller and not less than 4 foot centers for larger piping.

3.3.1.6 Horizontal cast iron pipe inside building: support each length of pipe (at the joint).

3.3.1.7 Vertical cast iron pipe: support at each floor and at the base.

3.3.2 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.3.3 Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.

3.3.4 Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.3.5 Provision for Movement:

3.3.5.1 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.

3.3.5.2 Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.3.5.3 Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum

pipe deflections allowed by ANSI B31 are not exceeded.

3.3.5.4 Sway Bracing: Provide rigid support sway bracing for all changes in direction greater than 45 degrees on piping 4" and larger.

3.3.6 Insulated Piping: Comply with the following installation requirements.

3.3.6.1 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:

3.4.1 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.

3.4.2 Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

3.5 Equipment Bases:

3.5.1 Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 22. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.5.2 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

SECTION 22 05 48 - VIBRATION ISOLATION

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to vibration isolation equipment.

1.3 Extent of vibration isolation required by this section is indicated on drawings and/or specified in other Division-22 sections.

1.4 Approval Submittals: When required by other Division-22 sections, submit product data sheets for each type of vibration isolation equipment including configuration and rating data. Submit with Division-22 section using vibration isolation, not as a separate submittal. Provide calculations showing supported weight, deflection, and isolator size and type for each item of supported equipment. Submit for:

1.4.1 Equipment Mountings. Type EM.

1.4.2 Hangers. Type HA.

1.4.3 Pipe Flexible Connections. Type PF.

1.5 O&M Data Submittals: Submit a copy of approval submittals for each type of vibration isolation equipment. Include this data in O&M Manual.

2 PRODUCTS

2.1 General: Provide factory-fabricated products recommended by manufacturer for use in service indicated. Provide products of types and deflections indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes which properly fit with equipment. All metal parts installed outside shall be hot dipped galvanized after fabrication.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide vibration isolation equipment of: Mason Industries, Keflex, Consolidated Kinetics, Vibration Mountings & Controls, Wheatley or approved equal. All vibration isolators shall be supplied by a single approved manufacturer.

2.4 Hangers:

2.4.1 Select hangers with the required deflection. Provide all required hanger rods and fasteners.

2.4.2 Types of hangers (HA):

1 Hangers (HA1): Vibration hangers shall contain a steel spring set in a neoprene cup manufactured with a grommet to prevent short-circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower-hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30.

2 Hangers (HA2): Vibration hangers shall contain a laterally stable steel spring and 0.3" deflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large

enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30N.

2.5 Pipe Flexible Connections:

2.5.1 Select pipe flexible connections suitable for duty indicated with ends to match piping system.

2.5.2 Types of pipe flexible connections (PF):

1 Pump Connections (PF1): Provide EPDM and dacron or neoprene and nylon flexible connectors rated at 200 psi and 250ºF. 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.

2 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.

3 Bronze Flexible Hoses (PF5): Provide 300 psi working pressure flexible hoses with corrugated bronze hose body and braided cover. Basis of Design: Mason Industries BBF with sweat ends.

3 EXECUTION

3.1 Install vibration isolation devices for the duty indicated and for ease of inspection, adjustment, and proper operation. Install in accordance with the manufacturer's written instructions and coordinate with shop drawings of supported equipment.

3.2 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.

3.3 Piping, ductwork and conduit shall not be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

3.4 Hangers:

3.4.1 Position vibration isolation hangers so that hanger housing may rotate a full 360 degrees without contacting any object.

3.4.2 Install steel angles, channels, rods and fasteners to level equipment, piping or ductwork and to evenly distribute the supported weight.

3.5 Pipe Flexible Connections:

3.5.1 Piping connected to vibration isolated equipment shall be installed so that it does not strain or force out of alignment the vibration isolators supporting the basic equipment, nor shall pipes restrict such equipment from "floating" freely on its respective vibration isolation system. Flexible connections shall be used to eliminate transferring vibration along piping.

3.5.2 Flexible connections and hoses shall not be used to compensate for pipe misalignment. Units shall be aligned so that the flexible connection is not distorted perpendicular to the axis of the piping.

3.5.3 Install flexible connections in pump suction and discharge, and where shown on the drawings or required by equipment specifications.

3.5.4 Drain piping connected to vibrating equipment shall not physically contact any building construction or non-isolated systems or components.

END OF SECTION

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SECTION 22 05 53 - PLUMBING IDENTIFICATION

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to or requiring identification devices specified herein.

1.3 Extent of plumbing identification work required by this section is indicated on drawings and/or specified in other Division-22 sections.

1.4 Refer to Division-26 sections for identification requirements of electrical work; 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.

2 PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-22 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

2.2.1 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 1-¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions.

2.2.2 Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

2.2.3 Identification Paint: Standard identification enamel.

2.3 Plastic Pipe Markers

2.3.1 Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

2.3.1.1 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.

2.3.1.2 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.

2.4 Valve Tags:

2.4.1 Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" diameter tags, except as otherwise indicated.

2.4.2 Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" square black tags with white lettering, except as otherwise indicated.

2.5 Engraved Plastic-Laminate Signs:

2.5.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2.5.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; ⅛" for larger units.

2.5.3 Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for water heaters, pumps, etc.

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 Piping System Identification:

3.2.1 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:

3.2.1.1 Plastic pipe markers.

3.2.1.2 Stenciled markers, black or white for best contrast.

3.2.2 Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

3.2.2.1 Near each valve and control device.

3.2.2.2 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.

3.2.2.3 Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.

3.2.2.4 At access doors and similar access points which permit view of concealed piping.

3.2.2.5 Near major equipment items and other points of origination and termination.

3.2.2.6 Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.2.2.7 On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.3 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.

3.4 Valve Charts: Provide framed, glass covered valve charts in each mechanical room. Identify

coded valve number, valve function, and valve location for each valve.

3.5 Plumbing Equipment Identification: Install engraved plastic laminate sign on or near each major item of plumbing equipment and each operational device. Label shall indicate type of system and area served. For concealed devices, sign shall be affixed in an exposed location to allow UF personnel to determine the location of the device without removing the concealing material. If several small devices are located on one concealed unit, only the main unit need be identified with an exposed tag. Provide signs for the following general categories of equipment and operational devices:

3.5.1 Main control and operating valves, including safety devices.

3.5.2 Meters, gauges, thermometers and similar units.

3.5.3 Pumps.

3.5.4 Water heaters.

3.5.5 Tanks.

3.6 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment items such as motors, pumps, 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.

3.7 Adjusting and Cleaning:

3.7.1 Adjusting: Relocate any plumbing identification device which has become visually blocked by work of this division or other divisions.

3.7.2 Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION

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SECTION 22 07 19 - INSULATION FOR PLUMBING EQUIPMENT AND PIPING

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-22 Basic Plumbing Materials and Methods Sections apply to work of this section.

1.3 Approval Submittals:

1.3.1 Product Data: Submit a 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:

1.3.1.1 Fiberglass pipe insulation

1.3.1.2 Flexible unicellular piping insulation

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armacell, Industrial Insulation Group, 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 plumbing 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:

2.3.1 Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated. (Preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F)

2.3.2 Flexible Unicellular Pipe Insulation: ASTM C534, Type I. (Tubular, suitable for use to 200°F.)

2.3.3 Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

2.3.4 Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.

2.3.5 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.

3 EXECUTION

3.1 General:

3.1.1 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.

3.1.2 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.

3.1.3 Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".

3.1.4 Do not apply insulation to surfaces while they are hot or wet.

3.1.5 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.

3.1.6 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:

3.2.1 Insulate the following piping systems (indoor locations):

3.2.1.1 Domestic hot water, greater than 140° F: up to 2" pipe - 1½" thick, over 2" pipe 2" thick.

3.2.1.2 Domestic hot water, 140° F and lower: up to 1½" pipe - 1" thick, over 1½" pipe - 1½" thick.

3.2.1.3 Cold water pipe: ½" thick.

3.2.2 Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3 inch 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.

3.2.3 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.

3.2.4 Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture; on unions, flanges, strainer blowoffs, flexible connections and expansion joints.

3.2.5 Piping to Six Feet Above Finished Floor: Provide 0.016" thickness smooth aluminum jacket fastened with aluminum bands 12" on center. 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.

3.3 Flexible Unicellular Pipe Insulation:

3.3.1 Insulate the following piping systems:

3.3.1.1 Horizontal or vertical above-grade waste or storm piping receiving condensate from air conditioning units to points of connection receiving waste from 4 or more fixtures - ½" thick.

3.3.1.2 Horizontal or vertical above grade waste piping receiving discharge from ice machines, coolers, freezers or similar units to points of connection receiving waste form 4 or more fixtures - ½" thick.

3.3.1.3 Air compressor after-cooler piping - ¾" thick.

3.3.2 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.

END OF SECTION

SECTION 22 11 00 - PIPES AND PIPE FITTINGS

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to pipes and pipe fittings specified herein.

1.3 Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-22 sections.

1.4 Codes and Standards:

1.4.1 Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

1.4.2 Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.4.3 NSF Labels: Where plastic piping is indicated to transport potable water, provide pipes and pipe fittings bearing approval label by National Sanitation Foundations (NSF61).

1.5 Test Report and Verification Submittals:

1.5.1 Submit welding certification for all welding installers prior to commencing work.

1.5.2 Submit brazing certification for all brazing installers prior to commencing work.

2 PRODUCTS

2.1 Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. All piping provided for a particular system shall be by the same manufacturer.

2.2 Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.3 Piping Materials/Products:

2.3.1 Soldering Materials:

2.3.1.1 Tin-Antimony (95-5) Solder: ASTM B-32, Grade 95TA.

2.3.1.2 Silver-Phosphorus Solder: ASTM B-32, Grade 96TS.

2.3.2 Pipe Thread Tape: Teflon tape.

2.3.3 Protective Coating: Koppers Bitumastic No. 505 or equal.

2.3.4 Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast iron flanges; raised-face for steel flanges, unless otherwise noted.

2.3.5 Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials. Materials shall be determined by installer to comply with installation requirements.

2.3.6 Brazing Materials: Silver content of not less than 15%. Materials shall be determined by installer to comply with installation requirements.

2.4 Copper Tube and Fittings:

2.4.1 Copper Tube:

2.4.1.1 Copper Tube: ASTM B88; Type K or L as indicated for each service; hard-drawn temper unless specifically noted as annealed.

2.4.1.2 DWV Copper Tube: ASTM B306.

2.4.2 Fittings:

2.4.2.1 Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

2.4.2.2 Copper Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4.2.3 Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

2.5 Steel Pipes and Pipe Fittings

2.5.1 Pipes:

2.5.1.1 Black or Galvanized Steel Pipe: ASTM A53, ASTM A795, ASTM 135.

2.5.1.2 All pipe shall be manufactured in the United States and labeled accordingly.

2.5.2 Pipe Fittings:

2.5.2.1 Threaded Malleable Iron: ANSI B16.3; plain or galvanized as indicated.

2.5.2.2 Malleable Iron Threaded Unions: ANSI B16.39; selected by installer for proper piping fabrication and service requirements including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.

2.5.2.3 Threaded Pipe Plugs: ANSI B16.14.

2.5.2.4 Flanged Cast Iron: ANSI B16.1, including bolting.

2.5.2.5 Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing.

2.5.2.6 Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns, rated to match connected pipe.

2.5.2.7 Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than schedule 80 pipe where length remaining unthreaded is less than 1 ½ inches, and where pipe size is less than 1 ½ inches, and do not thread nipples full length (no close-nipples).

2.6 Plastic Pipes and Fittings:

2.6.1 Pipes:

2.6.1.1 PVC DWV Pipe: ASTM D-2665, Schedule 40.

2.6.1.2 CPVC Pressure Pipe: ASTM D-2846, Schedule 40 or 80.

2.6.2 Fittings:

2.6.2.1 PVC Solvent Cement: ASTM D-2564.

2.6.2.2 PVC DWV Socket: ASTM D-2665.

2.6.2.3 CPVC Schedule 40 Socket: ASTM D-2846.

2.6.2.4 CPVC Schedule 80 Socket: ASTM D-2846.

2.6.2.5 CPVC Schedule 80 Threaded: ASTM D-2846.

2.7 Cast Iron Soil Pipes and Fittings:

2.7.1 Pipe:

2.7.1.1 Hubless Cast Iron Soil Pipe: CISPI301; ASTM A888.

2.7.1.2 Cast Iron Hub-and-Spigot Soil Pipe: ASTM A74, coated.

2.7.2 Fittings:

2.7.2.1 Hubless Cast Iron Soil Pipe Fittings: Two piece cast iron with stainless steel bolts and nuts, MG Coupling or equal.

2.7.2.2 Hubless Cast Iron Soil Pipe Fittings: Neoprene gasket complying with ASTM C564 and stainless steel holding band.

2.7.2.3 Cast Iron Hub-and-Spigot Soil Pipe Fittings: Match soil pipe units; complying with ASTM A74.

2.7.2.4 Compression Gasket: Neoprene ASTM C564.

3 EXECUTION

3.1 Installation

3.1.1 General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings, not bushings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.1.2 Comply with ANSI B31 Code for Pressure Piping.

3.1.3 Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to ½" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

3.1.4 Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall

construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Protect concealed piping from physical damage in accordance with the Florida Building Code - Plumbing.

3.1.5 Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.

3.1.5.1 Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with building construction and installed work.

3.2 Piping System Joints: Provide joints of the type indicated in each piping system.

3.2.1 Solder copper tube-and-fitting joints where indicated, in accordance with ASTM B 828. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings in accordance with ASTM B 813. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Solder shall conform to ASTM B 32 and shall be lead free. Wipe excess solder from joint before it hardens.

3.2.2 Thread pipe in accordance with ANSI B1.20.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.

3.2.3 Flanged Joints: Match flanges within piping system, and at connection with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets. Bolts shall project 1/8" to 3/8" beyond nut face when tight.

3.2.4 Weld pipe joints in accordance with recognized industry practice and as follows. Be guided by ANSI B.31.

3.2.4.1 Weld pipe joints only when ambient temperature is above 0°F.

3.2.4.2 Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

3.2.4.3 Use pipe clamps or tack-weld joints; 4 welds for pipe sizes to 10". All welds shall be open-butt.

3.2.4.4 Build up welds with root pass, followed by filler pass and then a cover pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

3.2.4.5 Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

3.2.4.6 At Installer's option, install forged branch-connection fittings wherever branch pipe is less than 3" and at least two pipe sizes smaller than main pipe indicated; or install regular "T" fitting. Weld-O-Let or equal.

3.2.4.7 All field welding and cutting using oxygen-acetylene methods within the building shall be performed in accordance with NFPA-51B.

3.2.5 Plastic Pipe Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards.

3.2.5.1 Solvent-cemented joints shall be made in accordance with ASTM D-2235 and ASTM F-402.

3.2.6 Cast-Iron Joints: Tightly pack joint with joint packing material. Do not permit packing to enter bore of finished joint. Clean joint after packing. Fill remaining joint space with one pouring of lead to indicated minimum depth measured from face of bell. After lead has cooled, calk joint tightly by use of hammer and calking iron. If using compression joints, comply with manufacturer's installation instruction using gaskets and lubricant furnished specifically for this duty.

3.2.7 Hubless Cast-Iron Joints: Comply with coupling manufacturer's installation instructions.

3.2.8 Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B.31 using an approved flux and filler metal conforming to AWS A5.8.

3.3 Piping Installation

3.3.1 Install piping to allow for expansion and contraction.

3.3.2 Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with at least two layers of plastic electrical tape. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.

3.3.3 Underground Piping:

3.3.3.1 Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18" above piping.

3.3.3.2 Coat the following underground (uninsulated) pipes with a heavy coat of bitumastic or provide an 8 mil polyvinyl sleeve: black steel pipe, galvanized steel pipe, copper tubing.

END OF SECTION

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SECTION 22-11-13 - FACILITY WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes water-distribution piping and related components outside the building for water service.

B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

A. EPDM: Ethylene propylene diene terpolymer rubber.

B. LLDPE: Linear, low-density polyethylene plastic.

C. PA: Polyamide (nylon) plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. RTRF: Reinforced thermosetting resin (fiberglass) fittings.

H. RTRP: Reinforced thermosetting resin (fiberglass) pipe.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.

1. Wiring Diagrams: Power, signal, and control wiring for alarms.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water valves and specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.

2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.

3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

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

D. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.

E. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

F. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.

1. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.9 PROJECT CONDITIONS

A. Interruption of Existing Water-Distribution Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. N/A

1.10 COORDINATION

A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Application" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.2 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, annealed temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, drawn temper.
   1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

D. Copper Unions:
   1. MSS SP-123.
   2. Cast-copper-alloy, hexagonal-stock body.
   3. Ball-and-socket, metal-to-metal seating surfaces.
   4. Solder-joint or threaded ends.

E. Copper, Brass or Bronze, Pressure-Seal-Joint Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Flow Controls; Conbraco Industries, Inc.
      b. Elkhart Products Corporation.
      c. Mueller Industries, Inc.
      d. NIBCO INC.
      e. Viega LLC.
   2. Fittings: Cast-brass, cast-bronze, or wrought-copper with EPDM O-ring seal in each end. Sizes NPS 2-1/2 and larger with stainless steel grip ring and EPDM O-ring seal.
   3. Minimum 200-psig working-pressure rating at 250 deg F.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
   1. Grooved-End, Ductile-Iron Pipe Appurtenances:
      a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
         1) Anvil International.
         2) Smith-Cooper International.
         3) Victaulic Company.
      b. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
      c. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

D. Flanges: ASME 16.1, Class 125, cast iron.

2.4 PE PIPE AND FITTINGS

A. PE, ASTM Pipe: ASTM D 2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than 200 psig.
   1. Insert Fittings for PE Pipe: ASTM D 2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.
   2. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than 200 psig.
   1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than 200 psig.

C. PE, Fire-Service Pipe: ASTM F 714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG Class 200
   1. Molded PE Fittings: ASTM D 3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

2.5 PVC PIPE AND FITTINGS

A. PVC, Schedule 40 Pipe: ASTM D 1785.
   1. PVC, Schedule 40 Socket Fittings: ASTM D 2466.

B. PVC, Schedule 80 Pipe: ASTM D 1785.
   1. PVC, Schedule 80 Socket Fittings: ASTM D 2467.
   2. PVC, Schedule 80 Threaded Fittings: ASTM D 2464.

C. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket, and with spigot end.
   1. Comply with UL 1285 for fire-service mains if indicated.
   2. PVC Fabricated Fittings: AWWA C900, Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
   4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Gaskets: AWWA C111, rubber.
   5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
      a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.6 Deleted

2.7 SPECIAL PIPE FITTINGS

A. Ductile-Iron Rigid Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. EBAA Iron, Inc.
      b. U.S. Pipe and Foundry Company.
      c. Zurn Industries, LLC.
   2. Description: Three-piece, ductile-iron assembly consisting of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Flexible Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. EBAA Iron, Inc.
      b. Hays Fluid Controls.
      c. Star Pipe Products.
      d. Zurn Industries, LLC.
   2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

C. Ductile-Iron Deflection Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. EBAA Iron, Inc.
   2. Description: Compound, ductile-iron coupling fitting with sleeve and 1 or 2 flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
      a. Pressure Rating: 250 psig minimum.

2.8 JOINING MATERIALS

A. Refer to Section 33 05 00 "Common Work Results for Utilities" for commonly used joining materials.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

D. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.9 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Mfg. Co.
      b. Dresser, Inc.
      c. Ford Meter Box Company, Inc. (The).
      d. Hays Fluid Controls.
      e. JCM Industries, Inc.
      f. Smith-Blair, Inc.
      g. Viking Johnson.
   2. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
      a. Standard: AWWA C219.
      b. Gasket Material: Natural or synthetic rubber.
      c. Pressure Rating: 200 psigminimum.
      d. Metal Component Finish: Corrosion-resistant coating or material.

C. Split-Sleeve Pipe Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Victaulic Company.
   2. Description: Metal, bolted, split-sleeve-type, reducing or transition coupling with sealing pad and closure plates, O-ring gaskets, and bolt fasteners.
      a. Standard: AWWA C219.
      b. Sleeve Dimensions: Of thickness and width required to provide pressure rating.
      c. Gasket Material: O-rings made of EPDM rubber, unless otherwise indicated.
      d. Pressure Rating: 200 psig minimum.
      e. Metal Component Finish: Corrosion-resistant coating or material.

D. Flexible Connectors:
   1. Nonferrous-Metal Piping: Bronze hose covered with bronze wire braid; with copper-tube, pressure-type, solder-joint ends or bronze flanged ends brazed to hose.
   2. Ferrous-Metal Piping: Stainless-steel hose covered with stainless-steel wire braid; with ASME B1.20.1, threaded steel pipe nipples or ASME B16.5, steel pipe flanges welded to hose.

E. Dielectric Fittings:
   1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
   2. Dielectric Unions:
      a. Description:
         1) Standard: ASSE 1079.
         2) Pressure Rating: 250 psig
         3) End Connections: Solder-joint copper alloy and threaded ferrous.
   3. Dielectric Flanges:
      a. Description:
         1) Standard: ASSE 1079.
         2) Factory-fabricated, bolted, companion-flange assembly.
         3) Pressure Rating: 250 psig

4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:
   a. Description:
      1) Nonconducting materials for field assembly of companion flanges.
      2) Pressure Rating: 250 psig
      3) Gasket: Neoprene or phenolic.
      4) Bolt Sleeves: Phenolic or polyethylene.
      5) Washers: Phenolic with steel backing washers.
5. Dielectric Nipples:
   a. Description:
      1) Standard: IAPMO PS 66.
      2) Electroplated steel nipple complying with ASTM F 1545.
      3) Pressure Rating: 300 psig at 225 deg F
      4) End Connections: Male threaded or grooved.
      5) Lining: Inert and noncorrosive, propylene.

2.10 CORROSION-PROTECTION PIPING ENCASEMENT

A. Encasement for Underground Metal Piping:
   1. Standards: ASTM A 674 or AWWA C105.
   2. Material: LLDPE film of 0.008-inch minimum thickness.
   3. Material: LLDPE film of 0.008-inch minimum thickness, or high-density, crosslaminated PE film of 0.004-inch minimum thickness.
   4. Material: High-density, crosslaminated PE film of 0.004-inch minimum thickness.

2.11 GATE VALVES

A. AWWA, Cast-Iron Gate Valves:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American AVK Co.
      b. American Cast Iron Pipe Company.
      c. Clow Valve Company; a subsidiary of McWane, Inc.
      d. Crane; Crane Energy Flow Solutions.
      e. EJ.
      f. Flomatic Corporation.
      g. Kennedy Valve Company; a division of McWane, Inc.
      h. M & H Valve Company; a division of McWane, Inc.
      i. McWane, Inc.
      j. Mueller Co.
      k. NIBCO INC.
      l. Tyler Pipe; a subsidiary of McWane Inc.
      m. U.S. Pipe and Foundry Company.
      n. Zurn Industries, LLC.
   2. Nonrising-Stem, Metal-Seated Gate Valves:
      a. Description: Gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
         1) Standard: AWWA C500.
         2) Minimum Pressure Rating: 200 psig.
         3) End Connections: Mechanical joint.
         4) Interior Coating: Complying with AWWA C550.

3. Nonrising-Stem, Resilient-Seated Gate Valves:
   a. Description: Gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
4. Nonrising-Stem, High-Pressure, Resilient-Seated Gate Valves:
   a. Description: Ductile-iron body and bonnet; with bronze or ductile-iron gate, resilient seats, bronze stem, and stem nut.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 250 psig.
      3) End Connections: Push on or mechanical joint.
      4) Interior Coating: Complying with AWWA C550.
5. OS&Y, Rising-Stem, Metal-Seated Gate Valves:
   a. Description: Cast- or ductile-iron body and bonnet, with cast-iron double disc, bronze disc and seat rings, and bronze stem.
      1) Standard: AWWA C500.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Flanged.
6. OS&Y, Rising-Stem, Resilient-Seated Gate Valves:
   a. Description: Cast- or ductile-iron body and bonnet, with bronze or gray- or ductile-iron gate, resilient seats, and bronze stem.
      1) Standard: AWWA C509.
      2) Minimum Pressure Rating: 200 psig.
      3) End Connections: Flanged.

B. UL/FMG, Cast-Iron Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Cast Iron Pipe Company.
   b. Clow Valve Company; a subsidiary of McWane, Inc.
   c. Crane; Crane Energy Flow Solutions.
   d. Kennedy Valve Company; a division of McWane, Inc.
   e. M & H Valve Company; a division of McWane, Inc.
   f. McWane, Inc.
   g. Mueller Co.
   h. NIBCO INC.
   i. Stockham; Crane Energy Flow Solutions.
   j. U.S. Pipe and Foundry Company.
   k. Zurn Industries, LLC.
2. UL/FMG, Nonrising-Stem Gate Valves:
   a. Description: Iron body and bonnet with flange for indicator post, bronze seating material, and inside screw.
      1) Standards: UL 262 and FMG approved.
      2) Minimum Pressure Rating: 175 psig.
      3) End Connections: Flanged.
3. OS&Y, Rising-Stem Gate Valves:
   a. Description: Iron body and bonnet and bronze seating material.
      1) Standards: UL 262 and FMG approved.
      2) Minimum Pressure Rating: 175 psig.

3) End Connections: Flanged.

C. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Crane; Crane Energy Flow Solutions.
   b. Hammond Valve.
   c. Jenkins Valves; Crane Energy Flow Solutions.
   d. Milwaukee Valve Company.
   e. NIBCO INC.
   f. Red-White Valve Corp.
   g. Stockham; Crane Energy Flow Solutions.
   h. Zurn Industries, LLC.
2. OS&Y, Rising-Stem Gate Valves:
   a. Description: Bronze body and bonnet and bronze stem.
      1) Standards: UL 262 and FMG approved.
      2) Minimum Pressure Rating: 175 psig.
      3) End Connections: Threaded.
3. Nonrising-Stem Gate Valves:
   a. Description: Class 125, Type 1, bronze with solid wedge, threaded ends, and malleable-iron handwheel.
      1) Standard: MSS SP-80.

2.12 GATE VALVE ACCESSORIES AND SPECIALTIES

A. Tapping-Sleeve Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Cast Iron Pipe Company.
   b. Clow Valve Company; a subsidiary of McWane, Inc.
   c. EJ.
   d. Flowserve Corporation.
   e. Kennedy Valve Company; a division of McWane, Inc.
   f. M & H Valve Company; a division of McWane, Inc.
   g. McWane, Inc.
   h. Mueller Co.
   i. U.S. Pipe and Foundry Company.
2. Description: Sleeve and valve compatible with drilling machine.
   a. Standard: MSS SP-60.
   b. Tapping Sleeve: Cast- or ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection. Include sleeve matching size and type of pipe material being tapped and with recessed flange for branch valve.
   c. Valve: AWWA, cast-iron, nonrising-stem, resilient-seated gate valve with one raised face flange mating tapping-sleeve flange.

B. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel approximately 5 inches in diameter.

1. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut.

C. Indicator Posts: UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.

2.13 CHECK VALVES

A. AWWA Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American AVK Co.
   b. American Cast Iron Pipe Company.
   c. APCO Willamette Valve and Primer Corporation.
   d. Clow Valve Company; a subsidiary of McWane, Inc.
   e. Crane; Crane Energy Flow Solutions.
   f. Flomatic Corporation.
   g. Kennedy Valve Company; a division of McWane, Inc.
   h. M & H Valve Company; a division of McWane, Inc.
   i. McWane, Inc.
   j. Mueller Co.
   k. NIBCO INC.
   l. Stockham; Crane Energy Flow Solutions.
   m. WATTS.
2. Description: Swing-check type with resilient seat. Include interior coating according to AWWA C550 and ends to match piping.
   a. Standard: AWWA C508.
   b. Pressure Rating: 175 psig.

B. UL/FMG, Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. American Cast Iron Pipe Company.
   b. Clow Valve Company; a subsidiary of McWane, Inc.
   c. Crane; Crane Energy Flow Solutions.
   d. Globe Fire Sprinkler Corporation.
   e. Kennedy Valve Company; a division of McWane, Inc.
   f. Kidde Fire Fighting; A UTC Business Unit.
   g. Matco-Norca.
   h. McWane, Inc.
   i. Mueller Co.
   j. NIBCO INC.
   k. Reliable Automatic Sprinkler Co., Inc. (The).
   l. Stockham; Crane Energy Flow Solutions.
   m. Tyco Fire Products LP.
   n. United Brass Works, Inc.
   o. Victaulic Company.
   p. Viking Corporation.
   q. WATTS.
2. Description: Swing-check type with pressure rating; rubber-face checks, unless otherwise indicated; and ends matching piping.
   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 250 psig

2.14 DETECTOR CHECK VALVES

A. Detector Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; A WATTS Brand.
   b. Badger Meter, Inc.
   c. FEBCO; A WATTS Brand.
   d. Globe Fire Sprinkler Corporation.
   e. Kennedy Valve Company; a division of McWane, Inc.
   f. McWane, Inc.
   g. Mueller Co.
   h. Victaulic Company.
   i. Viking Corporation.
   j. WATTS.
   k. Zurn Industries, LLC.
2. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.
   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 175 psig.
   c. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.
3. Description: Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.
   a. Standards: UL 312 and FMG approved.
   b. Pressure Rating: 175 psig.

2.15 BUTTERFLY VALVES

A. AWWA Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DeZURIK/Copes-Vulcan.
   b. Flomatic Corporation.
   c. Milliken Valve Company.
   d. Milwaukee Valve Company.
   e. Mosser Valve.
   f. Mueller Co.
   g. Pratt, Henry Company.
   h. Val-Matic Valve & Manufacturing Corp.
2. Description: Rubber seated.
   a. Standard: AWWA C504.
   b. Body: Cast or ductile iron.
   c. Pressure Rating: 150 psig.

B. UL Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Kennedy Valve Company; a division of McWane, Inc.
   b. McWane, Inc.
   c. Milwaukee Valve Company.
   d. Mueller Co.
   e. NIBCO INC.
   f. Pratt, Henry Company.
   g. Viega LLC.
2. Description: Metal on resilient material seating.
   a. Standards: UL 1091 and FMG approved.
   b. Body: Cast or ductile iron.
   c. Pressure Rating: 175 psig.

2.16 PLUG VALVES

A. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. DeZURIK/Copes-Vulcan.
   b. Homestead Valve.
   c. M & H Valve Company; a division of McWane, Inc.
   d. McWane, Inc.
   e. Milliken Valve Company.
   f. Pratt, Henry Company.
   g. Val-Matic Valve & Manufacturing Corp.
2. Description: Resilient-seated eccentric.
   a. Standard: MSS SP-108.
   b. Body: Cast iron.
   c. Pressure Rating: 175-psig minimum CWP.
   d. Seat Material: Suitable for potable-water service.

2.17 Deleted

2.18 WATER METERS

A. Water meters will be furnished by utility company.

2.19 DETECTOR-TYPE WATER METERS

A. Detector-Type Water Meters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Badger Meter, Inc.
   b. Mueller Co.
   c. Neptune Technology Group Inc.
   d. Sensus Metering Systems.

B. Description: Main line, proportional meter with second meter on bypass. Register flow in gallons.
   1. Standards: AWWA C703, UL listed, and FMG approved.
   2. Pressure Rating: 150 psig.
   3. Bypass Meter: AWWA C701, turbine-type, bronze case.
      a. Size: At least one-half nominal size of main-line meter.

C. Description: Main-line turbine meter with strainer and second meter on bypass. Register flow in gallons.
   1. Standards: AWWA C703, UL listed, and FMG approved.
   2. Pressure Rating: 175 psig.
   3. Bypass Meter: AWWA C701, turbine-type, bronze case.
      a. Size: At least NPS 2.

2.20 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; A WATTS Brand.
      b. Apollo Flow Controls; Conbraco Industries, Inc.
      c. FEBCO; A WATTS Brand.
      d. Flowmatic Corporation.
      e. WATTS.
      f. Wilkins.
      g. Zurn Industries, LLC.
   2. Standard: AWWA C511
   3. Operation: Continuous-pressure applications.
   4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.

B. Double-Check, Backflow-Prevention Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; A WATTS Brand.
      b. Apollo Flow Controls; Conbraco Industries, Inc.
      c. FEBCO; A WATTS Brand.
      d. Flowmatic Corporation.
      e. WATTS.
      f. Wilkins.
      g. Zurn Industries, LLC.
   2. Standard: AWWA C510
   3. Operation: Continuous-pressure applications, unless otherwise indicated.
   4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Ames Fire & Waterworks; A WATTS Brand.
      b. Apollo Flow Controls; Conbraco Industries, Inc.
      c. FEBCO; A WATTS Brand.
      d. WATTS.

e. Wilkins.
f. Zurn Industries, LLC.

2. Standards: ASSE 1047 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig Copy and edit paragraph and subparagraphs below for each type of double-check, detector-assembly backflow preventer required.

D. Double-Check, Detector-Assembly Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Ames Fire & Waterworks; A WATTS Brand.
   b. Apollo Flow Controls; Conbraco Industries, Inc.
   c. FEBCO; A WATTS Brand.
   d. WATTS.
   e. Wilkins.
   f. Zurn Industries, LLC.
2. Standards: ASSE 1048 and UL listed or FMG approved.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

E. Backflow Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Apollo Flow Controls; Conbraco Industries, Inc.
   b. FEBCO; A WATTS Brand.
   c. Flowmatic Corporation.
   d. WATTS.
   e. Wilkins.
   f. Zurn Industries, LLC.
2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.21 WATER METER BOXES

A. Description: Cast-iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Option: Base section may be cast-iron, PVC, clay, or other pipe.

B. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Description: Polymer-concrete body and cover for disc-type water meter, with lettering "WATER" in cover; and with slotted, open-bottom base section of length to fit over service piping. Include vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches square.

2.22 Deleted

2.23 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:

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

b. BF Products Inc.
c. DekoRRa Products LLC.
d. Dunco Manufacturing, Inc.
e. G&C Enclosures.
f. Hot Box: Hubbell Power Systems, Inc.
g. HydroCowl, Inc.
h. WATTS.

2. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F.
   a. Standard: ASSE 1060.
   b. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.
   c. Class I-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
      1) Housing: Reinforced aluminum or fiberglass construction.
         a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
         b) Drain opening for units with drain connection.
         c) Access doors with locking devices.
         d) Insulation inside housing.
         e) Anchoring devices for attaching housing to concrete base.
      2) Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AquaSHIELD.
   b. BF Products Inc.
   c. DekoRRa Products LLC.
   d. Dunco Manufacturing, Inc.
   e. G&C Enclosures.
   f. Hot Box: Hubbell Power Systems, Inc.
   g. HydroCowl, Inc.
   h. WATTS.
2. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
   a. Standard: ASSE 1060.
   b. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
   c. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.
      1) Housing: Reinforced aluminum or fiberglass construction.
         a) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
         b) Drain opening for units with drain connection.
         c) Access doors with locking devices.
         d) Anchoring devices for attaching housing to concrete base.

C. Enclosure Bases:

1. Description: 4-inch minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.24 FIRE DEPARTMENT CONNECTIONS

A. Fire Department Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkhart Brass Mfg. Co., Inc.
   b. Fire End & Croker Corporation.
   c. Guardian Fire Equipment, Inc.
   d. Kidde Fire Fighting; A UTC Business Unit.
   e. Potter Roemer LLC.
   f. Reliable Automatic Sprinkler Co., Inc. (The).
2. Description: Freestanding, with cast-bronze body, thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch-high brass sleeve; and round escutcheon plate.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.

B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.

C. Do not use flanges or unions for underground piping.

D. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

E. Underground water-service piping NPS 3/4 to NPS 3 shall be any of the following:

1. PE, ASTM pipe;
2. PVC, Schedule 80 pipe socket fittings; and solvent-cemented joints.

F. Underground water-service piping NPS 4 to NPS 8 shall be any of the following:

1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings joints.
2. PE, AWWA pipe; PE, AWWA fittings; and heat-fusion joints.
3. PVC, Schedule 80 pipe socket fittings; and solvent-cemented joints.
4. NPS 4 and NPS 6: NPS 6 PVC, AWWA Class 150 pipe; PVC, AWWA Class 150 fabricated or molded fittings; and gasketed joints.
5. NPS 8: PVC, AWWA Class 200 pipe; mechanical-joint, ductile-iron fittings; and gasketed joints.

G. Water Meter Box Water-Service Piping shall be same as underground water-service piping.

H. Underground Fire-Service-Main Piping shall be any of the following:
   1. Ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical joints.
   2. PVC, AWWA Class 200 pipe listed for fire-protection service; PVC Class 200 fabricated fittings; and gasketed joints.

I. Aboveground Fire-Service-Main Piping shall be ductile-iron, grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.

3.3 VALVE APPLICATIONS

A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal resilient-seated gate valves with valve box.
   2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 2 and Smaller: Bronze, rising stem.
      b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated
      c. Check Valves: AWWA C508, swing type.
   4. Pressure-Reducing Valves: Use for water-service piping in vaults and aboveground to control water pressure.
   5. Relief Valves: Use for water-service piping in vaults and aboveground.
      a. Air-Release Valves: To release accumulated air.
      b. Air/Vacuum Valves: To release or admit large volume of air during filling of piping.
      c. Combination Air Valves: To release or admit air.
   6. Detector Check Valves: Use for water-service piping in vaults and aboveground to detect unauthorized use of water.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping-system common requirements.

3.5 PIPING INSTALLATION

A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:
   1. Install tapping sleeve and tapping valve according to MSS SP-60.
   2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
   3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
   4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following:
   1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
   2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
   3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
   4. Install corporation valves into service-saddle assemblies.
   5. Install manifold for multiple taps in water main.
   6. Install curb valve in water-service piping with head pointing up and with service box.

E. Comply with NFPA 24 for fire-service-main piping materials and installation.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
   2. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

F. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
   1. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.

G. Install PE pipe according to ASTM D 2774 and ASTM F 645.

H. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

I. Install fiberglass AWWA pipe according to AWWA M45.

J. Bury piping with depth of cover over top at least 30 inches and according to the following:
   1. Under Driveways: With at least 36 inches cover over top.
   2. In Loose Gravelly Soil and Rock: With at least 12 inches additional cover.

K. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

L. Extend water-service piping and connect to water-supply source and building-water-piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building-water-piping systems when those systems are installed.

M. Sleeves are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

N. Mechanical sleeve seals are specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

O. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

P. See Section 21 12 00 "Fire-Suppression Standpipes," Section 21 13 13 "Wet-Pipe Sprinkler Systems," and Section 21 13 16 "Dry-Pipe Sprinkler Systems" for fire-suppression-water piping inside the building.

Q. See Section 22 11 16 "Domestic Water Piping" for potable-water piping inside the building.

3.6 JOINT CONSTRUCTION

A. See Section 33 05 00 "Common Work Results for Utilities" for basic piping joint construction.

B. Make pipe joints according to the following:
   1. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools and procedures recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.
   2. Ductile-Iron Piping, Gasketed Joints for Water-Service Piping: AWWA C600 and AWWA M41.

3. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.
4. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
5. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
6. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
7. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.
8. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

3.7 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
   1. Concrete thrust blocks.
   2. Locking mechanical joints.
   3. Set-screw mechanical retainer glands.
   4. Bolted flanged joints.
   5. Heat-fused joints.
   6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
   3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
   4. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.8 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL/FMG, Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

H. Relief Valves: Comply with AWWA C512. Install aboveground with shutoff valve on inlet.

3.9 DETECTOR-CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

C. Support detector check valves, meters, shutoff valves, and piping on brick or concrete piers.

3.10 WATER METER INSTALLATION

A. By Utility

3.11 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.12 VACUUM BREAKER ASSEMBLY INSTALLATION

A. Install pressure vacuum breaker assemblies of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install pressure vacuum breaker assemblies in vault or other space subject to flooding.

3.13 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

D. Support NPS 2-1/2 and larger backflow preventers, valves, and piping near floor and on brick or concrete piers.

3.14 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.15 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.16 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.17 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Install with valve below frost line. Provide for drainage.

C. AWWA Fire Hydrants: Comply with AWWA M17.

D. UL/FMG Fire Hydrants: Comply with NFPA 24.

3.18 FLUSHING HYDRANT INSTALLATION

A. Install post-type flushing hydrants with valve below frost line and provide for drainage. Support in upright position. Include separate gate valve or curb valve and restrained joints in supply piping.

B. Install ground-type flushing hydrants with valve below frost line and provide for drainage. Install hydrant box flush with grade. Include separate gate valve or curb valve and restrained joints in supply piping.

C. Install sampling stations with valve below frost line and provide for drainage. Attach weather-resistant housing and support in upright position. Include separate curb valve in supply piping.

3.19 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire department connection to mains.

3.20 CONNECTIONS

A. See Section 33 05 00 "Common Work Results for Utilities" for piping connections to valves and equipment.

B. Connect water-distribution piping to interior domestic water and fire-suppression piping.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.21 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

C. Prepare reports of testing activities.

3.22 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 31 20 00 "Earth Moving."

B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel. See Section 33 05 00 "Common Work Results for Utilities" for identifying devices.

3.23 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

END OF SECTION 22 11 13

SECTION 22 11 16 - POTABLE WATER SYSTEM

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-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.

1.3 Extent of potable water systems work, is indicated on drawings and schedules, and by requirements of this section.

1.4 Insulation for potable water piping is specified in other Division-22 sections, and is included as work of this section. Insulation requirements include:

1.4.1 Domestic hot water piping

1.4.2 Cold water piping above ceilings and/or in attics.

1.5 Excavation and backfill required in conjunction with water piping is specified in other Division-22 sections, and is included as work of this section.

1.6 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to selection and installation of plumbing materials and products. Comply with local utility requirements.

1.6.1 All products used in potable water systems shall meet the low lead requirements of NSF-372.

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data and installation instructions for:

1.7.1.1 Valves

1.7.1.2 Strainers

1.7.1.3 Hose bibbs

1.7.1.4 Wall hydrants

1.7.1.5 Water hammer arresters

1.7.1.6 Backflow preventers

1.7.1.7 Meters and gauges

1.7.1.8 Relief valves

1.7.1.9 Trap primers

1.7.1.10 Access doors

1.8 Test Reports and Verification Submittals:

1.8.1 Backflow Preventer Test Report: Submit Test Report for each backflow preventer.

1.8.2 Disinfection: Submit report by Health Department.

1.9 O&M Data Submittals: Submit a copy of all approval submittals. Submit maintenance data and parts lists for valves, backflow preventers, trap primers. Include these data in O&M manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Florida Building Code - Plumbing where applicable. Provide sizes and types matching pipe materials used in potable water systems. Where more than one type of materials or products is indicated, selection is Installer's option.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.

2.3 Identification: Provide identification complying with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

2.4 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

2.4.1 Interior Water Piping:

2.4.1.1 Above Grade: Copper tube; Type L, hard-drawn temper; wrought-copper fittings, solder-joints.

2.4.1.2 Below Grade: Copper tube; Type L, soft-annealed temper; no joints below floor.

2.4.1.3 Chlorinated polyvinyl chloride pipe (CPVC) , Schedule 80; CPVC socket fittings, solvent cement joints.

2.4.2 Solder joints shall be made with 95-5 solder.

2.5 Piping Specialties: Provide piping specialties complying with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

2.6 Supports and Anchors: Provide supports and anchors complying with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

2.7 Interior Valves: Provide valves complying with Division-22 Basic Plumbing Materials and Methods section "Valves", in accordance with the following listing:

2.7.1 Sectional and Shutoff Valves: PGA1, PGA2, PGA3, PBA1, PBA2.

2.7.2 Drain Valves: PBA1, PBA2.

2.7.3 Check Valves: PCK1, PCK2, PCK3.

2.8 Exterior Valves: Provide as indicated, gate valves, AWWA C500, 175 psi working pressure. Provide threaded, flanged, hub, or other end configurations to suit size of valve and piping connections. Provide inside screw type for use with curb valve box, iron body, bronze-mounted, double disc, parallel seat, non-rising stem. Clow Corp., Dresser Mfg., Fairbanks Co., Kennedy, Stockham.

2.9 Hose Bibbs: Provide rough nickel plated hose bibbs with lock shield compression stop and removable handle, solid flange, female connection with ¾" male threaded hose end, and straight line type non-removable vacuum breaker with ¾" male threaded hose end. Acorn 8121 RCP or equal model by Woodford.

2.10 Non-freeze Wall Hydrants: Provide ¾" anti-syphon, non-freeze wall hydrant with bronze casing,

satin bronze box, straight inlet connection, and integral vacuum breaker-backflow preventer, Wade W-8700 or approved equal.

2.11 Water Hammer Arresters: Provide bellows type water hammer arresters, stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201. Precision Plumbing Products, Josam, Zurn, Amtrol, Wade, Jay R. Smith, or approved equal.

2.12 Backflow Preventers:

2.12.1 Provide reduced pressure principle backflow preventers consisting of a complete assembly including shutoff valves on inlet and outlet and strainer on inlet. Backflow preventers shall include test cocks and pressure-differential relief valve located between 2 positive seating check valves. Construct in accordance with ASSE Standard 1013. Watts Model # Series LF909. Comply with local utility requirements.

2.13 Meters and Gauges: Provide meters and gauges complying with Division-22 Basic Plumbing Materials and Methods section "Meters and Gauges", in accordance with the following listing:

2.13.1 Thermometers

2.13.2 Pressure gauges

2.13.3 Calibrated balancing cocks

2.14 Combined Pressure-Temperature Relief Valves: Provide relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, in accordance with ASME Boiler and Pressure Vessel Code. Provide bronze body, test lever and thermostat complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Provide temperature relief at 210°F, and pressure relief at 150 psi. Watts, Cash, Zurn, or approved equal.

2.15 Trap Primers: Provide brass trap primers and distribution units to seal floor drains indicated on drawings. Trap primer valves shall be automatic, self contained type with no springs or diaphragms and shall not require adjustment. Trap primer valves shall be the type that can be installed anywhere on cold water piping. Distribution units shall supply 1-4 floor drains. Trap primer valves shall comply with ASSE 1018. Precision Plumbing Products PR-500, or approved equal. Where P-trap primers are indicated use "Prime-Eze" by Jay R. Smith, or approved equal.

2.16 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division-22 Basic Materials and Methods Section “Access Doors”.

3 EXECUTION

3.1 General: Examine areas and conditions under which potable water systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing identification in accordance with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

3.3 Install water distribution piping in accordance with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings".

3.3.1 Install piping with 1/32" per foot (¼%) downward slope towards drain point.

3.3.2 Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.4 Install exterior water piping in compliance with local governing regulations. Water piping shall be installed with a minimum of 30 inches of cover unless otherwise indicated.

3.5 Install piping specialties in accordance with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

3.6 Install supports and anchors in accordance with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

3.7 Install valves in accordance with Division-22 Basic Plumbing Materials and Methods section "Valves".

3.7.1 Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves two or more plumbing fixtures or equipment connections, and elsewhere as indicated.

3.7.2 Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

3.7.3 Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain potable water system.

3.7.4 Check Valves: Install where indicated.

3.7.5 Calibrated Balancing Cocks: Install in each hot water recirculating loop, and elsewhere as indicated.

3.8 Hose Bibbs and Wall Hydrants: Install on concealed piping where indicated with vacuum breaker. Provide shutoff valve at inlet. Mount 18 inches above grade or finished floor.

3.9 Install backflow preventers where indicated, and where required by Florida Building Code-Plumbing. Locate in same room as equipment being protected. Install 12" - 36" AFF with 12" clear in back and 24" clear in front. Pipe relief outlet to nearest floor drain or outside as shown on the drawings. Provide test and report by State of Florida Certified Backflow Preventer Specialist.

3.10 Install meters and gauges in accordance with Division-22 Basic Plumbing Materials and Methods section "Meters and Gauges".

3.11 Install relief valves on each water heater, and where indicated in accordance with the manufacturer's instructions. Pipe untrapped, full size outside or to floor drain. Terminate discharge with a visible air gap or air gap fitting in the same room as the water heater. Cut the end of the pipe at a 45° angle and terminate 6 inches above the floor or grade.

3.12 Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Florida Building Code-Plumbing.

3.13 Equipment Connections: Connect hot and cold water piping system to equipment as indicated, and comply with equipment manufacturer's installation instructions. Provide shutoff valve and union for each connection, provide drain valve on drain connection.

3.14 Install water hammer arresters in upright position, in locations and of sizes indicated in accordance with PDI Standard WH-201.

3.15 Install trap primers as indicated, and in accordance with manufacturer's installation instructions. Provide access panels to all trap primers unless accessible through a lay-in ceiling.

3.16 Locate and coordinate installation of access doors for all valves and devices in accordance with Division-22 Basic Plumbing Materials and Methods section “Access Doors”.

3.17 Piping Tests: Test, clean, and sterilize potable water piping in accordance with testing

requirements of Division-22 Basic Plumbing Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems".

3.18 O&M Training: Provide four hours in one session.

END OF SECTION

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SECTION 22 11 23 - PLUMBING PUMPS

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-22 Basic Materials and Methods sections apply to work of this section.

1.3 Extent of plumbing pumps work required by this section is indicated on drawings, and by requirements of this section.

1.4 Refer to Division-26 sections for the following work; not work of this section.

1.4.1 Power supply wiring from power source to power connection on pumps. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory installed, by manufacturer.

1.4.2 Interlock wiring between pumps; and between pumps and field-installed control devices.

1.5 Codes and Standards: Provide electric motors and components which are listed and labeled by UL and comply with NEMA standards.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's pump specifications, dimensions, weights, required clearances, installation and start-up instructions. Submit current accurate pump characteristic performance curves with selection points clearly indicated. Submit product data for:

1.6.1.1 In-Line Recirculation Pumps.

1.6.2 Short Circuit Current Ratings (SCCR):

1.6.2.1 All controls panels and enclosures shall have SCCR labeling per NEC.

1.6.2.2 Provide equipment with SCCR suitable for location installed.

1.6.2.3 Contact engineer for maximum available fault current at equipment prior to providing approval submittals so SCCR can be included in approval submittals.

1.6.2.4 In no case shall the SCCR be less than the following:

1.6.2.4.1 For equipment rated 100 amps and higher the minimum SCCR shall be 65 kA.

1.6.2.4.2 For equipment rated 50 amps and lower than 100 amps the minimum SCCR shall be 35 kA.

1.6.2.4.3 For equipment rated 20 amps and lower than 50 amps the minimum SCCR shall be 20 kA.

1.6.2.4.4 For equipment rated 20 amps the minimum SCCR shall be 10 kA.

1.7 O&M Data Submittals:

1.7.1 Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to plumbing pumps. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.7.2 O&M Data: Submit a copy of approval submittals and maintenance data and parts lists for each type of pump, control, and accessory; including "trouble-shooting" maintenance guide. Include this data, product data and wiring diagrams in O&M manual.

2 PRODUCTS

2.1 General: Provide factory-tested pumps, thoroughly cleaned and painted with one coat of machinery enamel prior to shipment. Provide high efficiency motors in accordance with Division-22 section “Electric Motors”. Type, size, and capacity of each pump is listed in schedules on the drawings. Provide pumps of same type by same manufacturer.

2.2 In-Line Recirculation Pumps:

2.2.1 General: Provide in-line all-bronze recirculation pumps where indicated, and of capacities as indicated.

2.2.2 Type: Horizontal, oil-lubricated, designed for 125 psi working pressure, 225°F continuous water temperature, and specifically designed for quiet operation.

2.2.3 Body: Bronze construction.

2.2.4 Shaft: Steel, ground and polished, integral thrust collar.

2.2.5 Bearings: Two horizontal sleeve bearings designed to circulate oil.

2.2.6 Seal: Mechanical, with carbon seal face rotating against ceramic seat.

2.2.7 Motor: Non-overloading at any point on pump curve, open, drip-proof, sleeve bearings, quiet operating, rubber mounted construction, built-in thermal overload protection.

2.2.8 Coupling: Self-aligning, flexible coupling.

2.2.9 Provide aquastattime clock to stop pump when not needed for loop temperature maintenance.

2.2.10 Acceptable Manufacturers: Subject to compliance with requirements, provide in-line recirculation pumps of one of the following:
Amtrol Inc.
Armstrong Pumps, Inc.
Bell & Gossett ITT.
Taco, Inc.

3 EXECUTION

3.1 Examine areas and conditions under which plumbing pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install plumbing pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that plumbing pumps comply with requirements and serve intended purposes.

3.3 Access: Provide access space around plumbing pumps for service as indicated, but in no case less than that recommended by manufacturer.

3.4 In-Line Pump Support: Install pumps supported from piping system.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.

Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-16 sections. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.6 Piping Connections: Refer to Division-22 plumbing piping sections. Provide piping, valves, accessories, gauges, supports, and flexible connections as indicated.

3.6.1 Install strainer on inlet and shut-off valves on inlet and outlet of recirculation pumps.

3.6.2 Install check valve in rise from sump pumps.

3.6.3 Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer.

3.7 Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

3.8 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.9 Spare Parts: Provide spare fuses per Section 22 05 12.

END OF SECTION

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SECTION 22 11 24 - GAS SYSTEM

1 GENERAL

1.1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

1.2 Division-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.

1.3 Extent of gas systems work, is indicated on drawings and schedules, and by requirements of this section.

1.4 Excavation and backfill required in conjunction with gas service piping is specified in Division-22 sections, and is included as work of this section.

1.5 Codes and Standards

1.5.1 NFPA Compliance: Fabricate and install gas systems in accordance with NFPA 54 "National Fuel Gas Code".

1.5.2 Utility Compliance: Fabricate and install gas systems in accordance with local gas utility company requirements and standards.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data and installation instructions as follows:

1.6.1.1 Gas cocks and/or ball valves

1.6.1.2 Laboratory gas cocks

1.6.1.3 Gas appliance connectors.

1.6.1.4 Access doors

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for ball valves, lab gas cocks, appliance connectors, and gas vents. Include these data in O&M manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with NFPA 54 where applicable. Base pressure rating on gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in gas systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 Identification: Provide identification complying with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

2.3 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

2.3.1 Gas Service Piping:

2.3.1.1 All Pipe Sizes: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

2.3.1.2 Wrapping: Machine wrap pipe using 50% overlap wrap, with polyvinyl chloride tape. Hand wrap fittings using 100% overlap wrap extending 6" beyond fitting onto wrapped pipe. Comply with tape manufacturer's installation instructions.

2.3.1.3 Pipe Sizes ½" Through 12": Thermoplastic gas pressure pipe, tubing, and fittings complying with ASTM D 2513.

2.3.1.4 Pipe Sizes 2" Through 12": Reinforced epoxy resin gas pressure pipe and fittings complying with ASTM D 2517.

2.3.2 Building Distribution Piping:

2.3.2.1 Pipe Size 2" and Smaller: Black steel pipe; Schedule 40; malleable-iron threaded fittings.

2.3.2.2 Pipe Sizes 2" and Smaller: Gas piping within each laboratory shall be Type L hard drawn copper with silver solder brazed joints.

2.3.2.3 Pipe Size 2½" and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings.

2.4 Piping Specialties: Provide piping specialties complying with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

2.5 Sealants: Provide UL-listed or AGA approved sealants for gas piping.

2.6 Supports and Anchors: Provide supports and anchors complying with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

2.7 Valves: Provide valves complying with Division-22 Basic Plumbing Materials and Methods section “Valves” and in accordance with the following listing.

2.7.1 Gas Cocks 2" and Smaller: UL-listed, AGA approved, 150 psi non-shock WOG, full port, bronze straightway cock, flat or square head, threaded ends.

2.7.2 Gas Cocks 2½" and Larger: UL-listed, CGA approved, MSS SP-78; 175 psi, lubricated plug type, full port, semi-steel body, single gland, wrench operated, flanged ends.

2.7.3 Wrenches: Provide operating wrenches for all gas cocks serving boilers.

2.7.4 Acceptable Manufacturers for gas cocks: Subject to compliance with requirements, provide products of one of the following: Resun R1430 and R1431, Milliken 200M and 201M or approved equal.

2.7.5 Laboratory gas cocks are specified in Division-22 section "Plumbing Fixtures, Equipment and Trim".

2.8 Condensing Positive Pressure Gas Vents: Provide stainless steel positive pressure concentric vents of AL29-4C stainless steel. Vents shall be specifically designed for positive pressure condensing duty. The system shall include pipe, top, flashing cone, storm collar, joist shield, support plates, firestops, and fittings as required by the manufacturer for a complete installation. Acceptable Manufacturer: Subject to compliance with requirements, provide Metal Fab or approved equal.

2.9 Gas Meter and Regulator: Provided by local utility company.

2.10 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division-22 Basic Materials and Methods Section “Access Doors”.

3 EXECUTION

3.1 Examine areas and conditions under which gas systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer. Coordinate with gas supplier prior to starting work.

3.2 Install plumbing identification in accordance with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

3.3 Install gas piping in accordance with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings".

3.3.1 Use sealants on metal gas piping threads which are chemically resistant to gas. Use sealants sparingly, and apply to only male threads of metal joints.

3.3.2 Remove cutting and threading burrs before assembling piping.

3.3.3 Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged. Do not use bushings in the gas system.

3.3.4 Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping, or equipment connections are completed.

3.3.5 Ground gas piping electrically and continuously within project, and bond tightly to grounding connection.

3.3.6 Install drip-legs in gas piping where indicated, and where required by code or gas company requirements.

3.3.7 Install "Tee" fitting with bottom outlet plugged or capped, at bottom of pipe risers.

3.3.8 Use dielectric unions where dissimilar metals are joined together.

3.3.9 Install piping with 1/64" per foot (⅛%) downward slope in direction of flow.

3.3.10 Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hydronic piping above 200°F.

3.3.11 For piping underground beneath buildings, install in welded conduit. Extend conduit inside and terminate in accessible portion of building and seal. Extend conduit outside minimum of 4" from building, and vent above grade.

3.4 Gas Service: Arrange with utility company to provide gas service to indicated location with meter, pressure regulator and shutoff at terminus. Consult with utility as to extent of its work, costs, fees, and permits involved. The Owner shall pay such costs and fees and obtain permits.

3.5 Install piping specialties in accordance with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

3.6 Install supports and anchors in accordance with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

3.7 Installation of Valves:

3.7.1 Gas Cocks: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.

3.7.2 Locate gas cocks where easily accessible, and where they will be protected from possible injury.

3.8 Equipment Connections: Connect gas piping to each gas-fired equipment item, with drip leg and shutoff gas cock. Comply with equipment manufacturer's instructions.

3.9 Locate and coordinate installation of access doors for all valves and devices in accordance with Division-22 Basic Plumbing Materials and Methods section “Access Doors”.

3.10 Gas Vent Installation:

3.10.1 Install gas vents for all draft gas-fired appliances in accordance with NFPA 54 and the manufacturer's instructions. Provide all flashing and related materials.

3.10.2 Gas vents shall terminate at least 3 feet above the roof and 2 feet higher than any portion of a building within a horizontal distance of 10 feet.

3.10.3 Minimum vertical gas vent length is 5 feet.

3.10.4 Slope horizontal gas vent connectors upward at least ¼ inch per foot.

3.11 Piping Tests: Inspect, test, and purge gas systems in accordance with NFPA 54, local utility requirements, and Division-22 Basic Plumbing Materials and Methods section "Testing, Cleaning and Sterilization of Piping Systems".

3.12 O&M Training: Provide four hours in one session.

END OF SECTION

SECTION 22 13 13 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Hub-and-spigot, cast-iron soil pipe and fittings.
   2. Hubless cast-iron soil pipe and fittings.
   3. Ductile-iron, gravity sewer pipe and fittings.
   4. Ductile-iron, pressure pipe and fittings.
   5. ABS pipe and fittings.
   6. PVC pipe and fittings.
   7. Fiberglass pipe and fittings.
   8. Concrete pipe and fittings.
   9. Nonpressure-type transition couplings.
   10. Pressure-type pipe couplings.
   11. Expansion joints and deflection fittings.
   12. Backwater valves.
   13. Cleanouts.
   14. Encasement for piping.
   15. Manholes.
   16. Concrete.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Pipe and fittings.
   2. Non-pressure and pressure couplings
   3. Expansion joints and deflection fittings.
   4. Backwater valves.
   5. Cleanouts.

B. Shop Drawings: For manholes. Include plans, elevations, sections, details, and frames and covers.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:
   1. Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

2. Show system piping in profile. Draw profiles to horizontal scale of not less than 1 inch equals 50 feet and to vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

B. Product Certificates: For each type of pipe and fitting.

C. Field quality-control reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.7 FIELD CONDITIONS

A. Interruption of Existing Sanitary Sewerage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. N/A

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A74, Service class.

B. Gaskets: ASTM C564, rubber.

C. Calking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A888 or CISPI 301.

B. CISPI-Trademark, Shielded Couplings:

1. Description: ASTM C1277 and CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Charlotte Pipe and Foundry Company.
   c. Dallas Specialty & Mfg. Co.
   d. Fernco Inc.
   e. Mission Rubber Company, LLC; a division of MCP Industries.
   f. Tyler Pipe; a subsidiary of McWane Inc.

C. Heavy-Duty, Shielded Couplings:

1. Description: ASTM C1277 and ASTM C1540, with stainless-steel shield; stainless-steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ANACO-Husky.
   b. Clamp-All Corp.

c. Dallas Specialty & Mfg. Co.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. Tyler Pipe; a subsidiary of McWane Inc.

D. Cast-Iron, Shielded Couplings:
1. Description: ASTM C1277 with ASTM A48/A48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C564, rubber sleeve with integral, center pipe stop.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Clamp-All Corp.
d. Dallas Specialty & Mfg. Co.
e. MG Piping Products Company.
f. Mission Rubber Company, LLC; a division of MCP Industries.
g. Tyler Pipe; a subsidiary of McWane Inc.

E. Unshielded Couplings:
1. Description: ASTM C1277 and ASTM C1461, rigid, sleeve-type, reducing- or transition-type mechanical coupling, with integral, center pipe stop, molded from ASTM C1440, thermoplastic elastomer (TPE) material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ANACO-Husky.
b. Charlotte Pipe and Foundry Company.
c. Clamp-All Corp.
d. Dallas Specialty & Mfg. Co.
e. MG Piping Products Company.
f. Mission Rubber Company, LLC; a division of MCP Industries.
g. Tyler Pipe; a subsidiary of McWane Inc.

2.3 DUCTILE-IRON, GRAVITY SEWER PIPE AND FITTINGS

A. Pipe: ASTM A746, for push-on joints.

B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153/A21.53, ductile iron, for push-on joints.

D. Gaskets: AWWA C111/A21.11, rubber.

2.4 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Push-on-Joint Piping:
1. Pipe: AWWA C151/A21.51.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron.
3. Compact Fittings: AWWA C153/A21.53.
4. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe and fittings.

B. Mechanical-Joint Piping:
1. Pipe: AWWA C151/A21.51, with bolt holes in bell.
2. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, with bolt holes in bell.
3. Compact Fittings: AWWA C153/A21.53, with bolt holes in bells.

4. Glands: Cast or ductile iron; with bolt holes and high-strength, cast-iron or high-strength, low-alloy steel bolts and nuts.
5. Gaskets: AWWA C111/A21.11, rubber, of shape matching pipe, fittings, and glands.

2.5 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: ASTM D2661, with bell-and-spigot ends for gasketed joints.
1. NPS 3 to NPS 6: SDR 35.
2. NPS 8 to NPS 12: SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

2.6 PVC PIPE AND FITTINGS

A. PVC Cellular-Core Sewer Piping:
1. Pipe: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
2. Fittings: ASTM D3034, SDR 35 PVC socket-type fittings.

B. PVC Corrugated Sewer Piping:
1. Pipe: ASTM F949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F477, elastomeric seals.

C. PVC Profile Sewer Piping:
1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

D. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

E. PVC Gravity Sewer Piping:
1. Pipe and Fittings: ASTM F679, PS 75 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

F. PVC Pressure Piping:
1. Pipe: AWWA C900, Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 200 PVC pipe with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Water-Service Piping:
1. Pipe: ASTM D1785, Schedule 80 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D2467, Schedule 80 PVC, socket type.

2.7 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling; for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and include corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
   1. For Cast-Iron Soil Pipes: ASTM C564, rubber.
   2. For Concrete Pipes: ASTM C443, rubber.
   3. For Fiberglass Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
   4. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
   5. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
   1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dallas Specialty & Mfg. Co.
      b. Fernco Inc.
      c. Logan Clay Pipe.
      d. Mission Rubber Company, LLC; a division of MCP Industries.
      e. NDS Inc.
      f. Plastic Oddities.

D. Shielded, Flexible Couplings:
   1. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Mfg. Co.
      b. Dallas Specialty & Mfg. Co.
      c. Mission Rubber Company, LLC; a division of MCP Industries.

E. Ring-Type, Flexible Couplings:
   1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fernco Inc.
      b. Logan Clay Pipe.
      c. Mission Rubber Company, LLC; a division of MCP Industries.

F. Nonpressure-Type, Rigid Couplings:
   1. Description: ASTM C1461, sleeve-type, reducing- or transition-type mechanical coupling; molded from ASTM C1440, TPE material; with corrosion-resistant-metal tension band and tightening mechanism on each end.
   2. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. ANACO-Husky.

2.8 PRESSURE-TYPE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cascade Waterworks Mfg. Co.
   2. Dresser, Inc.

3. Ford Meter Box Company, Inc. (The).
4. Jay R. Smith Mfg. Co.
5. JCM Industries, Inc.
6. Romac Industries, Inc.
7. Victaulic Company.
8. Viking Johnson.

B. Tubular-Sleeve Couplings: AWWA C219, with center sleeve, gaskets, end rings, and bolt fasteners.

C. Metal, bolted, sleeve-type, reducing or transition coupling; for joining underground pressure piping. Include 200-psig minimum pressure rating and ends of same sizes as piping to be joined.

D. Gasket Material: Natural or synthetic rubber.

E. Metal Component Finish: Corrosion-resistant coating or material.

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:
1. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. EBAA Iron, Inc.
   b. Romac Industries, Inc.
   c. Star Pipe Products.

B. Ductile-Iron Expansion Joints:
1. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for expansion indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dresser, Inc.
   b. EBAA Iron, Inc.
   c. Jay R. Smith Mfg. Co.
   d. JCM Industries, Inc.

C. Ductile-Iron Deflection Fittings:
1. Description: Compound coupling fitting with ball joint, flexing section, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include rating for 250-psig minimum working pressure and for up to 15 degrees of deflection.
2. Manufacturers: Subject to compliance with requirements, provide products by the following:
   a. EBAA Iron, Inc.

2.10 BACKWATER VALVES

A. Cast-Iron Backwater Valves:
1. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. Tyler Pipe; a subsidiary of McWane Inc.
   d. WATTS.
   e. Zurn Industries, LLC.
3. Horizontal type; with swing check valve and hub-and-spigot ends.
4. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
5. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:
1. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Industries, LLC.

2.11 CLEANOUTS

A. Cast-Iron Cleanouts:
1. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
   f. Zurn Industries, LLC.
3. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:
1. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Industries, LLC.

2.12 ENCASEMENT FOR PIPING

A. Standard: ASTM A674 or AWWA C105/A21.5.

2.13 Deleted

2.14 CONCRETE

A. General: Cast-in-place concrete complying with ACI 318, ACI 350, and the following:
   1. Cement: ASTM C150/C150M, Type II.
   2. Fine Aggregate: ASTM C33/C33M, sand.
   3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
   4. Water: Potable.

B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
   1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
      a. Invert Slope: 1 percent through manhole.
   2. Benches: Concrete, sloped to drain into channel.
      a. Slope: 8 percent.

D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
   1. Reinforcing Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
   2. Reinforcing Bars: ASTM A615/A615M, Grade 60 deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure, drainage piping according to the following:
   1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
   2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   3. Install piping with 36-inch minimum cover.
   4. Install hub-and-spigot, cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
   5. Install hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
   6. Install ductile-iron, gravity sewer piping according to ASTM A746.
   7. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
   8. Install PVC cellular-core sewer piping according to ASTM D2321 and ASTM F1668.
   9. Install PVC corrugated sewer piping according to ASTM D2321 and ASTM F1668.
   10. Install PVC profile sewer piping according to ASTM D2321 and ASTM F1668.
   11. Install PVC Type PSM sewer piping according to ASTM D2321 and ASTM F1668.
   12. Install PVC gravity sewer piping according to ASTM D2321 and ASTM F1668.
   13. Install fiberglass sewer piping according to ASTM D3839 and ASTM F1668.
   14. Install nonreinforced-concrete sewer piping according to ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
   15. Install reinforced-concrete sewer piping according to ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main, pressure piping according to the following:
   1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place-concrete supports or anchors.
   2. Install piping with 36-inch minimum cover.
   3. Install ductile-iron pressure piping according to AWWA C600 or AWWA M41.
   4. Install ductile-iron special fittings according to AWWA C600.
   5. Install PVC pressure piping according to AWWA M23 or to ASTM D2774 and ASTM F1668.
   6. Install PVC water-service piping according to ASTM D2774 and ASTM F1668.

H. Install corrosion-protection piping encasement over the following underground metal piping according to ASTM A674 or AWWA C105/A21.5:
   1. Hub-and-spigot, cast-iron soil pipe.
   2. Hubless cast-iron soil pipe and fittings.
   3. Ductile-iron pipe and fittings.
   4. Expansion joints and deflection fittings.

I. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure, drainage piping according to the following:
   1. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
   2. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
   3. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
   4. Join ductile-iron, gravity sewer piping according to AWWA C600 for push-on joints.
   5. Join ABS sewer piping according to ASTM D2321 for elastomeric-seal joints.
   6. Join PVC cellular-core sewer piping according to ASTM D2321 and ASTM F891 for solvent-cemented joints.
   7. Join PVC corrugated sewer piping according to ASTM D2321.
   8. Join PVC profile sewer piping according to ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
   9. Join PVC Type PSM sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
   10. Join PVC gravity sewer piping according to ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasket joints.
   11. Join fiberglass sewer piping according to ASTM D4161 for elastomeric-seal joints.
   12. Join nonreinforced-concrete sewer piping according to ASTM C14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
   13. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.
   14. Join dissimilar pipe materials with nonpressure-type, flexible couplings.

B. Join force-main, pressure piping according to the following:
   1. Join ductile-iron pressure piping according to AWWA C600 or AWWA M41 for push-on joints.
   2. Join ductile-iron special fittings according to AWWA C600 or AWWA M41 for push-on joints.
   3. Join PVC pressure piping according to AWWA M23 for gasketed joints.
   4. Join PVC water-service piping according to ASTM D2855.
   5. Join dissimilar pipe materials with pressure-type couplings.

C. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Shielded flexible couplings for pipes of same or slightly different OD.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
   2. Use pressure pipe couplings for force-main joints.

3.4 MANHOLE INSTALLATION

A. General: Install manholes complete with appurtenances and accessories indicated.

B. Install precast concrete manhole sections with sealants according to ASTM C891.

C. Install FRP manholes according to manufacturer's written instructions.

D. Form continuous concrete channels and benches between inlets and outlet.

E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 6 inches above finished surface elsewhere unless otherwise indicated.

F. Install manhole-cover inserts in frame and immediately below cover.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318.

3.6 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping manholes or pits.

B. Install combination horizontal and manual gate-type valves in piping and in manholes.

C. Install terminal-type backwater valves on end of piping and in manholes. Secure units to sidewalls.

3.7 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and use cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18” by 18” by 6”deep. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

B. Connect force-main piping to building's sanitary force mains specified in Section 22 13 16 "Sanitary Waste and Vent Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of, and be flush with, inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.

4. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to grease, oil, and sand interceptors specified in Section 22 13 23 "Sanitary Waste Interceptors."

3.9 CLOSING ABANDONED SANITARY SEWER SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8-inch thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes: Excavate around manhole as required and use either procedure below:

1. Remove manhole and close open ends of remaining piping.
2. Remove top of manhole down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade according to Section 31 20 00 "Earth Moving."

3.10 IDENTIFICATION

A. Comply with requirements in Section 31 20 00 "Earth Moving" for underground utility identification devices. Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate report for each system inspection.
2. Defects requiring correction include the following:
   a. Alignment: Less than full diameter of inside of pipe is visible between structures.
   b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
   c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
   d. Infiltration: Water leakage into piping.
   e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to requirements of authorities having jurisdiction.

3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
    a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water and maintain such pressure without leakage for at least 15 minutes.
    b. Close openings in system and fill with water.
    c. Purge air and refill with water.
    d. Disconnect water supply.
    e. Test and inspect joints for leaks.
6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
    a. Test plastic gravity sewer piping according to ASTM F1417.
    b. Test concrete gravity sewer piping according toASTM C1628.
7. Force Main: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig.
    a. Ductile-Iron Piping: Test according to AWWA C600, "Hydraulic Testing" Section.
    b. PVC Piping: Test according to AWWA M23, "Testing and Maintenance" Chapter.
8. Manholes: Perform hydraulic test according to ASTM C969.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 22 13 13

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SECTION 22 13 16 - SOIL, WASTE AND VENT SYSTEM

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-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.

1.3 Extent of soil waste and vent systems work is indicated on drawings and schedules, and by requirements of this section.

1.4 Insulation for soil and waste systems is specified in other Division-22 sections, and is included as work of this section. Insulation requirements include:

1.4.1 Horizontal or vertical above grade waste pipes receiving discharge from ice machines, coolers, freezers or similar units to points of connection receiving waste from 4 or more fixtures.

1.4.2 Horizontal or vertical above grade waste pipes receiving condensate from air conditioning equipment to point of connection receiving waste from 4 or more fixtures.

1.5 Excavation and backfill required in conjunction with soil, waste and vent piping is specified in other Division-22 sections and is included as work of this section.

1.6 Refer to Division-7 section "Flashing and Sheet Metal" for flashings required in conjunction with soil and waste systems; not work of this section.

1.7 Code Compliance: Comply with applicable portions of Florida Building Code-Plumbing pertaining to plumbing materials, construction and installation of products. Comply with local utility requirements.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data for:

1.8.1.1 Cleanouts

1.8.1.2 Floor drains

1.9 O&M Data Submittals: Submit a copy of all approval submittals. Include these data in O&M manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in soil and waste systems. Where more than one type of materials or products is indicated, selection is Installer's option.

Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide green tape with black printing reading "CAUTION SEWER LINE BURIED BELOW".

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following listed for each item.

2.3 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

2.3.1 Above Ground Soil, Waste, and Vent Piping:

2.3.1.1 Copper tube; Type DWV; Cast-bronze fittings, drainage pattern, 50-50 solder-joint. Use for waste arms only. Connections to tapped cast iron fittings shall be made with C X MPT DWV soil pipe adapters. Connections to hub-cast iron fittings shall be made with C X SPIGOT DWV soil pipe adapters. Connections to no hub cast-iron fittings shall be made with C X NO HUB DWV soil pipe adapters.

2.3.1.2 Cast-iron hub-and-spigot soil pipe; service weight; cast-iron hub-and-spigot soil pipe fittings, lead and oakum joints.

2.3.1.3 Cast-iron hub-and-spigot soil pipe; cast-iron hub-and-spigot soil pipe fittings, compression gasket joints.

2.3.1.4 Hubless cast-iron soil pipe; service weight; hubless cast-iron soil pipe fittings, hubless joints.

2.3.1.5 Polyvinyl chloride plastic pipe (PVC); Type DWV; PVC plastic type DWV socket-type fitting, solvent cement joints. Do not use in fire-rated assemblies or return air plenums.

2.3.2 Underground Building Drain Piping (within 5 feet of the building):

2.3.2.1 Cast-iron hub-and-spigot soil pipe; service weight; cast-iron hub-and-spigot soil pipe fittings, lead and oakum joints.

2.3.2.2 Cast-iron hub-and-spigot soil pipe; cast-iron hub-and-spigot soil pipe fittings, compression gasket joints.

2.3.2.3 Pipe Size 6" and Smaller: Polyvinyl chloride sewer pipe (PVC); Type DWV; PVC plastic type DWV socket-type.

2.4 Pipe Specialties: Provide piping specialties complying with Division-22 Basic Materials and Methods section "Piping Specialties".

2.5 Supports and Anchors: Provide supports and anchors complying with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

2.6 Cleanouts: Provide factory-fabricated drainage piping products of size and type indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations. Josam, Jay R. Smith, Wade, Zurn, Watts.

2.6.1 Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1 countersunk head.

2.6.2 Cleanouts for Cast-Iron Piping Systems:

2.6.2.1 Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nickel-brass cover. Furnish with carpet marker style for carpeted floors. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with waterproof membrane. Wade W-6000 spigot outlet for Ty-Seal hub, W-6010 inside caulk, or W-6030 hub outlet for push-on as required.

2.6.2.2 Cleanouts in Piping: Cast-iron cleanout ferrule with threaded brass countersunk plug for caulked piping, Wade W-8550-D. For no-hub piping, furnish no-hub ferrule with W-8590-D threaded brass countersunk plug.

2.6.2.3 Wall Cleanouts: Cast-iron ferrule with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw. Wade W-8450-R for caulked joints. No-hub ferrule, Wade-8590-E plug, and Wade W-8480 cover for no-hub joints.

2.6.2.4 Grade Cleanouts: Cast-iron cleanout ferrule with threaded brass countersunk plug. Wade W-8530-D. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Wade W-7035-Z or equal.

2.6.2.5 Cleanouts in Paved Areas: Cast iron body, adjustable housing, ferrule with plug and round loose scoriated tractor cover. Wade W-8300-MF. Coordinate concrete depth at site with adjustable flange.

2.6.3 Cleanouts for PVC Systems:

2.6.3.1 Floor Cleanouts: Cast-iron body with adjustable head, brass plug, and scoriated nick-brass cover. Furnish with carpet marker style for carpeted floors. Furnish with recessed cover for tile floors. Furnish with clamping ring for floors with membrane. Wade W-6030 hub outlet for push-on.

2.6.3.2 Cleanouts in Piping: PVC cleanout adaptor with threaded PVC plug.

2.6.3.3 Wall Cleanouts: PVC cleanout adaptor with tapped, countersunk, threaded brass plug and round stainless steel access cover with screw. Wade W-840-R-75. Add same as above here.

2.6.3.4 Grade Cleanouts: PVC cleanout adaptor with countersunk, threaded brass plug. Wade W-8590-D plug. In sidewalks and other finished concrete, provide access cover frames with a non-tilting tractor cover. Wade W-7035-Z or equal.

2.6.3.5 Cleanouts in Paved Areas: Cast iron body, adjustable housing, ferrule with plug and round loose scoriated tractor cover. Wade W-8300-MF. Coordinate concrete depth at site with adjustable flange.

2.7 Floor Drains: Provide floor drains of size as indicated on drawings; and type, including features, as specified herein. Josam, Jay R. Smith, Wade, Zurn, Watts.

2.7.1 Floor Drains: Provide inside caulk bottom outlet or TY-Seal hub outlet with adaptor for cast iron trap installation and a 4" deep trap seal. Provide clamping rings for floors with membrane.

2.7.2 Strainer: Provide 5" square satin-nickel bronze strainer.

2.7.3 Trap Primer Connection: Provide ½" trap primer tapping.

2.7.4 Funnel: Provide funnel where shown on the drawings.

2.7.5 Basis of Design: Wade Series 1100.

3 EXECUTION

3.1 Examine substrates and conditions under which soil and waste systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 Piping Installation:

3.2.1 Install above grade soil and waste piping in accordance with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", and with Florida Building Code-Plumbing.

3.2.2 Install underground soil and waste pipes as indicated and in accordance with Florida Building Code-Plumbing. Lay underground piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work

stops.

3.2.3 Install building soil and vent piping pitched to drain at minimum slope of ¼" per foot (2%) for piping 2½" and smaller, and 1/8" per foot (1%) for piping 3" and larger.

3.3 Install piping specialties in accordance with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

3.4 Install supports and anchors in accordance with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

3.5 Installation of Cleanouts: Install in above ground piping and building drain piping as indicated, as required by Florida Building Code-Plumbing; and at each change in direction of piping greater than 45°; at minimum intervals of 100'; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

3.5.1 Size: Cleanouts shall be full size up to 4". Piping over 4" shall have a reducing fitting to accommodate a 4" cleanout unless indicated otherwise on drawings.

3.5.2 Install cleanouts to allow adequate clearance for rodding. Cleanouts on piping 6" and smaller piping shall have a minimum of 18" clearance; cleanouts on piping 8" and larger shall have 36" clearance.

3.5.3 Protect all finished surfaces of cleanouts with a suitable adhesive covering until construction is completed.

3.5.4 Cleanouts to Grade: Provide an 18" x 18" x 8" thick concrete pad around the cleanout. Set the cleanout ferrule, adapter, or access cover frame in the concrete as required. The cleanout shall be extended to the finished grade. The concrete pad shall slope away from the cleanout in all directions approximately one inch. Cover pad with fill to finished grade.

3.5.5 Cleanouts in Paved Areas: Provide concrete pad similar to cleanout to grade and coordinate concrete depth at site with adjustable flange. Access cover frames are required.

3.6 Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through waterproof membranes.

3.7 Vent Flashing Sleeves: Install on stack passing through roof, secure to stack flashing in accordance with manufacturer's instructions.

3.8 Installation of Floor Drains: Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

3.8.1 Coordinate flashing work with work of waterproofing and adjoining substrate work.

3.8.2 Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

3.8.3 Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

3.8.4 Position drains so that they are accessible and easy to maintain.

3.9 Connection of Trap Primers: Connect trap primers as indicated, and in accordance with manufacturer's installation instructions. Pitch piping towards drain trap, minimum of 1/8" per foot (1%). Adjust trap primer for proper flow.

3.10 Piping Runouts to Fixtures: Provide soil and waste piping runouts to plumbing fixtures and drains, with approved trap, of sizes indicated, but in no case smaller than required by Florida Building

Code-Plumbing.

3.11 Test, clean, flush, and inspect soil and waste piping in accordance with requirements of Division-22 Basic Plumbing Materials and Methods section "Testing, Cleaning and Sterilization of Piping Systems".

3.12 Television Inspection: On completion of all work, TV all sanitary piping and submit videotapes to document that all gravity piping below grade is clean and fee of dirt and debris.

END OF SECTION

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SECTION 22 40 00 - PLUMBING FIXTURES, EQUIPMENT, TRIM & SCHEDULE

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-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.

1.3 Extent of plumbing fixtures work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to Division-26 sections for field-installed electrical wiring required for plumbing fixtures; not work of this section.

1.5 Codes and Standards:

1.5.1 Plumbing Fixture Standards: Comply with applicable portions of Florida Building Code- Plumbing pertaining to materials and installation of plumbing fixtures.

1.5.2 ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.

1.5.3 PDI Compliance: Comply with standards established by PDI pertaining to plumbing fixture supports.

1.5.4 UL Listing: Construct plumbing fixtures requiring electrical power in accordance with UL standards and provide UL-listing and label.

1.5.5 ANSI Compliance: Construct and install barrier-free plumbing fixtures in accordance with ANSI Standard A117.1 "Accessible and Useable Buildings and Facilities."

1.5.6 Accessible Design: Construct and install barrier-free plumbing fixtures in accordance with Chapter 11, Florida Building Code.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, furnished specialties and accessories; and installation instructions. Submit manufacturer's assembly-type drawings indicating dimensions, roughing-in requirements, required clearances, and methods of assembly of components and anchorages. The submittal shall be organized by "fixture number" and each fixture package shall be so identified. Each fixture package shall include all of the required fitting and trim, even if such devices are used for more than one fixture.

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for each type of plumbing fixture and accessory; including "trouble-shooting" maintenance guide. Include these data in O&M manual.

1.8 Handle plumbing fixtures carefully to prevent breakage, chipping and scoring fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

2 PRODUCTS

2.1 General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide trim, carrier, seats, and valves as specified. Where not specified, provide products as recommended by manufacturer, and as required for complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.2 Model Numbers: Basis of design model numbers of a particular manufacturer are listed in the fixture schedule as an aid to contractors. Where conflicts between the model number and the written description occur, the written description shall govern. Where acceptable manufacturers are listed, products are subject to compliance with requirements.

2.3 Materials:

2.3.1 Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.

2.3.2 All fixtures shall be white vitreous china unless otherwise specifically noted. Where enameled iron fixtures are specified, they shall be furnished with acid resisting enamel.

2.3.3 Where fittings, trim and accessories are exposed or semi-exposed provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.

2.3.4 Stainless Steel Sheets: ASTM A 167, hardest workable temper. Finish shall be No. 4, bright, directional polish on exposed surfaces.

2.3.5 Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASTM C 554.

2.3.6 Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.

2.4 Plumbing Fittings, Trim and Accessories:

2.4.1 Faucets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality chrome-plated, cast-brass faucets, valves, or other dispensing devices, of type and size indicated, and as required to operate as indicated.

2.4.1.1 Automatic Faucets: Provide battery powered electronic sensor-operated faucets with 0.5 gpm vandal-resistant spray head. Set volume adjustment at 0.25 gallons per operation.

2.4.1.2 Aerators: Provide aerators of types approved by Health Department having jurisdiction.

2.4.1.3 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Delta, Moen.

2.4.2 Stops: Provide chrome-plated brass, angle type, manual shutoff valves and ⅜" chrome-plated flexible supply pipes to permit fixture servicing without shutdown of water supply piping systems for all fixtures. Coordinate with fixture requirements.

2.4.2.1 Provide loose key stops, 1/4 turn ball type. Basis of Design - Brasscraft KT series.

2.4.2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Brasscraft, Chicago, McGuire, or Proflo.

2.4.3 Waste Outlets: Provide removable P-traps, drains, waste arms, tailpieces and wastes-to-wall where drains are indicated for direct connection to drainage system for all fixtures unless otherwise noted. Provide drains, tailpieces and waste arms where indirect drains are indicated. Waste outlets shall be full size of fixture drain connection.

2.4.3.1 Provide chrome-plated cast-brass P-traps and drains with cleanout.

2.4.3.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Brasscraft, McGuire, or Proflo.

2.4.4 Insulation Kit: Provide preformed flexible, vinyl insulation kits for hot and cold water supplies and for waste where indicated. True Bro Model #102 or approved equal.

2.4.5 Flush Valves: Provide quiet-flush, chrome-plated, cast-brass flush valves with vacuum breaker and screwdriver stop. Where handicap service is indicated, provide ADA compliant handles with the handle on the wide side of the stall.

2.4.5.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Sloan Valve Co..

2.4.6 Carriers: Provide cast-iron short foot carriers for water closets, urinals, lavatories, electric water coolers of either graphitic gray iron, ductile iron, or malleable iron or steel as indicated. Coordinate with specific fixture requirements and conditions of the project.

2.4.6.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Josam, Wade, Zurn, J.R. Smith, Mifab or Watts.

2.4.7 Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

2.4.8 Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome-plated brass escutcheons with friction clips.

2.4.9 Comply with additional fixture requirements listed for each fixture and as required for a complete and functional system.

2.5 Water Closets:

2.5.1 General: Provide white china siphon jet type unless otherwise noted.

2.5.1.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. American Standard, Kohler.

2.5.2 Fixture Seats: Provide white, heavy molded plastic fixture seats with stainless steel self-sustaining check hinges.

2.5.2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Bemis Mfg. Co., Beneke Corp., Church, Sperzel, Olsonite, Centaco, Proflo.

2.5.3 Water Closet Schedule:

2.5.3.1 WC1 Floor-Mounted Flush Valve Water Closet: Provide standard floor-mounted elongated bowl water closet with 1½" top spud and automatic flush valve. Provide open front seat with stainless steel, self sustaining check hinges, less cover.

Water Closet	American Standard 3451001 [1.28 gpf]
Seat	Bemis 1655SSCT
Automatic Flush Valve Battery	Sloan G2 8111

2.5.3.2 WC2 Accessible Floor-Mounted Flush Valve Water Closet: Provide floor-mounted elongated bowl water closet with 1½" top spud and automatic flush valve. Provide open front seat with stainless steel, self sustaining check hinges, less cover .

Water Closet	American Standard 2854.128 [1.28 gpf]
Seat	Bemis 1655SSCT
Automatic Flush Valve Battery	Sloan G2 8111

2.6 Urinals:

2.6.1 General: Provide white china siphon jet wall hung type with ¾" top spud and 2" outlet unless otherwise noted. Provide short foot carrier with top and bottom hanger plates.

2.6.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Sloan.

2.6.3 Urinal Schedule:

2.6.3.1 UR6 Handicap Urinal: Provide handicap urinal with 0.125 gpf automatic flush valve.

Urinal and Automatic Battery Type Flush Valve	Sloan WEUS 1000.1401

2.7 Lavatories:

2.7.1 General: Provide white china lavatories.

2.7.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Bradley.

2.7.3 Lavatory Schedule:

2.7.3.1 L18 Accessible Wall Mount Lavatory with Battery Operated Automatic Faucet: Provide accessible 29 ¾" x 21" wall mounted oval lavatory with ADA compliant automatic hand-washing faucet. Provide handicap type waste and grid drain. Provide insulation kit for supply and waste. Provide 0.35 gpm aerator. Provide support bracket per manufacturer requirements.

Lavatory	Bradley LVADI
Faucet	Bradley S53-3700-R-T-3-PC
Grid Drain	McGuire 155 WC
Insulation Kit	Truebro Model 102
Mixing Valve	Watts LFMMVMI-US
Soap Dispenser	Bradley 6-3700-R-F/L-T-PC-A14-030

2.8 Electric Water Coolers:

2.8.1 General: Provide self-contained hands free electric water cooler with entire water system free of lead. All joints shall be made using silver solder. Units shall be complete with an air-cooled refrigeration system consisting of a hermetic compressor, cooler, pre-cooler, condenser fan, thermostat safety controls and all other related devices. The unit shall have a capacity of 8 gallons per hour. The cabinet shall be stainless steel with vermin proof insulation. The top shall be fabricated of stainless steel with a No. 4 finish. Provide sensor, operator, transformer and all related controls for fully automatic operation. Where handicap units are indicated, the bubbler and fountain shall be ADA compliant.

2.8.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Elkay Mfg. Co., Halsey Taylor Div., Haws Drinking Faucet Co., Sunroc, Oasis.

2.8.3 Electric Water Cooler Schedule:

2.8.3.1 EWC6 Wall Hung Electric Water Cooler with Bottle Filler: Provide ADA compliant hands free wall hung dual units with filtered bottle filler. Bottle filler shall be on the high side of the dual unit. Provide replacement filter 3 pack for each EWC.

Electric Water Cooler	Elkay LZSTL8WSLP
Replacement Filter Pack	Elkay 51300C 3PK

2.9 Drinking Fountains:

2.9.1 General: Provide 18-gauge stainless steel drinking fountain with the entire water system free of lead. Where handicap units are3 indicated, the bubbler and fountain shall be ADA compliant.

2.9.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each ite. Elkay Mfg. Co., Halsey Taylor Div., Haws Drinking Faucet Co..

2.9.2.1 Drinking Fountain Schedule:

2.9.2.2 DF3 Handicap Two Level Drinking Fountain with Bottle Filler: Provide ADA compliant handicap two-level wall-hung drinking fountain with front push bar and bottle filler. Provide vandal-resistant bottom cover plates and wall mounting plate.

Drinking Fountain with Bottle Filler	Elkay LVRCTLDDWSK

2.10 Mop Receptors:

2.10.1 General: Provide one piece mop receptors with 3" integral stainless steel grid drain. Provide wall-mounted faucet with arm handles, vacuum breaker, stops, hose connection and hose bracket. Provide 30" hose.

2.10.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Stern-Williams Co., Fiat.

2.10.3 Mop Receptor Schedule:

2.10.3.1 MR1 Square Drop Front Mop Receptor: Provide 24" x 24" precast terrazzo mop receptor with 12" high shoulders and 6" drop front. Provide stainless steel caps on all curbs. Provide two panel stainless steel wall guard.

Mop Receptor 24" x 24"	Fiat TSB - 3000
Faucet	Fiat 830-AA
Hose and Bracket	Fiat 832-AA
Wall Guard	Fiat MSG 2424

2.11 Stainless Steel Sinks:

2.11.1 General: Provide Type 302, self-rimming stainless steel back ledge with No. 4 finish . Provide sound deadening material on the sides and bottom of the sink. Provide grid drain or strainer with removable crumb cup and stopper as indicated.

2.11.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Elkay, Just

2.11.3 Stainless Steel Sink Schedule:

2.11.3.1 SK 1 Single Compartment Sink: Provide 24" x 18 2/7" x 9 ¾ " deep under-mount single compartment stainless steel sink with pull down top mount hot and cold water supply fitting with gooseneck spout and 1.5 gpm aerator. Provide spray head. Provide grid strainer.

Sink	Kohler K-3822
Faucet	Kohler K-22972
Strainer	Elkay LK-18
Mixing Valve	Watts LFMMVMI-US

2.12 Showers:

2.12.1 General: Showers are field built tile stalls. Provide a 2" floor drain. See architectural drawings for water proofing membrane details.

2.12.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Delta.

2.12.3 Shower:

2.12.3.1 SH-2 Shower (Handicap): Provide ADA compliant, polished chromium-plated built-in pressure balancing shower fitting with white index, metal handle, spring loaded check stops, and adjustable safety limit stop. Provide wall shower with ½" IPS female coupling inlet, 69" of

flexible rubber lined metal hose with in-line vacuum breaker, handspray and 36" adjusting bar with hand shower slide bracket, all chrome-plated. Provide 1.5 gpm valve and check valves on hot and cold water pipes.

Mixing Valve and Shower Head	Delta T17TH155-25 with R10000-UNWS mixing valve.
Low Flow Shower Head	Delta 59462-B15-BG

2.13 Water Heaters:

2.13.1 Gas Water Heaters:

2.13.2 General: Provide AGA certified, sealed combustion, gas fired, direct vent instantaneous water ehater, factory assembled and tested, requireing only connection to services. Water heates whall be equipped with automatic thermostats, automatic operated main gas valve, gas pressure regulator, hot surface ignition, micro processor diagnostic control panel and LED function display. Provide three year guarantee. Water heater energy efficiency shall comply with ASHRAE 90, latest edition. Provide an ASME temperature and pressure relief and shut-off valves and outlet. Provide metal exhaust termination fittings.

2.13.3 Water Heater Schedule:

2.13.3.1 WH-1: Rinnai CU199i, 199,000 MBH

2.14 Emergency Showers and Eyewashes:

2.14.1 General: Provide full flow stay-open ball valve style with universal emergency sign. Finish shall be safety green paint. Unit shall be factory tested and comply ANSI Z 358.1.

2.14.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Bradley Corp., Western, Speakman, Guardian.

2.14.3 Emergency Shower and Eyewash Schedule:

2.14.3.1 ES-2 Recessed Emergency Shower/Eye Wash: Provide recessed safety station shower and eye wash combination with free standing drench shower, 1" stay-open shower valve, ½" stay open eyewash valve, hand operated eye wash with soft stream head and stainless steel bowl, floor flange and intermediate piping. Provide sign and handicap logo.

Shower and eye wash station	Guardian GBF2170

2.15 Lab Fixtures:

2.15.1 General: Coordinate with Division 11 and lab drawings.

2.15.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following for each item. Chicago Faucet.

2.15.3 Lab Fixture Schedule:

2.15.4 LS-1 Single Compartment Laboratory Sink: Sink by casework supplier. Provide hot and cold water deck mounted rigid gooseneck faucet with 4" wrist blades, supply fittings with water saving aerator, vacuum breaker, strainer 1½" tailpiece drain, 1½". Provide angle stops to wall with ⅜" flexible supplies.

Faucet	Chicago Faucet 930-GN8BVBE7-317XKCP
Supplies	McGuire 165K

2.16 IK-1 Ice Maker Kit: Provide 6" x 6" x 3½" plastic recessed wall box with wall flange, compression valve with brass seat installed through box. Provide approximately 10 linear feet ¼" O.D. soft copper with compression fitting in tight coil.

Valve and Box C.P. Industries 9000

2.16.1 IM-1 Ice Machine: Ice machine will be furnished under Division 11 of these specifications. Install all required plumbing and put ice machine in service. Provide ⅜" F.P.T. cold water connection to ice making water inlet from filter. Install filter unit (furnished with the ice machine) on the wall and ½" cold water piping to the filter with ball valve. Connect ½" F.P.T. to ice making water drain. Provide ¾" copper piping indirect waste piping from this ½" connection to the floor drain funnel. Connect separate ¾" F.P.T. to bin drain and provide ¾" copper indirect waste to the floor drain funnel. Wastes shall not be connected together. Use only drainage fittings, soldered. Provide cleanouts. Insulate with 1" foamed plastic to prevent sweating. Anchor waste piping to unit. Provide 6" x 6" x 3½" plastic recessed wall box with wall flange, compression valve with brass seat installed through box. Provide approximately 10 linear feet ⅜" O.D. soft copper with compression fitting in tight coil.

Valve and Box C.P. Industries 9000

2.17 FS-1 Floor Sink: Provide square top, stainless steel floor sink with round sump, stainless steel wire sediment basket and beehive dome strainer. Provide unit without grate for concealed locations under equipment and with full grate at exposed applications.

Floor Sink Wade W-9100 4" Size

2.18 LC-3 Lab Cocks Deck-Mounted: Provide double outlet gas lab cocks: Two No. W-242 chrome-plated straight ground key hose cock, No. W-245-2 Two-way 180° outlet turret, 3/8" female thread bottom inlet, integral tapered ten-serration hose tip with color-coded index.

Gas Hose Cock Kewaunee-W-266

3 EXECUTION

3.1 Examine roughing-in work of potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing fixtures of types indicated where shown and at indicated heights. Install in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Install in accordance with ADA and applicable handicap code requirements. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements of Florida Building Code - Plumbing pertaining to installation of plumbing fixtures. Furnish templates for cut-outs in countertops. Coordinate exact fixture locations with countertop shop drawings.

3.3 Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement. Mount at heights shown on the drawings. Fixture heights are floor-to-rim distance. Fitting heights are to centerline.

3.4 Install stop valve in water supply to each fixture.

3.5 After fixtures are set, the crack between the fixture and wall shall be caulked with DAP silicone-based caulking, or approved equal.

3.6 Protect installed fixtures from damage during remainder of construction period.

3.7 Provide a galvanized steel drain pan under all water heaters, not less than 24 gauge thickness and not less than 1½" deep. Provide 3/4" drain pipe.

3.8 Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and

replace with new units and proceed with retesting.

3.9 Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

3.10 Clean plumbing fixtures, trim, aerators, and strainers of dirt and debris upon completion of installation.

3.11 Adjust water pressure at faucets, shower valves, and flush valves to provide proper flow stream and specified gpm.

END OF SECTION

SECTION 22 67 13 - DI WATER SYSTEM

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-22 Basic Plumbing Requirements and Basic Plumbing Materials and Methods sections apply to work of this section.

1.3 Extent of DI water systems work is indicated on drawings and schedules, and by requirements of this section.

1.4 Approval Submittals:

1.4.1 Product Data: Submit manufacturer's technical product data and installation instructions for the following.

1.4.1.1 Piping.

1.4.1.2 Valves.

1.4.1.3 Meter and Gauges.

1.4.1.4 Short Circuit Current Ratings (SCCR):

1.4.1.5 All controls panels and enclosures shall have SCCR labeling per NEC.

1.4.1.6 Provide equipment with SCCR suitable for location installed.

1.4.1.7 Contact engineer for maximum available fault current at equipment prior to providing approval submittals so SCCR can be included in approval submittals.

1.4.1.8 In no case shall the SCCR be less than the following:

1.4.1.8.1 For equipment rated 100 amps and higher the minimum SCCR shall be 65 kA.

1.4.1.8.2 For equipment rated 50 amps and lower than 100 amps the minimum SCCR shall be 35 kA.

1.4.1.8.3 For equipment rated 20 amps and lower than 50 amps the minimum SCCR shall be 20 kA.

1.4.1.8.4 For equipment rated 20 amps the minimum SCCR shall be 10 kA.

1.5 Test Reports and Verification Submittals:

1.5.1 Submit report on cleaning and sterilization of piping systems.

1.5.2 Submit startup report for equipment.

1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for valves. Include these data in O&M Manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with Florida Building Code - Plumbing where applicable. Provide sizes and types matching pipe materials used in DI water systems. Where more than one type of

materials or products are indicated, selection is Installer's option.

2.2 Identification: Provide identification complying with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

2.3 Pipes and Fittings: Provide pipes and pipe fittings complying with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

2.3.1 Interior Water Piping: Schedule 80 CPVC, NSF labeled.

2.4 Piping Specialties: Provide piping specialties complying with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

2.5 Supports and Anchors: Provide supports and anchors complying with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

2.6 Valves: Provide valves in accordance with the following listing:

2.6.1 Sectional and Shutoff Valves: Ball valves, Schedule 80 CPVC, full port. Spears or equal.

2.6.2 Drain Valves: Ball valves, Schedule 80 CPVC, full port. Spears or equal.

2.6.3 Check Valves: Schedule 80 CPVC. Spears or equal.

2.7 Meters and Gauges: Provide meters and gauges in accordance with the following listing:

Rotometer for total flow measurement.
Pressure gauges.

3 EXECUTION

3.1 General: Examine areas and conditions under whichDI systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Install plumbing identification in accordance with Division-22 Basic Plumbing Materials and Methods section "Plumbing Identification".

3.3 Install water distribution piping in accordance with Division-22 Basic Plumbing Materials and Methods section "Pipes and Pipe Fittings".

3.3.1 Install piping with 1/32" per foot (1/4%) downward slope towards drain point.

3.3.2 Locate groups of pipes parallel to each other, spaced to permit servicing of valves.

3.4 Install piping using 45° ells. Use no 90° ells. Install piping such that dead-legs do not exceed 6 pipe diameters.

3.5 Install piping specialties in accordance with Division-22 Basic Plumbing Materials and Methods section "Piping Specialties".

3.6 Install supports and anchors in accordance with Division-22 Basic Plumbing Materials and Methods section "Supports and Anchors".

3.7 Install valves in accordance with Division-22 Basic Plumbing Materials and Methods section "Valves".

3.7.1 Shutoff Valves: Install on inlet and outlet of each equipment item and elsewhere as indicated.

3.7.2 Drain Valves: Install on each equipment item located to completely drain equipment for service

or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain system.

3.8 Install meters and gauges in accordance with Division-22 Basic Plumbing Materials and Methods section "Meters and Gauges".

3.9 Install equipment and startup, checkout and put in operation. Submit startup report.

3.10 Piping Tests: Test, clean, and sterilize potable water piping in accordance with testing requirements of Division-22 Basic Plumbing Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems" and the system supplier requirements to certify the system. Submit report.

3.11 Spare Parts: Provide spare fuses per Section 22 05 12.

END OF SECTION

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SECTION 22 99 15 - ACCESS DOORS

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 section making reference to or requiring access panels specified herein.

1.3 Approval Submittals:

1.3.1 Product Data: When required by other Division-22 sections, submit product data for access doors. Submit with Division-22 section using access doors, not as a separate submittal. Include rating data.

1.4 O&M Data Submittals: Submit a copy of approval submittal. Include this data in O&M Manuals.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Milcor, Jay R. Smith, Zurn, BOICO, Elmdor, or approved equal.

2.2 General: Where floors, walls and ceilings must be penetrated for access to plumbing work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

2.3 Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gauge frames and 14-gauge flush panel doors; 175° swing with concealed spring hinges; flush screw-driver-operated cam locks; factory-applied rust-inhibitive prime-coat paint finish.

2.4 Locks: Where indicated, provide flat pass key type, individually keyed unless otherwise indicated, 2 keys.

2.5 Fire Rated Access Doors: Where required furnish with 20-gauge insulated sandwich panel, automatic closing mechanism, cylinder type lock (self-latching with inside release mechanism), and continuous concealed steel hinge pin. Access doors shall carry the UL 1-½ hour "B" label.

2.6 Corrosion Resistant Access Doors: Where required in seawater labs and similar spaces, provide high impact resistant plastic access doors with snap latches. Surface finish shall accept paint to match ceiling. Acudor PA-3000, Babcock-Davis B-PL Series, or equal

3 EXECUTION

3.1 Access doors shall be installed to operate and service all plumbing equipment including valves, dampers, duct access panels, and other items requiring maintenance that are concealed above or behind finished construction. Access doors shall be installed in walls, chase and floors as necessary, but are not required in accessible suspended ceiling systems. Access doors shall have factory applied protective phosphate coating and baked enamel primer suitable for field painting.

3.2 Access doors shall be installed by the Division installing the substrate construction. However, responsibility for furnishing and determining location of access doors is part of this Division's work. The style of access door shall be suitable for construction into which installed.

3.3 Access doors shall be sized and located as required to provide proper maintenance and service access in accordance with the manufacturer's recommendations and code authority requirements for all devices and equipment.

END OF SECTION

SECTION 22 99 16 - TESTING, CLEANING, AND STERILIZATION OF PIPING SYSTEMS

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-22 Basic Plumbing Materials and Methods section, and is part of each Division-22 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.

2 PRESSURE TESTS

2.1 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.

2.2 Required test period is 2 hours.

2.3 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.

2.4 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.

2.5 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.

2.6 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.

2.7 Pressure Test Requirements:

2.7.1 Soil, Waste and Vent: Test all piping within the building with a 5 foot head of water. Test piping in sections so that all joints are tested. Provide test tees as required. A smoke test can be used at the Contractor's option.

2.7.2 Domestic Water and Deionized Water Perform hydrostatic test on all piping within the building at twice the normal static pressure at service point, but not less than 100 psig. Once tested, flush out piping and leave under pressure of the supply main or 40 psig for the balance of the construction period.

3 CLEANING AND STERILIZATION

3.1 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.

3.2 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.

3.3 Sterilization of Domestic Water Systems:

3.3.1 Prerequisites: All new hot and cold water piping installed (complete), all fixtures connected, system flushed out, and system filled with water.

3.3.2 The shut off valve at the water main shall be closed, all fixture outlets opened slightly, and a sterilizing solution shall be introduced at a manifold connection installed by the Contractor at the point of connection.

3.3.3 The solution shall contain 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or calcium hypochlorite. The solution shall be allowed to stand in the system for at least eight hours after which the entire system shall be flushed.

3.3.4 After final flushing, all aerators shall be removed, cleaned, and reinstalled. After final flush the residual chlorine shall not exceed 0.2 parts per million.

3.3.5 The Architect/Engineer shall be notified 24 hours prior to the procedure so that it can be witnessed.

3.3.6 Provide sampling and certified report by an independent testing lab. Provide written Health Department approval of disinfection samples.

3.4.6 Water samples shall be tested at HRS/Alachua County Public Health Unit, Environmental Health Division. Contractor shall pay the fee charged for this test. Test results are to be forwarded to the UF Project Manager and Physical Plant Division, Operations Engineering Section before service is turned on. A representative from PPD Operations Engineering shall be present during the water sampling.

3.4.7 Flushing, cleaning, sterilization and pressure testing procedures shall comply with State of Florida Health Standards.

END OF SECTION

SECTION 23 00 00 - MECHANICAL GENERAL

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 Related Documents:

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

1.2.2 This is a Basic Mechanical Requirements Section. Provisions of this section apply to work of all Division 23 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.

1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale mechanical drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed

within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and 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.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Approval Submittals:

1.9.1 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 and the following.

1.9.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.9.1.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.9.1.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.9.1.4 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.

1.9.1.5 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 cover sheet.

1.9.1.6 Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number 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.

1.9.1.7 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 coordinate with the electrical contractor and resolve all required electrical design changes (wire and conduit size, breaker 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.

1.9.1.8 Submittals shall be in searchable PDF format and not a scanned copy.

1.9.1.9 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.9.2 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.

1.9.3 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.

1.9.4 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 ¼" 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. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 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.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.4 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.

2.3.5 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.

2.3.6 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:

2.3.6.1 Principal of operation.

2.3.6.2 Materials of construction or finishes.

2.3.6.3 Thickness of gauge of materials.

2.3.6.4 Weight of item.

2.3.6.5 Deleted features or items.

2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 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.

3.2.2 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.

3.2.3 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.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction.

He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Construction Mechanical Utilities: Provide all temporary wiring for power and light required for construction purposes and remove such temporary wiring when use is no longer required.

3.4 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.5 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.

3.6 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.

3.7 Cutting and Patching: Contractor shall provide 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.

3.8 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.9 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 by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

3.10 HVAC Protection: The Contractor shall protect all HVAC equipment from both dust and odors and seal all duct, pipe and equipment openings with plastic. Prevent dust, debris and foreign materials from entering the ductwork, piping and equipment. If the HVAC system is operated during construction, the Contractor shall install and maintain temporary filters over grilles and openings. To comply with the FGBC credit requirements, the filtration medium must have a rating of MERV 8 or better. If an unducted plenum over the construction zone must be used, the Contractor shall isolate it by having all ceiling tiles in place. The Contractor shall check for leaks in the return ducts and air handlers and make needed repairs promptly.

3.10.1 The Contractor shall replace all filtration media just before occupancy, installing only a single set of final filtration media.

3.11 FGBC Indoor Air Quality (IAQ): Complete the construction IAQ management plan before construction begins. The plan shall include agenda items to be discussed regularly at preconstruction and construction meetings. Continually educating subcontractors and field personnel and giving them the proper resources (e.g., collection bins, cleaning tools and materials) reinforces the importance of following the plan's procedures and encourage their compliance. The contractor shall appoint an indoor air quality manager and take responsibility for identifying problems and implementing solutions. Provide control measures in five areas : HVAC protection (see previous paragraph), source control, pathway interruption, housekeeping, and scheduling.

Review applicability of each control measure and include those that apply in the final construction IAQ management plan. The control measures are as follows.

3.11.1 Source Control: The construction IAQ Management Plan should specify the control measures for materials containing VOCs. The Contractor shall cover, isolate and ventilate containers housing toxic materials.

3.11.2 Pathway Interruption: During construction, the contractor must isolate areas of work to prevent contamination of clean or occupied spaces. The Contractor shall exhaust contaminated air directly to the outside during installation of VOC-emitting materials. Depressurizing the work area will allow the air pressure differential between construction and clean areas to contain dust and odors. The contractor shall provide temporary barriers that contain the construction area.

3.11.3 Housing: The contractor shall institute cleaning activities designed to control contaminants in building spaces during construction and before occupancy. The contractor shall protect all porous building materials from exposure to moisture and store them in a clean area before installation. The contractor shall use vacuum cleaners with high-efficiency particulate filter and use wetting agents for dust.

3.11.4 Scheduling: The contractor shall sequence construction activities carefully over the duration of the project to minimize the impact on IAQ. If necessary, conduct activities with high pollution potential during off hours, such as weekends or evenings, to allow time for new materials to air out. The contractor shall plan adequate time to conduct flush-out and IAQ test procedures before occupancy. Upon completion of construction, the contractor shall replace all filtration media just before occupancy.

3.12 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 and leave premises free from debris and in a safe condition.

3.13 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.

3.14 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.

3.15 Record (As Built) Drawings:

3.15.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

3.15.2 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.16 Acceptance:

3.16.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.16.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.16.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.16.3.1 Submit training syllabi prior to training for owner review.

3.16.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.16.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.16.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.16.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.16.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.16.4.1.2 Complete wiring and control diagrams.

3.16.4.1.3 Routine maintenance operations.

3.16.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.16.4.1.5 Copies of final approved version of Approval Submittals.

3.16.4.1.6 Copies of all manufacturer's warranties.

3.16.4.1.7 Copies of Test Reports and Verification Submittals.

3.16.4.2 All included information shall comply with the following:

3.16.4.2.1 Remove all non-related information from O&Ms.

3.16.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.16.5 Record Drawings: Submit "Record Drawings".

3.16.6 Test and Balance Report: Submit four certified copies. The Report shall be submitted for review prior to the Substantial Completion Inspection unless otherwise required by Division 1.

3.16.7 Control Diagrams: Laminate and mount on equipment room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Mechanical

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 2/12/17

SECTION: 23 05 30/Hydronic Specialties

Use whatever standard headings you want here

1. Vent valves - Hoffman No. 62

List each item separately

2. In-line air separators - Bell & Gossett RL-4

Typical - list mfr name & model number

3. Diaphragm type compression tanks - Bell & Gossett B-200

4. Pump suction diffusers - Bell & Gossett ED-3

5. Triple duty valves - Bell & Gossett 3D-4S

M&A will list all comments on this sheet and will only stamp approvals on this sheet

6. Shot feeders - J. Woods No. 2

Leave space after each individual item for M&A comments

7. Pressure relief valves - Watts No. 6

8. Pressure reducing valves - Bell & Gossett No. 7

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

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SECTION 23 00 10 - CODES AND STANDARDS

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.

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 govern the work:

2.6.1 Florida Building Code - Building -Seventh Edition (2020).

2.6.2 Florida Building Code - Mechanical - Seventh Edition (2020).

2.6.3 Florida Building Code - Energy Conservation - Seventh Edition (2020).

2.6.4 Florida Building Code - Test Protocols for High Velocity Hurricane Zones - Seventh Edition (2020).

2.6.5 Florida Fire Prevention Code - Seventh Edition (2020).

2.6.5.1 Uniform Fire Code (NFPA 1) - 2018 Florida Edition.

2.6.5.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

2.6.6 National Electric Code (NFPA 70) - 2017.

2.6.7 Installation of Air Conditioning and Ventilation Systems (NFPA 90A) - 2015.

3 STANDARDS

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

3.1.1 Underwriters' Laboratories (UL)

3.1.2 American National Standards Institution (ANSI)

3.1.3 American Society of Testing Materials (ASTM)

3.1.4 National Fire Protection Association (NFPA)

3.1.5 National Electrical Manufacturers Association (NEMA)

3.1.6 Air Conditioning and Refrigeration Institute (ARI)

3.1.7 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

3.1.8 American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

3.1.9 Air Movement and Control Association (AMCA)

END OF SECTION

SECTION 23 05 00 - MECHANICAL RELATED WORK

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 Mechanical Requirements section. Provisions of this section apply to work of all Division 23 sections.

1.3 Coordinate all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 33 - SITE WORK

2.1 Specific requirements for excavation and backfill for underground piping are contained in Section 23 05 05.

2.2 The following work is part of Division 23:

2.2.1 All site heating hot water and chilled water piping and manholes.

2.2.2 All site steam and condensate piping and manholes.

2.2.3 All site heat recovery piping.

2.2.4 All site solar water piping.

3 DIVISION 3 - CONCRETE

3.1 Refer to Division 3, Concrete for:

3.1.1 Rough grouting in and around mechanical work.

3.1.2 Patching concrete cut to accommodate mechanical work.

3.2 The following is part of Division 23 work, complying with the requirements of Division 3

3.2.1 Curbs, foundations and pads for mechanical equipment.

3.2.2 Basins, sumps, and vaults of mechanical work.

3.2.3 Underground structural concrete to accommodate mechanical work.

3.2.4 Inertia bases.

4 DIVISION 4 - MASONRY

4.1 Refer to Division 4, Masonry for:

4.1.1 Installation of wall louvers.

4.1.2 Installation of access doors in walls.

5 DIVISION 5 - METALS

5.1 Refer to Division 5, Metals for:

5.1.1 Framing openings for mechanical equipment.

5.2 The following is part of Division 23 work.

5.2.1 Supports for mechanical work.

6 DIVISION 6 - WOOD AND PLASTIC

6.1 Refer to Division 6, Wood for:

6.1.1 Framing openings for mechanical equipment

7 DIVISION 7 - THERMAL AND MOISTURE PROTECTION

7.1 Refer to Division 7, Thermal and Moisture Protection for:

7.1.1 Installation of all roof curbs and roof supports for mechanical work.

7.1.2 Caulking and waterproofing of all wall and roof mounted mechanical work.

7.2 The following is part of Division 23 work, complying with the requirements of Division 7.

7.2.1 Fire barrier penetration seals.

8 DIVISION 8 - DOORS AND WINDOWS

8.1 Refer to Division 8, Doors & Windows for:

8.1.1 Installation of all door grilles.

8.1.2 Providing all undercuts

9 DIVISION 9 - FINISHES

9.1 Refer to Division 9, Finishes for:

9.1.1 Painting exposed ductwork, piping, and equipment.

9.1.2 Painting structural metal and concrete for mechanical work.

9.1.3 Painting door grilles and access panels.

9.1.4 Painting color-coded mechanical work indicated for continuous painting. See color schedule in Division 23 section, "Mechanical Identification".

9.1.5 Installation of access doors in gypsum drywall.

9.2 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.

9.3 Perform the following as part of Division 23 work:

9.3.1 Touch up painting of factory finishes.

9.3.2 Painting of all hangers.

10 DIVISION 11 - EQUIPMENT

10.1.1 Cooking hoods with fire suppression and dishwasher hoods.

10.2 Refer to Division 11 - Equipment for all laboratory equipment including cabinets, casework, student stations, demonstration desks, fume hoods, snorkel exhausts, canopy hoods, safety stations, and all related fittings, and trim.

10.3 Provide the following as part of Division 23 work:

10.3.1 All rigid ductwork, fans, related devices, and final connections necessary to make fume hoods, canopy hoods, and snorkel exhausts operational.

10.3.2 Fume hoods and canopy hoods.

11 DIVISION 26 - ELECTRICAL

11.1 Contractor 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 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.

11.2 Contractor shall provide all HVAC control wiring including the Building Automation System (BAS) sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26.

11.3 Contractor shall provide disconnect switches, starters, and contactors for mechanical equipment under Division 26 unless specifically noted as being furnished as part of mechanical equipment.

11.4 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.

END OF SECTION

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SECTION 23 05 05 - EXCAVATION & BACKFILL

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 excavation and backfill specified herein.

1.3 Existing Utilities: Underground utilities shown were taken from old drawings. The exact location of these utilities and irrigation branches and abandoned services are not known. Use extreme caution when excavating. Contact Physical Plant Division for more information on utility location.

1.4 Refer to other Division-23 sections and/or drawings for specific requirements of the particular piping system being installed. Where another Division-23 section or the drawings conflict with requirements of this section, the other Division-23 section or the drawings shall take precedence over the general requirements herein.

1.5 OSHA: Contractor employee worker protection for all trenching and excavation operations shall comply with 29 CFR 1926.650 Subpart P and all current OSHA requirements. Contractor shall also erect barriers, provide shoring and maintain excavations as required to protect the public and adjacent traffic.

1.6 Trench Safety Act: Contractor shall comply with all requirements of Florida Statutes Chapter 553, including the requirement to provide a separate line item to identify the cost to comply on a per lineal foot of trench and per square foot of shoring. Comply with UF Trenching and Excavation Safety Policy. Refer to www.ehs.ufl.edu/general/trench02.pdf.

1.7 Dig Permit: A Dig Permit must be obtained from the University of Florida Physical Plant prior to any excavation. In case of conflicts between this specification and the Dig Permit requirements, the most stringent will govern.

2 PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand.

2.2 Gravel: Clean, well graded hard stone or gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Fill free of clay, muck, stones, wood, roots or rubbish.

2.4 Identification Tape: Polyethylene 6 inches wide, 3.5 mil solid core encased in a 1 mil thick protective plastic jacket continuously printed with "CAUTION" in large black letters and type of pipe below. Tape shall conform to APWA specifications.

2.5 Copper Identification Wire: 14-gauge, single conductor, type UF.

3 EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever there is a possibility of encountering obstacles or any existing utility lines of any nature whatsoever. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavators within the limits of the building lines.

3.2 Bedding: Excavate to bottom grade of pipe to be installed, and shape bed of undisturbed earth to contour of pipe for a width of at least 50% of pipe diameter. If earth conditions necessitate excavation below grade of the pipe, such as due to the presence of clay, muck, or roots, subcut

and bring bed up to proper elevation with clean, new sand (as described in paragraph 2.1), deposited in 6" layers and tamped. Notify Architect/Engineer if subcut exceeds 12", or if bed is of an unstable nature. In this case a 6" minimum layer of gravel will be required before sand bedding begins. Submit cost proposal if the earth conditions require subcut in excess of 12" or if gravel is required to achieve proper bedding.

3.3 Placing: Pipe shall be carefully handled into place. Avoid knocking loose soil from the banks of the trench into the pipe bed. Rig heavier sections with nylon slings in lieu of wire rope to avoid crushing or chipping. Pipe which is handled with insulation in place, coated pipe, and jacketed pipe shall have special handling slings as required to prevent damage to the material.

3.4 Backfilling: Deposit clean new sand (as described in paragraph 2.1) to 6" above the pipe and tamp. Then deposit sand or earth carefully in 6" layers, maintaining adequate side support, especially on nonferrous piping materials. Compact fill in 6" layers, using mechanical means, up to the top elevation of the pipe, and in 12" layers to rough or finish grade as required. Fine grade and restore surface to original condition.

3.5 Special: Excavations shall be installed and maintained in satisfactory condition during the progress of the work. Subsurface structures are to be constructed in adequately sized excavations. De-watering equipment shall be installed and properly maintained where required. Shoring shall be employed in the event of unstable soil condition, and in all cases where required by OSHA regulations and necessary to protect materials and personnel from injury.

3.6 Identification: Install identification tape directly above all underground piping, one tape for each pipe where multiple pipes are installed. Depth of tape shall be at least 6 inches below finished grade and18" to 30" above buried pipe. Tape copper wire to non-metallic pipes.

3.7 Depth of Cover: Minimum cover for underground piping is 48 inches unless indicated otherwise.

3.8 Existing Pavement: Where new piping passes below existing streets, driveways, parking lots, or other paved areas, the pavement shall be saw cut. Backfill shall be compacted to 95% density and the pavement shall be patched to match existing pavement. Provide compaction tests and reports as required.

3.9 Landscape Restoration:

3.9.1 Lawn or Unpaved Areas: The soil shall be replaced according to the original profile. Compact the top 6" of subgrade and each 6" layer of backfill or fill material at 85% maximum density for cohesive soils and 90% relative density for cohesionless soils.

If additional soil is required, the Contractor shall supply weed free topsoil of a type to match existing topsoil.

3.9.2 Grass: Fine grade and solid sod with the type of grass to match the existing species and cultivar.

3.9.3 Landscape Maintenance: Contractor shall be responsible for watering and other grounds maintenance in the area of construction until the project is accepted.

3.9.4 UF: If there are any questions regarding type of grass or landscape restoration in general, Contractor should contact one of the campus landscape architects by calling 392-1155 or 392-1118.

END OF SECTION

SECTION 23 05 10 - ELECTRIC MOTORS

1 GENERAL

1.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Section 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 motors specified herein.

1.3 Extent of motors required by this section is indicated on drawings and/or specified in other Division-23 sections.

1.4 Comply with the requirements of Division 26.

1.5 UL Compliance: Comply with applicable UL standards pertaining to motors.

1.6 Approval Submittals:

1.6.1 Product Data: When required by other Division-23 sections, submit manufacturers standard product data sheets for each type of motor provided. Submit with Division-23 section using the motors, not as a separate submittal. Mark data sheet with arrows indicating product being supplied and list by unique descriptive name all motors to which each data sheet applies. Clearly indicate type, service factor, rpm, duty cycle, voltage, phase, nominal full load efficiency, power factor and insulation class. Field verify and coordinate mounting and frame requirements for matching the drive.

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit operation and maintenance data for each type of motor. Include these data in O&M Manual. Submit two copies of nameplate data sheet for each motor. One copy shall be included with the O&M Manual and a second copy shall be inserted in a waterproof pouch or bag and attached to the motor. Nameplate data sheets shall be typed or neatly printed and shall include all data on the motor nameplate plus a unique motor description such as "AHU-3 Fan Motor", "Distribution Pump #1" or similar description.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, General Electric, Baldor, US Electric, or approved equal.

2.2 General:

2.2.1 Motors shall conform to applicable portions of NEMA Standard MG-1, Motors and Generators.

2.2.2 Motors shall be sized for the application such that when the driven equipment is operated at rated capacity the motor current will not exceed the full-load nameplate current. Service factor shall not be used in normal operation.

2.3 Motor Design:

2.3.1 Integral Horsepower Motors:

2.3.1.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors. Provide cast-iron frame and mounting feet.

2.3.1.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200 volts for 208 volt systems, 230 volts for 240 volt systems and 460 volts for 480 volt systems.

2.3.1.3 Motors shall be NEMA Design B and shall have 1.15 service factor or greater at 60 hertz.

2.3.1.4 Insulation Systems

2.3.1.4.1 In fixed speed applications, motors shall have Class B insulation with 80°C rise over 40°C ambient.

2.3.1.4.2 For variable frequency drive (VFD) applications, motors shall have Class F insulation with 105°C rise over 40°C ambient. Motor manufacturer shall identify motors being used for VFD applications by marking the motor with a stainless steel name-plate “Inverter Duty”. Motors shall be provided with one set of thermostatic sensors.

2.3.1.5 Motor efficiencies shall be based on IEEE-112, 1984, Test Method B, as specified in NEMA Standard MG1-12.53. NEMA motor efficiency and power factor shall be clearly shown on the motor nameplate. Inverter duty motors shall have a CIV rating based on NEMA.

2.3.1.6 Motors shall be premium efficiency type and shall meet or exceed the following minimum nominal efficiencies at rated voltage. Motors must be labeled “PREMIUM EFFICIENCY” Standard efficiency motors meeting the indicated minimum efficiencies are not acceptable.

230/460 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	78.0 pct.
1.5 hp	86.5 pct.	78.0 pct.
2 hp	86.5 pct.	83.0 pct.
3 hp to 5 hp	89.5 pct.	80.0 pct.
7.5 hp	91.7 pct.	81.0 pct.
10 hp	91.7 pct.	82.0 pct.
15 hp	92.4 pct.	82.0 pct.
20 hp	93.0 pct.	86.0 pct.
25 hp	93.6 pct.	84.0 pct.
30 hp	93.6 pct.	83.0 pct.
40 hp	94.1 pct.	86.0 pct.
50 hp	94.5 pct.	87.0 pct.
60 hp	95.0 pct.	86.0 pct.
75 hp	95.4 pct.	87.0 pct.
100 hp	95.4 pct.	90.0 pct.
125 hp	95.8 pct.	88.0 pct.
150 hp	96.2 pct.	86.0 pct.
200 hp	96.2 pct.	87.0 pct.
Over 200 hp	96.2 pct.	87.0 pct.

200 VOLT, 3 PHASE

HORSEPOWER RANGE	MINIMUM NOMINAL EFFICIENCY	MINIMUM ACCEPTABLE POWER FACTOR
1 hp	85.5 pct.	78.0 pct.
1.5 hp	86.5 pct.	78.0 pct.
2 hp	86.5 pct.	83.0 pct.
3 hp to 5 hp	89.5 pct.	80.0 pct.
7.5 hp	91.7 pct.	81.0 pct.

10 hp	91.7 pct.	82.0 pct.
15 hp	92.4 pct.	82.0 pct.
20 hp	93.0 pct.	86.0 pct.
25 hp	93.6 pct.	84.0 pct.

2.3.1.7 Motors 25 hp and larger which are to be installed outdoors or in other high humidity areas shall be equipped with silicone rubber space heaters. Space heaters shall be energized when motor is de-energized.

2.3.1.8 Shaft Grounding: Provide shaft grounding brushes to prevent electrical bearing damage equal to Aegis SGR by Electro Static Technology.

2.3.2 Fractional Horsepower Motors ¾ hp and above:

2.3.2.1 Motors shall be open drip-proof or totally enclosed fan cooled as shown on the drawings or listed in the Division 23 section requiring motors.

2.3.2.2 Motors shall be three phase, 60 hertz, nominal 1800 rpm, rated at 200, 230 or 460 volts as shown on the drawings.

2.3.2.3 Motors shall be NEMA Design B with class B insulation, unless used with variable frequency drives.

2.3.3 Fractional Horsepower Motors less than ¾ hp:

2.3.3.1 Motors shall be single phase, 60 hertz, rated at 120 volts with integral thermal protection, unless otherwise noted on the drawings.

2.3.3.2 Electronic Commutation: Where scheduled, provide electronic commutation (EC) motors with premounted dial control speed potentiometer, minimum of 85% efficient at all speeds with 80% useable turndown.

2.4 Overload Protection: Properly sized overload protection shall be provided for each motor. This protection may be an integral part of the motor or may be part of the motor controller and shall interrupt each ungrounded conductor.

3 EXECUTION

3.1 Motor Size and Location:

3.1.1 Size and location of motors shown on the drawings are based on a particular design and may change with a different manufacturer. Submittal of shop drawings or product literature indicating motor sizes or locations different from that designed indicates that Contractor has fully coordinated any required changes to the electrical system with other trades. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

3.1.2 Contractor shall verify and make any necessary adjustments to electrical service, branch circuit wiring, branch circuit protection, overload protection, disconnect and controller (starter), or VFD based on actual nameplate data of the motors supplied prior to installation. Where applicable, connect motor winding thermostat to VFD.

3.2 Motor Voltages: Contractor shall field verify system voltage prior to ordering or installing any motors. Submittal of shop drawings or product literature indicating motor voltages indicates that Contractor has fully coordinated the motor with the electrical system and that any discrepancies have been resolved. Approval (if made) is on this basis and no additional cost will be allowed for any changes.

3.3 Motor Mounting: Adjust motor mounting as required to adjust the drive train for proper belt operation and to accommodate sheave changes or other requirements of the test and balance work.

END OF SECTION

SECTION 23 05 11 - VARIABLE FREQUENCY DRIVES

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 variable frequency drive work required by this section is indicated on drawings and schedules, and by requirements of this section. Motor characteristics are specified in Division-23 section “Electric Motors”.

1.4 Refer to other Division-23 sections for installation of pumps and AHUs in mechanical systems; not work of this section. Coordinate with pump and air handling unit suppliers.

1.5 Refer to Division-26 sections for the following work; not work of this section.

1.5.1 Power supply wiring for power source to power connection on pumps, air handling units, drives, controls and/or unit control panels.

1.6 Provide the following electrical work as work of this section, complying with requirements of Division-26 sections: Control wiring and signal wiring between field-installed controls, indicating devices, and unit control panels.

1.7 Codes and Standards:

1.7.1 Electrical Standards: Provide electrical products which have been tested, listed and labeled by UL and comply with NEMA standards.

1.7.2 NEMA Compliance: Comply with NEMA standards pertaining to components and devices for electric control systems.

1.7.3 NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.

1.7.4 NEC Compliance: Comply with NFPA 70 National Electric Code.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data for each type of drive furnished, indicating dimensions, capacities, performance characteristics including harmonic contributions, electrical characteristics, finishes of materials, and including installation instructions and start-up instructions.

1.9 Test Reports and Verification Submittals:

1.9.1 Submit manufacturer’s representative startup report.
1.9.2 Submit harmonics test report.

1.10 O&M Data: Submit maintenance instructions and spare parts lists. Include this data and a copy of approval data in O&M manual.

2 PRODUCTS

2.1 General: Provide products in sizes and capacities indicated, consisting of variable frequency drives, bypass devices, disconnects, controllers, sensors, transmitters, and other components as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard system components as indicated by published product information, designed and

constructed as recommended by manufacturer.

2.2 Variable Frequency Drives: Provide UL plenum rated, variable torque, variable frequency drives capable of being used with AC induction motors without causing overheating or excessive noises. Drives shall be housed in NEMA 1 enclosures. The supplier shall perform all necessary electric power analyses as required to ensure the drives operate properly in the service indicated. Provide the following performance and construction features:

2.2.1 The controller shall accept power as indicated on the drawings and provide a variable frequency output for speed control from 10% to 100% of base speed (1,800 rpm nominal). Provide fused input.

2.2.2 The drive shall produce a variable frequency, adjustable voltage output with a constant input power factor of at least 0.95 and a variable-torque constant volts/Hz ratio. The input stage shall use a full wave diode bridge. Provide DC switching power supply.

2.2.3 The drive shall maintain an overall efficiency from input to output of at least 95% over the full range of operation.

2.2.4 The drive shall not generate unacceptable line noise, motor noise, or radio frequency interference. Any isolation transformers, signal filters, or other devices required to prevent these problems, or to enable the drive to function properly with the available utility power and the indicated load side wiring length shall be provided by the manufacturer.

2.2.5 All units shall be warranted for a period of 5 years. All drives shall be pretested before shipment.

2.2.6 Drive features:

2.2.6.1 Minimum and maximum speed adjustment.

2.2.6.2 Separately adjustable acceleration and deceleration.

2.2.6.3 Output current limit adjustable to assure that motor current never exceeds drive input current rating.

2.2.6.4 Short circuit protection and ground fault protection. Over current protection for driven load shall comply with NEC.

2.2.6.5 4-20 mA and 0-10V configurable.

2.2.6.6 Under voltage and over voltage protection.

2.2.6.7 Over temperature protection.

2.2.6.8 Automatic restarting of the drive after a power outage or power dip.

2.2.6.9 Drive status indicator lights and digital display. Digital display shall be an LCD display with a minimum of 3 lines of text.

2.2.6.10 Mode selector switch (manual, off, automatic).

2.2.6.11 Standard manual speed adjustment.

2.2.6.12 Electronic contactor bypass.

2.2.6.13 Motor starter circuit and drive input disconnect switch complying with NEC Article 430. Three contactor bypass is acceptable configuration. Normal/Test selector keys shall allow testing and adjustment of the VFD while the motor is running in the bypass mode.

2.2.6.14 Phase loss protection (input and output) and surge suppression. Provide a minimum of six user programmable digital inputs.

2.2.6.15 Start/stop control in any mode from a remote signal or contact closure.

2.2.6.16 Auxiliary contact indicating run status.

2.2.6.17 RS-232 interface.

2.2.6.18 Internal diagnostics displayed on unit panel.

2.2.6.19 Drives shall be able to catch and drive into a spinning load.

2.2.6.20 Drives shall be integrated to Building Automation System (BAS). Coordinate communication protocol with BAS vendor; Bacnet compatibility is required.

2.2.6.21 Safety circuit.

2.2.6.22 VFD shall have a minimum short circuiting of 65K amps RMS (100K amps RMS with a DC bus reactor) without additional input fusing.

2.2.6.23 Hard wired feedback control signal.

2.2.7 Warranty and Startup: Provide five year warranty and onsite vendor startup assistance.

2.2.8 Acceptable Manufacturers: Subject to compliance with requirements, provide drives of one of the following:

Asea Brown Boveri

2.3 Harmonic Control in Electrical Power Systems:

2.3.1 Variable frequency drives (VFD) are specified to meet harmonic distortion limits as defined in ANSI/IEEE Standard 519-1992, Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems, based on the use of numerous drives simultaneously within the building and with the following criteria.

2.3.1.1 Point of Common Coupling: Secondary distribution of service transformer.

2.3.1.2 Total Harmonic Distortion (THD) Limit, Voltage: 1.0%

2.3.1.3 Total Demand Distortion (TDD) Limit, Current: 5.0% with short circuit ratio <20.

2.3.1.4 The service transformer for this application shall not be subjected to harmonic currents in excess of 5% of transformer rated current in accordance with ANSI/IEEE Standard 519.

2.4 Harmonic Mitigation:

2.4.1 6-pulse technology with 5% line reactor.

2.5 Variable Air Volume Flow and Variable Volume Pumping Sensors and Transmitters: Refer to Division-23 controls sections for air flow, pressure and differential pressure sensors and transmitters. Coordinate output of transmitters with input requirements of drives.

3 EXECUTION

3.1 Examine areas and conditions under which variable volume systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 Install the variable frequency drives where shown on the drawings in accordance with the manufacturer's printed instructions. If the drive is not located within sight of the motor, provide additional line side disconnect switch complying with the requirements of Division 26 and NEC Article 430.

3.3 Mounting: Provide slotted angles or channel bars with mounting hardware for securing drives to the wall. Combustible materials are not permitted.

3.4 Refer to Division-26 sections for motor connections and testing requirements.

3.5 Variable Volume Pumping Systems:

3.5.1 Verify that the drives control pump speeds properly over the full range of operation in response to the differential pressure signals.

3.5.2 System Adjustment: The drive supplier shall coordinate the setting of all adjustments and setpoints for initial operation. The system and all pumps and control valves shall be monitored for proper operation. It shall be recognized that final settings will be obtained by trial-and-error by necessity. Call backs to achieve proper settings shall be included in the base bid.

3.6 Variable Air Volume Systems:

3.6.1 Verify that the drives control the air handling unit speeds properly over the full range of operation in response to control signals. Coordinate drive operation with final sheave selection.

3.6.2 System Adjustment: The drive supplier shall coordinate the setting of all adjustments and setpoints for initial operation. Monitor variable volume valves and AHUs for proper operation. It shall be recognized that final settings and locations of static pressure transmitters will be obtained by trial-and-error by necessity. Call backs to achieve proper settings shall be included in the base bid.

3.7 Start-up: Start-up, test, and adjust variable volume systems in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment. Verify that drives are not generating harmonics.

3.8 Field Quality Control:

3.8.1 After installation of VFD and connection to mechanical equipment, perform harmonics test.

3.8.2 Testing procedure shall comply with IEC 61000-4-7, Electromagnetic Compatibility (EMC), Part 4-7, Testing and Measurement Techniques.

3.8.3 Testing will be considered complete when results indicate that harmonic distortion generated by each VFD system is less than acceptable levels specified.

3.8.4 Submit Test Report.

3.9 Owner's Instructions: Provide services of manufacturer's technical representative for 16 hours divided into four sessions to instruct Owner's personnel in operation and maintenance of variable volume systems. Schedule instruction with Owner, provide at least 7-day notice to Contractor and Engineer of training date.

3.10 System Verification: The manufacturer's authorized representative shall state in writing to the Engineer that the variable volume system is operating properly, final adjustments and calibrations are complete, and Owner training has been accomplished.

3.11 Spare Parts: Provide spare fuses per Section 23 05 12.

END OF SECTION

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SECTION 23 05 12 - FUSES 600 VOLTS AND BELOW

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:

1.3.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

2 PRODUCTS

2.1 Acceptable Producers: Buss, Farraz Shamut, Littlefuse, Siemens.

2.2 General: Products listed herein are common to various Mechanical Specification Sections for this project and as shown on this project's Drawings.

2.3 All fuses furnished for a particular item of equipment shall be by the same producer.

2.4 Voltage Rating:

2.4.1 Provide 600 volt fuses for 277/480 volt systems.

2.4.2 Provide 250 volt fuses for 120, 208 and 240 volt systems.

2.5 Ampere Ratings: Ampere ratings of fuses shall be as required by the equipment manufacturer.

2.6 Interrupting Ratings: Interrupting ratings of fuses shall be as required by the equipment manufacturer.

2.7 Current Limitation: Current limiting fuses shall be provided where required by the equipment manufacturer.

2.8 Rejection Fuse Clips: Provide fuse with rejection feature for switches required to have the rejection feature as required by the equipment manufacturer.

3 EXECUTION

3.1 Coordinate fuse type and ampacity with fuse holder.

3.2 Provide one set of spare fuses for each item of equipment requiring fuses. Spare fusing shall be provided within weatherproof containers for long-term storage. Spray paint container with the wording “Spare Fuses” and “Name of Equipment” on the side.

END OF SECTION

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SECTION 23 05 19 - PIPING SPECIALTIES

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 piping specialties specified herein.

2 PRODUCTS

2.1 General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.2 Escutcheons:

2.2.1 General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

2.2.2 Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

2.2.3 Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

2.3 Dielectric Waterways: Provide standard products recommended by manufacturer Victaulic Style 47 dielectric waterways for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action and stop corrosion. Dielectric unions are not acceptable.

2.4 Fire Barrier Penetration Seals:

2.4.1 Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork in accordance with the requirements of Division 7.

2.4.2 Cracks, Voids, or Holes Up to 4" Diameter: Use putty or calking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.

2.4.3 Openings 4" or Greater: Use sealing system capable of passing 3-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.

2.5 Fabricated Piping Specialties:

2.5.1 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 ¼" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

2.5.2 Pipe Sleeves: Provide pipe sleeves of one of the following:

2.5.2.1 Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gage; 4" to 6" 16 gage; over 6", 14 gage.

2.5.2.2 Steel-Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

2.5.2.3 Iron-Pipe: Fabricate from cast-iron or ductile-iron pipe; remove burrs.

2.5.3 Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:

2.5.3.1 Caulking and Sealant: Provide foam or caulking and sealant compatible with piping materials used.

2.6 Low Pressure Y-Type Pipeline Strainers:

2.6.1 General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Provide Type 304 stainless steel screens.

2.6.1.1 Water Strainers: Select for 200 psi working pressure (water, oil or gas). Provide 20 mesh screens through 2" size and 1/16" perforations for 2½" size and larger.

2.6.2 Select from the following types:

2.6.2.1 Soldered Ends, 2" and Smaller: Bronze body, screwed screen retainer with centered blowdown fitted with pipe plug.

2.6.2.2 Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.

2.6.2.3 Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

2.6.2.4 Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blowdown fitted with pipe plug.

3 EXECUTION

3.1 Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

3.2 Dielectric Waterways: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

3.3 Fire Barrier Penetration Seals: Provide pipe sleeve as required. Fill entire opening with sealing compound. Adhere to manufacturer's installation instructions. Refer to Division 7.

3.4 Drip Pans: Locate drip pans under piping passing over or within 3' 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.

3.5 Pipe Sleeves: Where required, in accordance with the following.

3.5.1 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 2 pipe sizes larger than piping run. Unless noted otherwise, sleeve shall be sized for full thickness of insulation with any vapor barrier. Insulation shall be continuous through sleeve. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves.

3.5.2 Sleeves shall be provided at the following locations:

3.5.2.1 Install iron-pipe sleeves with water stops at all at exterior penetrations in walls into the building. Fill annular space with mechanical sleeve seals. Sleeves are not required for exterior penetrations through floors, but may be provided at contractor option. If provided, fill mechanical space with mechanical sleeve seals.

3.5.2.2 Install iron-pipe sleeves at all penetrations of below grade foundation walls to protect piping from movement of the building foundation.

3.5.2.3 When required by the listing criteria, install sleeves in penetrations of fire-rated assemblies in accordance with the listing of the assembly.

3.5.2.4 For new construction projects (including additions), sleeves shall be provided for all piping through interior cast-in-place concrete or CMU walls. Sleeves shall be placed during the construction of the wall.

3.5.2.5 For renovation projects, sleeves shall be provided as outlined in this section for all new walls and partitions. Sleeves in existing walls shall only be required to protect the wall from damage due to expansion and contraction of the piping.

3.5.2.6 Sleeves are not required for penetrations through interior gypsum wallboard partitions unless required by one of the provisions above. Annular space around piping without sleeves shall be sealed with caulk or other approved material per Division 7.

3.5.2.7 For new construction projects, sleeves shall be installed for floor penetrations in areas that are considered wet. This includes mechanical rooms, toilet rooms, and laboratories. Extend floor sleeves 2" above floor finish. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves. Fill annular space with caulking or fire barrier sealant as required.

3.5.2.8 For renovation projects, approved alternate water stopping methods will be considered in lieu of sleeves for penetrations through floors.

3.6 Y-Type Strainers:

3.6.1 Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers ¾" and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.

3.7 Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:

Pumps
Temperature control valves.

END OF SECTION

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SECTION 23 05 20 - METERS AND GAUGES

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 meters and gauges specified herein.

1.3 Extent of meters and gauges required by this section is indicated on drawings and/or specified in other Division-23 sections.

1.4 UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

1.5 ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.6 Approval Submittals:

1.6.1 Product Data: When required by other Division-23 sections, submit manufacturer's technical product data for each type of meter and gauge. Submit with Division-23 section using meters and gauges, not as a separate submittal. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit for:

1.6.1.1 Thermometers

1.6.1.2 Temperature gauges

1.6.1.3 Pressure gauges

1.6.1.4 Gauge connector plugs

1.6.1.5 Calibrated balance valves

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit calibration curves and operating instructions for each type of meter or gauge. Include this data in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers (Thermometers and Pressure Gauges): Subject to compliance with requirements, Ashcroft, Ernst Gauge Company, Weksler, Marshalltown Instruments, Trerice, Weiss Instruments, Wheatley, Fluidyne or approved equal.

2.2 Glass Thermometers:

2.2.1 General: Provide glass thermometers of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2.2.2 Case: Die cast aluminum finished in baked epoxy enamel, glass front, spring secured, 9" long.

2.2.3 Adjustable Joint: Die cast aluminum, finished to match case, 180° adjustment in vertical plane, 360° adjustment in horizontal plane, with locking device.

2.2.4 Tube and Capillary: Non-mercury filled, magnifying lens, 1% scale range accuracy, shock mounted.

2.2.5 Scale: Satin faced, non-reflective aluminum, permanently etched markings.

2.2.6 Stem: Aluminum for separable socket, length to suit installation.

2.2.7 Range: Conform to the following:

2.2.7.1 Hot Water: 30°- 240°F with 2°F scale divisions.

2.2.7.2 Chilled Water: 0° - 100°F with 2°F scale divisions.

2.3 Thermometer Wells: Provide thermometer wells constructed of brass or stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well. Same manufacturer as thermometers.

2.4 Temperature Gauges:

2.4.1 General: Provide temperature gauges constructed of stainless steel.

2.4.2 Type: General use, bimetal, with re-calibration feature.

2.4.3 Case: Type 304 stainless steel with glass face, 3" diameter.

2.4.3.1 Hot Water: 30°- 240°F with 2°F scale divisions.

2.4.3.2 Chilled Water: 0°-100°F with 2°F scale divisions.

2.4.4 Stem: Provide 2" extended stem for insulated piping.

2.4.5 Basis of Design: Weiss 3RBM.

2.5 Pressure Gauges:

2.5.1 General: Provide pressure gauges of materials, capacities, and ranges indicated, designed and constructed for use in service indicated.

2.5.2 Type: General use, 1% accuracy, ANSI B40.1 grade A, phosphor bronze bourdon type, bottom connection.

2.5.3 Case: Aluminum, glass lens, 4-½" diameter.

2.5.4 Connector: Brass with ¼" male NPT.

2.5.5 Scale: White coated aluminum with black scale.

2.5.6 Range: Select so that highest possible pressure does not exceed 75% of full scale.

2.6 Pressure Gauge Cocks:

2.6.1 General: Provide ¼" ball valves for use as pressure gauge cocks.

2.6.2 Snubber: ¼" brass bushing with corrosion resistance porous metal disc, through which pressure fluid is filtered. Select disc material for fluid served and pressure rating.

2.7 Gauge Connector Plugs:

2.7.1 Provide temperature gauge connector plugs pressure rated for 500 psi and 200°F. Construct of brass and finish in nickel-plate, equip with ½" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting ⅛" 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. Pete's Plug or approved equal.

2.7.2 Provide pressure gauge connector plugs pressure rated for 500 psi and 200°F. construct of brass

and finish in nickel-plate, equip with ½" NPT fitting, with self-sealing valve core type neoprene gasketed orifice suitable for inserting ⅛" O.D. probe assembly from dial type insertion pressure gauge. Equip orifice with gasketed screw cap and chain. Provide extension, length equal to insulation thickness, for insulated piping. Pete's Plug or approved equal.

2.7.3 Provide master test kit with one 2-½" test gauge of suitable range, one gauge adapter probe, and one stem pocket testing thermometer (0°F-220°F).

2.8 Calibrated Balance Valves:

2.8.1 General: Provide as indicated, calibrated balance valves equipped with readout valves to facilitate connecting of differential pressure meter to balance valves. Equip each readout valve with 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 seals to prevent leakage around rotating element. Provide balance valves with preformed polyurethane insulation suitable for use on heating and cooling systems.

2.8.2 Victaulic:

2.8.2.1 2" (DN50) and Smaller Sizes: 300 psi, y pattern, globe type with soldered or threaded ends, non-ferrous Ametal® DZR brass copper alloy body, EPDM o-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Victaulic/TA Hydronics Series 786 or 787 STAD.

2.8.2.2 2 ½" (DN65) and Larger Sizes: 300 psi, y-pattern, globe type with flanged or grooved ends, ASTM A536 ductile iron body, all other metal parts of brass copper alloy, EPDM o-ring seals. 8, 12 or 16 -turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter. Victaulic /TA Hydronics Series 788 or 789 STAG.

2.8.3 Provide master test kit with two 10 foot lengths of hose and quick disconnect fittings.

2.8.4 Acceptable Manufacturers: Bell and Gossett, Taco, Nibco, Victaulic T/A Hydronics.

3 EXECUTION

3.1 Installation Of Thermometers and Temperature Gauges:

3.1.1 General: Install in vertical upright position, and tilt so as to be easily read by observer standing on floor.

3.1.2 Locations: Install thermometers in the following locations, and elsewhere as indicated:

3.1.2.1 At inlet and outlet of each hydronic coil in air handling units.

3.1.3 Thermometer Wells: Install in piping tee where indicated, in vertical upright position. Thermometers shall have at least 75% of stem in moving fluid.

3.1.4 Temperature Gauges: Install in piping for terminal runtouts where indicated.

3.1.5 Temperature Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.2 Installation of Pressure Gauges:

3.2.1 General: Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

3.2.2 Locations: Install in the following locations, and elsewhere as indicated:

3.2.2.1 At suction and discharge of each pump.

3.2.2.2 At inlet and outlet of each hydronic coil in air handling units

3.2.3 Pressure Gauge Cocks: Install in piping tee with snubber.

3.2.4 Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.3 Installation of Flow Measuring Meters:

3.3.1 General: Install flow measuring meters on piping systems located in accessible locations at most readable position.

3.3.2 Locations: Install in the following locations, and elsewhere as indicated:

3.3.2.1 At discharge of each floor-mounted pump and hydronic coil runouts to air handling units and in line with each BAS flow meter: calibrated balance valve.

3.3.2.2 At discharge of each in-line pump and hydronic coil run-outs to fan coil units, terminal units, and duct-mounted coils : Calibrated balance valves.

3.3.3 Calibrated Balance Valves: Install on piping with readout valves in vertical upright position. Maintain minimum length of straight unrestricted piping equivalent to three pipe diameters upstream of valve.

3.4 Adjusting And Cleaning:

3.4.1 Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

3.4.2 Cleaning: 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.

END OF SECTION

SECTION 23 05 23 - VALVES

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:

1.4.1 Valve Dimensions: For face-to-face and end-to-end dimensions of flanged or welding-end valve bodies, comply with ANSI B16.10.

1.4.2 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.

1.5.1 Check Valves. Type CK.

1.5.2 Ball Valves. Type BA.

1.5.3 Butterfly Valves. Type BF.

1.6 O&M Data Submittals: Submit a copy of approval submittals. Submit installation instructions, maintenance data and spare parts lists for each type of valve. Include this data in the O&M Manual.

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.

2.5 Check Valves:

2.5.1 Construction: Construct valves of castings free of any impregnating materials. Construct valves with a bronze regrinding disc with a seating angle of 40º to 45º, 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.

2.5.2 Comply with the following standards:

Cast Iron Valves: MSS SP-71. Cast Iron Swing Check Valves, Flanged and Threaded Ends.
Bronze Valves: MSS SP-80. Bronze Gate, Globe, Angle and Check Valves.
Steel Valves: ANSI B16.34. Steel Standard Class Valve Ratings.

2.5.3 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 2½" 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, for fire sprinkler use. Nibco KT-403-W.

5 Flanged Ends 2½" 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 2½" 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 2½" and Larger (CK9): Class 300, cast steel body, bolted cap, horizontal swing, seal welded seat rings, chromium stainless disc. Stockham 30-SF. Crane 159.

10 Nonslam Silent Check (CK10): Iron body, spring actuated, globe style silent check valve with renewable seats and disk. Nibco F-910 (125 lb.wog) or Nibco F-960 (250 lb wog) as required.

2.6 Ball Valves:

2.6.1 General: Select with port area equal to or greater than connecting pipe area, include seat ring designed to hold sealing material.

2.6.2 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 stainless steel stem. Provide TFE packing, TFE thrust washer, stainless steel ball and reinforced teflon seats. Valves 2" and smaller shall be full port design. Valves 2½" and larger shall be conventional port design. Stem extensions shall be furnished for use in insulated piping where insulation exceeds ½" thickness.

2.6.3 Comply with the following standards:

MSS SP-72. Ball Valves with Flanged or Butt Welding Ends for General Service.
MSS SP-110. Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

2.6.4 Types of ball (BA) valves:

1 Threaded Ends 3" and Smaller (BA1): Bronze two-piece full port body with adjustable stem packing. Nibco T-585-70-66. Apollo 77-140.

2 Soldered Ends 3" and Smaller (BA2): Bronze two-piece full port body with adjustable stem

packing. S585-70-66. Apollo 77-240.

2.7 Butterfly Valves:

2.7.1 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.

2.7.2 Types of butterfly (BF) valves:

1 Wafer Type 3" and Larger (BF1): 200 CWP, ductile-iron body, lever-operated, aluminum-bronze disc, Type 416 stainless steel stem, EPDM seat. Stockham LG-512. Nibco WD 2000-3. Crane 42-FXB-TL. Milwaukee MW222E-8416.

2 Lug Type 3" and Larger (BF2): 200 CWP, ductile-iron body, lever-operated, aluminum-bronze disc, Type 416 stainless steel stem, EPDM seat. Stockham LG-712. Nibco LD 2000-3. Crane 44-FXB-TL. Milwaukee ML132B-8416.

3 Wafer Type 3" and Larger (BF3): 150/200 CWP, ductile-iron body, gear-operated, aluminum-bronze disc, Type 416 stainless steel stem, EPDM seat. Stockham LG-522 and LG-521. Nibco WD 2000-5. Crane 42-FXB-G. Milwaukee MW 122B-8115.

4 Lug Type 3" and Larger (BF4): 150/200 CWP, ductile-iron body, gear-operated, aluminum-bronze disc, Type 416 stainless steel stem, EPDM seat. Stockham LG-722 and LG-721. Nibco LD 2000-5. Crane 44-FXB-G. Milwaukee ML 132B-8115.

5 Wafer Type 4" and Larger (BF5): 175 WWP, ductile-iron body, gear-operated, aluminum-bronze disc, Type 416 stainless steel stem, EPDM seat, UL listed. Stockham LG-52U. Nibco WD 3000-5.

6 Lug Type 4" and Larger (BF6): 175 WWP, ductile-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 416 stainless steel stem, EPDM seat, UL listed. Stockham LG-72U. Nibco LD 3500-5.

7 Grooved Type 4" and Larger (BF7): 175 WWP, ductile-iron body, gear-operated, nickel-plated ductile iron or aluminum bronze disc, Type 416 stainless steel stem, EPDM seat, UL listed. Stockham LG-82U. Nibco GD 2000-5.

8 Grooved Type 2" and Larger (BF8): Ductile iron or bronze body, EPDM or nitrile seats, grooved or threaded connections with integral tamper switch. UL listed Victaulic Series 705 or Butterball BB-SCS02 or BBVSCS02.

2.8 Victaulic: Grooved Victaulic valves may be used at Contractor's option, provided a comparison chart is submitted showing that the grooved valves are equal to basis of design valves.

2.9 Valve Features:

2.9.1 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

2.9.2 Valve features specified or required shall comply with the following:

1 Flanged: Provide valve flanges complying with ANSI B16.1 (cast iron), ANSI B16.5 (steel), or ANSI B16.24 (bronze).

2 Threaded: Provide valve ends complying with ANSI B1.20.

3 Solder-Joint: Provide valve ends complying with ANSI B16.18.

4 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.

5 Non-Metallic Disc: Provide non-metallic material selected for service indicated in accordance with manufacturer's published literature.

6 Renewable Seat: Design seat of valve with removable disc, and assemble valve so disc can be replaced when worn.

7 Extended Stem: Increase stem length by 2" minimum, to accommodate insulation applied over valve.

8 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.

3 EXECUTION

3.1 Installation:

3.1.1 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.

3.1.2 Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

3.1.3 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.

3.1.4 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:

3.2.1 Tube Size 3" and Smaller: Threaded valves. Soldered-joint valves may also be used.

3.2.2 Pipe Size 2" and Smaller: Threaded valves.

3.2.3 Pipe Size 2½" 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. Nonslam check valves installed at pump discharge shall be installed at least four pipe diameters from the pump discharge or any elbows. Provide flow straighteners if conditions prohibit required clearances.

END OF SECTION

SECTION 23 05 29 - SUPPORTS, ANCHORS, AND SEALS

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:

1.5.1 Provide pipe hangers and supports of which materials, design, and manufacture comply with ANSI/MSS SP-58.

1.5.2 Select and apply pipe hangers and supports, complying with MSS SP-69.

1.5.3 Fabricate and install pipe hangers and supports, complying with MSS SP-89.

1.5.4 Terminology used in this section is defined in MSS SP-90.

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.

2.2.1 Adjustable Steel Clevises: MSS Type 1.

2.2.2 Steel Double Bolt Pipe Clamps: MSS Type 3.

2.2.3 Adjustable Steel Band Hangers: MSS Type 7.

2.2.4 Steel Pipe Clamps: MSS Type 4.

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.

2.3.1 Two-Bolt Riser Clamps: MSS Type 8.

2.3.2 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.

2.4.1 Steel Turnbuckles: MSS Type 13.

2.4.2 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.

2.5.1 Center Beam Clamps: MSS Type 21.

2.5.2 C-Clamps: MSS Type 23.

2.5.3 Malleable Beam Clamps: MSS Type 30.

2.5.4 Side Beam Brackets: MSS Type 34.

2.5.5 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.

2.6.1 Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6.2 Protection Saddles: MSS Type 39; use with rollers, fill interior voids with segments of insulation matching adjoining insulation.

2.7 Miscellaneous Materials:

2.7.1 Metal Framing: Provide products complying with NEMA STD ML 1.

2.7.2 Steel Plates, Shapes and Bars: Provide products complying with ANSI/ASTM A 36.

2.7.3 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.

2.7.4 Heavy-Duty Steel Trapezes: Fabricate from steel shapes or continuous channel struts selected for loads required; weld steel in accordance with AWS standards.

3 EXECUTION

3.1 Preparation

3.1.1 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.

3.1.2 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:

3.2.1 Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.2.2 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:

3.3.1 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, Florida Building Code-Plumbing and Mechanical, 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.

3.3.1.1 Horizontal steel pipe and copper tube 1 ½" diameter and smaller: support on 6 foot centers.

3.3.1.2 Horizontal steel pipe and copper tube over 1 ½" diameter: support on 10 foot centers.

3.3.1.3 Vertical steel pipe and copper tube: support at each floor.

3.3.2 Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.3.3 Paint all black steel hangers with black enamel. Galvanized steel and copper clad hangers do not require paint.

3.3.4 Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.3.5 Provision for Movement:

3.3.5.1 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.

3.3.5.2 Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.3.5.3 Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 are not exceeded.

3.3.5.4 Sway Bracing: Provide rigid support sway bracing for all changes in direction greater than 45 degrees on piping 4" and larger.

3.3.6 Insulated Piping: Comply with the following installation requirements.

3.3.6.1 Shields: Where low-compressive-strength insulation or vapor barriers are indicated, install coated protective shields.

3.3.6.2 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:

3.4.1 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.

3.4.2 Fabricate and install anchors by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

3.4.3 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.

3.5 Equipment Bases:

3.5.1 Provide concrete housekeeping bases for all floor mounted equipment furnished as part of the work of Division 23. Size bases to extend minimum of 4" beyond equipment base in any direction; and 4" above finished floor elevation. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.5.2 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

SECTION 23 05 30 - HYDRONIC SPECIALTIES

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 insulation of hydronic specialties; not work of this section.

1.4 Codes and Standards:

1.4.1 ASME Compliance: Manufacture and install hydronic specialties in accordance with ASME B31.9 "Building Services Piping".

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data and installation instructions for each type of hydronic specialty. Include pressure drop curve or chart for each type and size of hydronic specialty. Submit schedule indicating manufacturer's figure number, size, location, rated capacities, and features for each required hydronic specialty.

1.5.1.1 Vent Valves

1.5.1.2 Air Separators

1.6 O&M Data Submittals:

2 PRODUCTS

2.1 General: Provide factory-fabricated hydronic specialties recommended by manufacturer for use in service indicated. Provide hydronic specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is installer's option but more than one type cannot be used on project.

2.2 Vent Valves:

2.2.1 Manual Vent Valves: Provide manual vent valves designed to be operated manually with screwdriver or thumbscrew, ⅛" N.P.T. connection.

2.2.2 Piping Automatic Vent Valves: Provide automatic vent valves designed to vent automatically with float principle, stamped brass body, pressure rated for 150 psi, ½" NPS inlet connection. Honeywell EA79. Use for all distribution piping.

2.2.3 Acceptable Manufacturers: Subject to compliance with requirements, provide manual vent valves of one of the following:

Honeywell
Crane
Bell & Gossett
Hoffman
Maid-O-Mist
Sarco
Wheatley

2.2.4 Acceptable Manufacturers: Subject to compliance with requirements, provide automatic vent valves

of the following:

Honeywell

2.3 Air Separators: Provide air separators pressure rated for 125 psi. Select capacity based on total system gpm.

2.3.1 In-Line Air Separators: Provide in-line air separators with tangential nozzles and stainless steel air collector tube as indicated. Construct sizes 1½" and smaller of cast iron; and sizes 2" and larger of steel complying with ASME Boiler and Pressure Vessel Code and stamped with "U" symbol. Furnish National Board Form U-1 denoting compliance.

2.3.2 Acceptable Manufacturers: Subject to compliance with requirements, provide air separators of one of the following:

Amtrol, Inc.
Bell & Gossett
John Wood Co.
Wheatley

3 EXECUTION

3.1 General: Examine areas and conditions under which hydronic specialties are to be installed. Do not proceed with work until satisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Vent Valves:

3.2.1 Manual Vent Valves: Install manual vent valves on each hydronic terminal at highest point, and on each hydronic piping drop in direction of flow for mains, branches, and runouts, and elsewhere as indicated.

3.2.2 Automatic Vent Valves: Install automatic vent valves at top of each hydronic riser and elsewhere as indicated. Install shut-off valve between riser and vent valve, pipe outlet to suitable plumbing drain.

3.3 Air Separators: Install in-line air separators in pump suction lines. Connect inlet and outlet piping. Run piping to compression tank with ¼" per foot (2%) upward slope towards tank. Install drain valve on units 2" and over.

END OF SECTION

SECTION 23 05 48 - VIBRATION ISOLATION

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 vibration isolation equipment.

1.3 Extent of vibration isolation required by this section is indicated on drawings and/or specified in other Division-23 sections.

1.4 Approval Submittals: When required by other Division-23 sections, submit product data sheets for each type of vibration isolation equipment including configuration and rating data. Submit with Division-23 section using vibration isolation, not as a separate submittal. Provide calculations showing supported weight, deflection, and isolator size and type for each item of supported equipment. Submit for:

1.4.1 Equipment Mountings. Type EM.

1.4.2 Hangers. Type HA.

1.5 O&M Data Submittals: Submit a copy of approval submittals for each type of vibration isolation equipment. Include this data in O&M Manual.

2 PRODUCTS

2.1 General: Provide factory-fabricated products recommended by manufacturer for use in service indicated. Provide products of types and deflections indicated; provide proper selection as determined by Installer to comply with specifications and installation requirements. Provide sizes which properly fit with equipment. All metal parts installed outside shall be hot dipped galvanized after fabrication.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide vibration isolation equipment of: Mason Industries, Keflex, Consolidated Kinetics, Vibration Mountings & Controls, Wheatley or approved equal. All vibration isolators shall be supplied by a single approved manufacturer.

2.3 Equipment Mountings:

2.3.1 Select mountings with the required deflection and fastening means. Provide steel rails or bases as required to compensate for equipment rigidity and overhang.

2.3.2 Types of equipment mountings (EM):

1 Spring Mountings (EM1): Spring isolators shall be free-standing and laterally stable without any housing. All mounts shall have leveling bolts. Spring diameter shall be not less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Springs shall be so designed that the ratio of horizontal stiffness to vertical stiffness is approximately one. Provide a nominal static deflection of at least 1.0". Basis of Design: Mason Industries SLFH.

2 Spring Mountings with Housings (EM2): Spring isolators shall consist of open, stable steel springs and include vertical travel limit stops to control extension when weight is removed. The housing of the spring unit shall serve as blocking during erection of equipment. Provide a nominal static deflection of at least 1.0". All mountings used outside shall be hot dipped galvanized. Basis of Design: Mason Industries SLR.

3 Spring Mountings with Housings (EM3): Spring isolators shall consist of open, stable steel springs with neoprene inserts to limit movement between upper and lower housing on start and stop. Provide a nominal static deflection of at least 1.0". Mountings shall be specifically designed for critical areas on light-weight floors. Basis of Design: Mason Industries C.

4 Neoprene Mountings (EM4): Double deflection neoprene-in-shear mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered. The top and bottom surfaces shall be neoprene ribbed and bolt holes shall be provided in the base. Basis of design: Mason Industries ND.

5 Pads (EM5): Waffle or ribbed pattern neoprene pads shall be fabricated from 40-50 durometer neoprene. Provide rigid steel plate and mounting angles as required. Basis of design: Mason Industries Super W.

2.4 Hangers:

2.4.1 Select hangers with the required deflection. Provide all required hanger rods and fasteners.

2.4.2 Types of hangers (HA):

1 Hangers (HA1): Vibration hangers shall contain a steel spring set in a neoprene cup manufactured with a grommet to prevent short-circuiting of the hanger rod. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hanger box lower-hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30.

2 Hangers (HA2): Vibration hangers shall contain a laterally stable steel spring and 0.3" deflection neoprene or fiberglass element in series. A neoprene neck shall be provided where the hanger rod passes through the steel box supporting the isolator mount to prevent metal to metal contact. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Basis of Design: Mason Industries 30N.

3 Hangers (HA3): Double deflection neoprene-in-sheer or EPDM hangers. Units shall be complete with projected neoprene bushing to prevent steel-to-steel contact between hanger box and hanger rod. Average static deflection shall be not less than 0.4 inches. Basis of Design: Mason Industries HD.

3 EXECUTION

3.1 Install vibration isolation devices for the duty indicated and for ease of inspection, adjustment, and proper operation. Install in accordance with the manufacturer's written instructions and coordinate with shop drawings of supported equipment.

3.2 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.

3.3 Piping, ductwork and conduit shall not be suspended from one another or physically contact one another. Vibrating systems shall be kept free from non-vibrating systems.

3.4 Equipment Mountings:

3.4.1 Unless otherwise shown or specified, all floor-mounted equipment shall be set on housekeeping equipment bases. Refer to Division-23 section “Supports, Anchors, and Seals”.

3.4.2 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. All support frames shall be sufficiently stiff and rigid so as to prevent distortion and misalignment of components installed thereon.

3.4.3 Align equipment mountings for a free, plumb installation. Isolators that are binding, offset or fully compressed will not be accepted.

END OF SECTION

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SECTION 23 05 53 - MECHANICAL IDENTIFICATION

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.

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

2.2.1 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 1-¼" high letters for ductwork and not less than ¾" high letters for access door signs and similar operational instructions.

2.2.2 Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.

2.2.3 Identification Paint: Standard identification enamel.

2.3 Plastic Pipe Markers

2.3.1 Pressure-Sensitive Type: Provide manufacturer's standard pre-printed, permanent adhesive, color-coded, pressure-sensitive vinyl pipe markers.

2.3.1.1 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.

2.3.1.2 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.

2.4 Valve Tags:

2.4.1 Brass Valve Tags: Provide 19-gage polished brass valve tags with stamp-engraved piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" diameter tags, except as otherwise indicated.

2.4.2 Plastic Laminate Valve Tags: Provide manufacturer's standard 3/32" thick engraved plastic laminate valve tags, with piping system abbreviation in ¼" high letters and sequenced valve numbers ½" high, and with 5/32" hole for fastener. Provide 1-½" square black tags with white

lettering, except as otherwise indicated.

2.5 Engraved Plastic-Laminate Signs:

2.5.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2.5.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; ⅛" for larger units.

2.5.3 Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.6 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for all equipment.

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:

3.2.1 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.

3.2.2 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.

3.2.3 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:

3.3.1 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:

3.3.1.1 Plastic pipe markers.

3.3.1.2 Stenciled markers, black or white for best contrast.

3.3.2 Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces and exterior non-concealed locations.

3.3.2.1 Near each valve and control device.

3.3.2.2 Near each branch, excluding short take-offs for terminal units; mark each pipe at branch, where there could be question of flow pattern.

3.3.2.3 Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.

3.3.2.4 At access doors, manholes and similar access points which permit view of concealed piping.

3.3.2.5 Near major equipment items and other points of origination and termination.

3.3.2.6 Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.

3.3.2.7 On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.3.3 The following piping shall be provided with pipe marker identification.

System	Abbreviation
Chilled Water Supply	CHWS
Chilled Water Return	CHWR
Heating Hot Water Supply	HHWS
Heating Hot Water Return	HHWR

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, HVAC terminal devices and similar rough-in connections of end-use units. Coordinate code with operating instructions.

3.5 Mechanical Equipment Identification: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device. Label shall indicate type of system and area served. For concealed devices, sign shall be affixed in an exposed location to allow UF personnel to determine the location of the device without removing the concealing material. If several small devices are located on one concealed unit, only the main unit need be identified with an exposed tag. Provide signs for the following general categories of equipment and operational devices:

3.5.1 Main control and operating valves, including safety devices.

3.5.2 Meters, gauges, thermometers and similar units.

3.5.3 Pumps

3.5.4 Fans and terminal units.

3.5.5 Air handlers and fan coil units.

3.6 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment. 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.

3.7 Fume Exhaust Fans: Provide engraved plastic laminate signs that identify which rooms are served by the exhaust fan per NFPA-45.

3.8 Adjusting and Cleaning:

3.8.1 Adjusting: Relocate any mechanical identification device which has become visually blocked by work of this division or other divisions.

3.8.2 Cleaning: Clean face of identification devices.

END OF SECTION

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SECTION 23 05 93 -TESTING AND BALANCING OF MECHANICAL SYSTEMS

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. Division-23 Basic Mechanical Materials Sections apply to work of this section.

1.2 Description of Work:

1.2.1 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.

1.2.2 Coordination Meeting: A pre-TAB meeting shall be held to coordinate with the Engineer, General Contractor, Mechanical Contractor and Controls Contractor responsible for the HVAC system installation as required to complete the TAB work. TAB requirements for reporting, testing and optimization shall be reviewed at this meeting.

1.3 The intent of this specification is to balance HVAC systems within the tolerances listed, maintaining the pressure relationships indicated, with a minimum of noise and energy use. This process is inherently iterative in nature.

1.3.1 Airflow Tolerances:

1.3.1.1 Air Handling: The supply air, return air and outdoor air quantities shall be balanced within ±5% of design values.

1.3.1.2 Exhaust Fans: The exhaust fan quantities shall be set as required to maintain the design exhaust terminal flows within ±5% of design values. If no exhaust terminals exist, exhaust fan air quantities shall be balanced within ± 10% of design values.

1.3.1.3 Terminal Units: The air quantities associated with VAV boxes, fan coil units and other terminal units shall be balanced within ±5% of design values.

1.3.1.4 Ceiling Diffusers, Supply Registers, Return and Exhaust Inlets: Balance to an air quantity within ±10% of the design values. Where the drawings indicate a design pressure differential for the room, air quantities shall be further adjusted to a more restrictive tolerance as required to establish the pressure differential.

1.3.2 Temperature Tolerances:

1.3.2.1 Air Handling Temperatures: The controlled temperatures at AHUs shall be verified to be under control within ± 1°F of design values.

1.3.2.2 Room Temperatures: Balance systems and controls within ±2°F of indicated settings.

1.3.3 Pressure Relationships: Where code or design indicates a specific pressure relationship, the pressure relationship shall take precedence over airflow tolerances. Airflow tolerances may need to be held tighter than allowed tolerances to meet pressure relationships. Demonstrate the existence of positive or negative pressure to Engineer and authority having jurisdiction by making direct measurements of room relative pressure and/or flow direction.

1.3.4 Laboratory Systems: In addition to demonstrating proper airflow and temperature control, verify that all VAV systems operate correctly and maintain pressure relationships at reduced air flows.

1.3.5 Fume Hoods: Balance fume hood systems as required to maintain +10%-0% of the specified face velocity at the indicated sash position. Coordinate with authority having jurisdiction (EH&S) to insure proper fume hood certification.

1.3.6 Hydronic Flow: Balance hydronic flow rates to within +10%-0% of design values.

1.4 Quality Assurance: The TAB Contractor shall be certified as follows:

1.4.1 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.

1.4.2 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.

1.4.3 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.

1.4.4 A NEBB or AABC certified professional or technician shall be present at the site during any and all testing.

1.5 Job Conditions:

1.5.1 Do not proceed until coordination meeting has been held.

1.5.2 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.

1.5.3 Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

1.5.4 Do not proceed until duct pressure tests are complete and satisfactory.

1.5.5 Do not proceed until architectural work that would affect balancing (walls, ceiling, windows, doors) have been installed.

1.5.6 Testing may proceed system by system, but each HVAC system must be complete as describe herein.

1.5.7 The mechanical contractor shall make any changes in pulleys, belts, and dampers, and/or add dampers as required for correct balancing.

1.6 Approval Submittals

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

1.6.2 Submit project specific TAB forms showing how requirements of this section will be documented.

1.7 Test Reports and Verification Submittals:

1.7.1 Submit four (4) copies 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.

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).

3 EXECUTION

3.1 General:

3.1.1 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.

3.1.2 Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards, and as modified or detailed herein.

3.1.3 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.

3.1.4 Punch List: Prepare a deficiency (punch)list for the Contractor with a copy to the Engineer that lists all items that are incorrectly installed or are functioning improperly. Provide a retest after all items are corrected.

3.1.5 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.

3.1.6 Patch holes in insulation, ductwork and housings which have been cut or drilled for test purposes in manner recommended by original Installer.

3.1.7 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.

3.1.8 Include in the TAB report recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced.

3.1.9 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

3.2.1 Check all HVAC controls for proper location, calibration and sequence of operation.

3.2.2 Check operation of all controllers and controlled devices to verify proper action and direction. Check the operation of all interlocks.

3.2.3 Check all motorized dampers for leakage when in closed position. If leakage is more that 5%, mechanical contractor shall reset damper linkages.

3.2.4 Check all control valves for complete closure and correct action under all operating conditions.

3.2.5 Check all lab supply and exhaust system controls. Check variable volume functions in all four extreme conditions per report requirements.

3.2.6 Check control of outdoor air at air handling units at maximum and minimum supply air cfm and at clean and dirty filter conditions. Verify proper operation of outdoor air controls at all points.

3.2.7 Smoke Detectors: Perform differential pressure test at each smoke detector and report required and measured values.

3.3 Air Balancing

3.3.1 Leakage tests on ductwork must have been completed before air balancing.

3.3.2 Set dampers, volume controls and fan speeds to obtain specified air delivery with minimum noise level and minimum energy use. Rebalance as required to accomplish this. Simulate fully loaded filters during test.

3.3.3 Set grille deflections as noted on plans. Modify deflections if required to eliminate drafts or objectionable air movement. Record air terminal velocity after completion of balance work. Record final grille and register deflection settings if different from that specified on contract drawings.

3.3.4 Record all fan speeds.

3.3.5 Optimization of Variable Volume Supply Systems: Measure static pressure at all major branches. Adjust fan controllers for minimum required static pressure at the end of each branch. Balance outlets. Check at both modulated and full cooling condition. Traverse main supply ducts. All branches must be above the minimum required static pressure. Once balanced at 100% load, reset static pressure setpoint down until the most remote terminal is satisfied with 0.10 in w.g. static above the minimum (typically 0.30 in w.g.) required. Set static pressure controller to maintain this static pressure. The supply fan must track and deliver the proper air quantity with no objectionable noise. The system must be stable and operate properly at 50% load. Simulate maximum filter loading during testing. The intent is for the variable frequency drive to operate at 55-60 Hz at maximum filter loading. Report the value of the minimum static pressure that will provide proper airflow in the TAB Report and set the static pressure controller for this value. Report speed of variable frequency drives.

3.3.6 Airflow Measurement: Airflow measurements for air handling units (AHU), exhaust fans (EF) and VAV boxes shall be obtained by duct traverse and reported in the TAB Report with the indicated BAS reading from AHU or EF flow rings and VAV box controller readings for comparison. The location of the traverse shall be indicated on a sketch included in the TAB Report. If airflow is determined by any other means than a traverse (i.e., sum of outlets, or other indirect method) it shall be clearly stated in the TAB Report. Organize TAB Report contemporaneous data so that the following can be readily checked:

3.3.6.1 Comparison of actual cfm to design cfm and percent variance.

3.3.6.2 Comparison of supply air cfm to return plus outdoor air cfm.

3.3.6.3 Comparison of each AHU supply air cfm to the sum of its terminals.

3.3.6.4 Comparison of each terminal (such as VAV box or supply valve) total cfm to the sum of the outlets for the terminal.

3.3.6.5 Comparison of each EF cfm to the sum of the inlets for the EF.

3.3.6.6 Comparison of total outdoor air cfm to total conditioned exhaust cfm for each zone, floor, or AHU as applicable. Provide an indication of the net positive or negative cfm for that zone, floor, or AHU.

3.3.7 Static Pressure Measurement: Static pressure (SP) measurements for AHUs, EFs and terminal units shall be obtained at both suction and discharge so that total static pressure (TSP) can be reported. Plot design cfm and SP on fan curve and include in TAB Report. In addition, the static pressure drop across each component of the equipment (such as coils, filters, etc.) shall be reported and shown on a sketch included in the TAB Report. Organize TAB Report contemporaneous data so that the following can be readily checked:

3.3.7.1 Comparison of actual SP to design SP for each fan.

3.3.7.2 Comparison of TSP to sum of component SPs for each fan.

3.3.7.3 Comparison of measured SPs to BAS filter DP and duct SP readings.

3.3.8 Laboratory Measurements: Report room cfm offset at the following four conditions:

3.3.8.1 Maximum cooling and maximum fume exhaust.

3.3.8.2 Maximum cooling and minimum fume exhaust.

3.3.8.3 Minimum cooling and maximum fume exhaust

3.3.8.4 Minimum cooling and minimum fume exhaust.

3.4 Water Balancing:

3.4.1 Verify proper operation of all hydronic system devices to ensure the proper flowrate, flow direction and pressure are maintained.

3.4.2 Set balancing cocks and flow control devices to obtain specified water flow rates to all coils.

3.4.3 Optimization of Variable Volume Pumping Systems: Coordinate with variable speed drives to achieve balance with minimum pump speed. Report the value of the minimum differential pressure that will provide proper flow in the TAB Report and set the differential pressure controller for this value. Pump balancing cocks (if present) shall be fully open. Set maximum speed control for variable speed pumps. Verify proper operation of variable speed pumps and the associated distribution system at 50% and 100% flow.

3.4.4 Pump Measurements: Pump measurements shall report the measured shutoff head and the operating head. Plot these on a copy of the pump curve for each pump and include in the TAB Report. Organize the TAB Report contemporaneous data so that the following can be readily checked:

3.4.4.1 Measured pump performance with pump curve for each pump.

3.4.4.2 Total pump flow with sum of coil flows for each pump.

3.5 Heat Exchange Device Measurements: Measurements for heat exchange devices such as coils shall be taken such that flows and temperatures are contemporaneous and can be used to calculate the Btu/hr using both fluids. The measurements shall be taken with sufficient precision to demonstrate a Btu/hr calculation agreement within 10%. Show all data on a diagram of the heat exchange device and include in the TAB Report. Organize the TAB Report contemporaneous data so that the following can be readily checked:

3.5.1 Comparison of measured values to BAS readings.

3.5.2 Comparison of calculated Btu/hr for both fluids.

3.5.3 Comparison of calculated values to design values.

3.6 Data Collection:

3.6.1 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.

3.6.2 It is the intent of this section to record data on balanced systems, under normal operating or design conditions. Data collection and recording shall be precise and contemporaneous so that flows and temperatures can be used to calculate coil Btu/hr for both airside and waterside. Acceptable Btu/hr calculation variation is 10%.

3.6.3 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. Inlet and outlet temperature of each heat exchange device - both fluids. For air, record both wet and dry bulb temperatures.

3.6.4 Pressures:

1. Suction and discharge static pressure of each fan.
2. Air pressure drop across each coil and component of each AHU.
3. Suction and discharge pressure of each pump.
4. Water pressure drop through each heat exchange device.

3.6.5 Flow rates:

1. Flow rate through each fan.
2. Flow rate through each pump.
3. Flow rate through each coil.
4. Flow rate through each air distribution device.

3.6.6 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.

4 FUME HOOD TESTING

4.1 Conform to all applicable requirements of Parts 1.0, 2.0 and 3.0 herein.

4.2 Ensure room air balance is satisfactory prior to initiating fume hood testing.

4.3 General Requirements:

4.3.1 Each fume hood, when properly installed in a laboratory and connected to an exhaust fan of the

proper capacity, shall contain and remove fumes generated within the hood. The face velocity range shall be 100 fpm with the sash 16" open. No reverse flows of air will be allowed along the sides, top, bottom, or front of the hood. The Owner and/or a designated representative may view the tests and successful results are contingent upon concurrence by the Owner and/or the representative.

4.3.2 The performance test requirements listed in this section shall be used for the establishment of baseline performance characteristics for comparison with future periodic evaluations of laboratory chemical fume hoods.

4.4 Performance Test Procedures:

4.4.1 "Properly installed" means that the hood is in an area where there is at least 5 feet clear space in front for observation of the airflow pattern entering the hood. This area shall be without cross drafts or other air currents exceeding 20 fpm that would affect the hood performance in the area in front and around the hood.

4.4.2 Fume hood face velocity shall be verified as follows: with exhaust system on, the quantity of air being exhausted shall be determined by measuring the velocity of air entering the hood face and multiplying this velocity by the square feet of hood opening. The hood sash shall be in the 16" open position. The air velocity shall be determined by averaging at least nine velocity readings taken at the hood face. Readings shall be taken in the center of a grid made up of 3 sections across the middle of the hood face and 3 sections each across the bottom and top of the hood face. Readings shall not vary more than $\pm$ 10 fpm from the average face velocity. Report all readings in the TAB Report.

4.4.3 When the selected face velocity has been established, a smoke bomb (one-half minute size, as available from E. Vernon Hill Company, San Francisco, California) shall be discharged within the hood area to show the exhaust capability of the hood and its design efficiency. No reverse air flows will be permitted. Place lighted bomb in the hood area and move it to various places, meanwhile checking end panels and working surface to verify that no reverse air flows exist at any point. Lower the sash to closed position to verify that a sufficient air volume is flowing through the hood working area to carry away fumes from a massive fume source. Immediately after the smoke bomb stops discharging smoke, the hood area shall be purged of smoke. Report results in the TAB Report.

4.4.4 Lower sash to a point 6 inches above work surface. Velocity, as measured at three points across the reduced face opening, shall be at least two times but less than three times the design face velocity when the sash was fully raised. Report all readings in the TAB Report.

4.4.5 With the sash still at the 6 inch open position, the exhaust air volume (indicated as a function of the average velocity determined in the duct with the pitot tube) shall be essentially the same as when the sash was fully raised. Measure exhaust flow in the duct with the sash fully open and fully closed. Total exhaust flow shall be essentially the same as measured previously with the different sash opening positions.

4.4.6 Check sash operation by raising and lowering sash. Sash shall glide smoothly and freely, and hold at any height without creeping, assuring proper counterbalance. No metal-to-metal contact shall be allowed between the sash and the sash track.

4.4.7 With the exhaust system off, turn on auxiliary air system and adjust the supply air volume to the scheduled value. The auxiliary air volume shall be determined with the pitot tube.

4.4.8 Measure the air velocity along a line 3" out from the face of the hood and at a height equal to the bottom of the sash when the sash is in a fully raised position. The velocity should not exceed 200 fpm along this line.

4.4.9 Turn on the exhaust system and operate at the average face velocity specified. Maintain auxiliary air operation. This will provide the desired ratio of auxiliary air to room air being exhausted by the

hood.

4.4.10 Introduce a 1-minute smoke bomb into the auxiliary air system prior to the point that air enters the plenum and observe the air pattern. Smoke must indicate a smooth uniform air pattern leaving the auxiliary air discharge and smoke must be efficiently entrained and exhausted by the hood when the sash is fully raised.

4.4.11 Repeat smoke bomb test, but with the sash in fully closed position. Smoke must be efficiently captured by air entering the bypass.

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

END OF SECTION

SECTION 23 07 13 - EXTERIOR INSULATION FOR DUCTWORK

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:

1.3.1 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:

1.3.1.1 Rigid duct insulation

1.3.1.2 Flexible duct insulation

1.3.1.3 Insulation for exterior ducts.

1.3.1.4 Sheet waterproofing for exterior ducts.

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Knauf, Owens-Corning, Johns Manville, Certainteed. All products shall be low VOC to meet FGBC requirements.

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 0.75 pcf density with UL rated aluminum foil vapor barrier (FSK).

2.5 General Purpose Mastic: Benjamin Foster 35-00 Series, 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 30-65, Childers CP-34, or approved equal. Provide "Low Odor" type. Provide water-based product. 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 85-60, Childers CP-82, Childers CP-127, or approved equal. Provide water-based product. 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, Chil Glass #10 or equal.

2.9 Sheet Waterproofing: Flex Clad 400 (or equal) prefabricated, self-adhering, sheet type protective membrane with embossed UV-resistant aluminum weathering surface and multiple layers of high density, cross-linked polymer film.

3 EXECUTION

3.1 Insulate all supply, return, exhaust and outdoor air ductwork exposed in mechanical rooms, mezzanines, fan lofts or in any finished spaces with 1½" thick rigid fiberglass insulation with vapor barrier.

3.2 Installation of Rigid Insulation:

3.2.1 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.

3.2.2 Adhere insulation to duct with 50 percent coverage using approved insulation adhesive applied in 6-inch wide swaths with 6-inch 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-inch centers and 3 inches 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.

3.2.3 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 2.2" thick fiberglass blanket insulation with vapor barrier (installed R-value of 6.0 minimum).

3.4 Installation of Flexible Insulation:

3.4.1 Insulate round elbows and fittings with wrap such that thickness is equal to adjoining duct covering. Clean and dry ductwork prior to insulating.

3.4.2 Adhere insulation to duct with 50 percent coverage using approved insulation adhesive applied in 6-inch wide swaths with 6-inch 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-inch centers and 3 inches 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.

3.4.3 Lap all joints 2 inches and seal joints with 4-inch wide strips of open mesh glass fabric embedded in two coats of general purpose mastic.

3.4.4 Seal all punctures and breaks in aluminum vapor barrier with open mesh glass fabric and vapor barrier sealant.

END OF SECTION

SECTION 23 07 19 - INSULATION FOR EQUIPMENT AND PIPING

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:

1.3.1 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:

1.3.1.1 Fiberglass pipe insulation

1.3.1.2 Cellular glass pipe above ground insulation

1.3.1.3 Cellular glass pipe below ground insulation

1.3.1.4 Cellular glass equipment insulation

1.3.1.5 Flexible unicellular piping insulation

1.4 O&M Data Submittals: Submit a copy of all approval submittals. Include in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide insulation products by Armacell, Calsilite Group, Industrial Insulation Group, Johns Manville, Knauf, Owens Corning, Pittsburgh Corning, U.S. Rubber, or approved equal. All products shall be asbestos-free. All products shall be low VOC to meet FGBC requirements.

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:

2.3.1 Fiberglass Pipe Insulation: ASTM C547, Class 1 unless otherwise indicated. (Preformed sleeving with white all-service jacket, suitable for temperatures up to 450°F)

2.3.2 Cellular Glass Pipe Insulation: ASTM C552, Type II, Class 1. (Uncovered.)

2.3.3 Flexible Unicellular Pipe Insulation: ASTM C534, Type I. (Tubular, suitable for use to 200°F.) Inside diameter shall be sized for the piping or tubing being insulated.

2.3.4 Staples, Bands, Wires, and Cement: As recommended by the insulation manufacturer for applications indicated.

2.3.5 Adhesives, Sealers, Protective Finishes: Products recommended by the insulation manufacturer for the application indicated.

2.3.6 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.

2.3.7 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:

2.4.1 Cellular Glass Equipment Insulation: ASTM C552, Type I (Flat, uncovered blocks.)

2.4.2 Jacketing Material for Equipment Insulation: Provide 8 ounce canvas jacket, except as otherwise indicated.

2.4.3 Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

2.4.4 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.

3 EXECUTION

3.1 General:

3.1.1 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.

3.1.2 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.

3.1.3 Maintain integrity of vapor-barrier on insulation and protect it to prevent puncture and other damage. Label all insulation "ASBESTOS FREE".

3.1.4 Do not apply insulation to surfaces while they are hot or wet.

3.1.5 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.

3.1.6 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:

3.2.1 Insulate the following piping systems (indoor locations):

3.2.1.1 Heating hot water: up to 1¼ " pipe - 1½" thick, over 1¼" pipe 2" thick.

3.2.2 Apply insulation to pipe with all side and end joints butted tightly. Seal longitudinal lap by pressurizing with plastic sealing tool. Apply 3 inch 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.

3.2.3 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.

3.2.4 Omit insulation on unions, flanges, strainer blowoffs, flexible connections and expansion joints.

3.3 Cellular Glass Pipe Insulation (Above Ground):

3.3.1 Insulate the following piping systems:

3.3.1.1 Chilled water: smaller than 6" pipe - 1½" thick, 6" and larger pipe - 2" thick.

3.3.1.2 Heating hot water: smaller than 6" pipe - 1 ½" thick, 6" and larger pipe - 2" thick.

3.3.2 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 inches 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.

3.3.3 Indoor Exposed 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 inches 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.

3.4 Cellular Glass Equipment Insulation:

3.4.1 Insulate the following equipment:

3.4.1.1 Chilled water pumps -2" thick.

3.4.2 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 two inches 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:

3.5.1 Insulate the following piping systems:

3.5.1.1 Condensate drains from air conditioning units - ½" thick.

3.5.2 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.

3.5.3 Insulation outside the building shall be protected by a 0.016" thickness aluminum jacket with aluminum bands on 12" centers.

END OF SECTION

SECTION 23 08 05 - START-UP REQUIREMENTS FOR HEATING, VENTILATING, & AIR CONDITIONING (HVAC) SYSTEMS

1 GENERAL

1.1 Intent: It is the intent of this section to require that the startup requirements and report noted herein be performed prior to starting TAB work on each system. Work can be phased with permission of the Engineer.

1.2 Coordination:

1.2.1 The Contractor shall furnish to the TAB Contractor a complete set of plans, specifications, addenda, shop drawings, equipment performance data sheets, change orders, etc. as requested by the TAB Contractor.

1.2.2 The Contractor shall participate in a TAB coordination meeting to discuss interface requirements with the TAB Contractor and to establish a schedule for TAB work prior to start of TAB work.

1.3 Test Reports and Verification Submittals:

1.3.1 Submit Startup Report as described herein for each system. Attach Factory Startup Report for equipment as required by other Division-23 sections.

2 PRODUCTS: None

3 EXECUTION:

3.1 The TAB work shall not commence until the Engineer has received written notice from the Contractor that HVAC systems are 100% complete and are fully operational. Submit Startup Report as described herein.

3.2 The Contractor shall place all HVAC systems and equipment into complete operation during each working day of TAB work.

3.3 The Contractor shall provide access to HVAC systems and equipment by supplying ladders and/or scaffolding, and opening access panels and equipment room doors.

3.4 The TAB Contractor will provide to the Contractor TAB punch lists of non-complying HVAC work as they are discovered. The Contractor shall replace or repair non-complying work as soon as possible in order not to delay completion of TAB work.

3.5 Airside Systems: The Contractor shall provide the following information to the Engineer to substantiate proper start-up and preliminary adjustments of air handler units, belt driven fans, and duct systems.

3.5.1 Verify that air grilles (supply, return, exhaust, transfer, outdoor, etc.) are installed and connected to the duct system.

3.5.2 Verify that duct systems are clean of debris.

3.5.3 Verify that ducts attached with flexible connectors are aligned within ½" and have a uniform gap between ducts of 1"-1.5". Flexible connectors shall not leak and shall be insulated.

3.5.4 Verify that filters are clean and filter spacers are installed.

3.5.5 Verify that balancing dampers at grilles and branch ducts are operational and are fully opened.

3.5.6 Verify that fire dampers are correctly installed and are fully opened.

3.5.7 Verify that fan discharges are appropriate for the outlet ductwork with regards to the "system effect" per AMCA Publication 201. Inappropriate fan discharges will not be accepted.

3.5.8 Verify proper fan rotation.

3.5.9 Verify proper belt drive alignment.

3.5.10 Verify fan motor overload elements are correctly sized.

3.5.11 Adjust fan sheave until CFM is at or above design CFM. Provide additional sheaves and belts as required. Verify that motor is not overloaded.

3.5.12 Verify that HVAC control systems are fully operational.

3.6 Hydronic Systems: The Contractor shall provide the following information to the Engineer to substantiate proper start-up and preliminary adjustments of HVAC pumps and piping systems.

3.6.1 Verify that the hydronic systems are properly flushed, filled, vented, purged and chemically treated and that all leaks are repaired. Verify proper air venting.

3.6.2 Verify that the correct strainer screens are clean and installed.

3.6.3 Verify that pump/motor shafts are correctly aligned.

3.6.4 Verify proper pump rotation and flow direction.

3.6.5 Verify that all balancing valves and circuit setters are fully opened.

3.6.6 Verify that test ports, pressure gauges and thermometers are properly installed and are accessible at coils and pumps. Extensions to allow for pipe insulation are required. Pressure gauges at pumps must utilize pump taps in order for head measurements to correlate with the pump performance curves.

3.6.7 Verify pump motor overload elements are correctly sized.

3.6.8 Adjust balancing valve at pump discharge until GPM is at or greater than design GPM. Verify motor is not overloaded.

3.6.9 Provide flow meter data (IN WC and GPM), pump performance chart with flow data plotted, actual motor volts/amps, rated motor volts/amps and motor overload element capacity.

3.6.10 Verify that HVAC control systems for coils are fully operational.

3.7 VAV Systems: The Contractor shall provide the following information to the Engineer to substantiate the proper start-up and preliminary adjustments of variable air volume boxes and control systems.

3.7.1 Verify that the inlet duct to the box is straight for a minimum of five (5) inlet duct diameters.

3.7.2 Verify that the discharge duct from the box has no branch takeoffs within five (5) feet of the box discharge.

3.7.3 Set the VAV box thermostat to 85°F. Verify that the VAV box modulates to minimum cooling, and the heating activates.

3.7.4 Set the VAV box or laboratory supply valve thermostat to 55°F. Verify that the reverse operation

occurs and the VAV box or laboratory supply valve modulates to maximum cooling.

3.7.5 Set box thermostat to 75°F. Deadband shall not exceed 1°F.

3.7.6 Set minimum and maximum CFM based on manufacturer's calibration curves.

3.7.7 Verify that the static pressure probe is located 75% of the distance down the longest duct run. Mark the location of the probe on the as-builts and notify the TAB Contractor of same.

3.7.8 Verify that the static pressure control properly modulates the AHU fan's variable frequency drive. Set static pressure controller to maintain 1 in. w.g. as the initial setting.

3.7.9 Verify that the supply air temperature controller properly modulates the chilled water control valve. Set controller to maintain 55°F. Verify that all heating coil control valves as properly modulated.

3.8 Fume Hood Systems: The Contractor shall provide the following information to the Engineer to substantiate the operation and proper startup of fume hood and related laboratory systems.

3.8.1 Verify that all fume hood exhaust fans have proper belt alignment and fan rotation. Verify motor overloads are correctly sized.

3.8.2 Adjust fan sheave until CFM is at or above design CFM. Provide additional sheaves and belts as required. Verify that motor is not overloaded.

3.8.3 Verify that variable volume valves are correctly installed. Verify that variable functions correctly operate.

3.8.4 Verify that fume exhaust fan controls properly sequence, stage and control static pressure.

3.9 Startup Report: The Contractor shall submit the startup information required by this section to the Engineer in a typed report organized as outlined herein. The Startup Report is required to meet the written notice described herein prior to starting TAB work. TAB work will not start until the Startup Report has been submitted and approved.

END OF SECTION

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SECTION 23 08 10 - HVAC SYSTEM COMMISSIONING

1 GENERAL

1.1 Intent: This section describes the work performed by the HVAC Commissioning Authority and the supporting work required by the Contractor. The Commissioning Authority will be provided by the Owner. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

1.2 Intent of Commissioning Process:

1.2.1 Verify operation and functional performance of HVAC systems for compliance with "Design Intent". "Design Intent" is used to indicate the detailed requirements for the HVAC system, comprised of:

1.2.1.1 Design criteria and assumptions

1.2.1.2 HVAC system description and contract documentation

1.2.1.3 Intended methods of system operation and maintenance

1.2.2 Document HVAC tests and inspections.

1.2.3 Verify application of operation and maintenance manuals, as-built (record) documents, spare parts listing, special tools listing, and other items as may be specified herein for support of HVAC systems and equipment.

1.2.4 Coordinate and direct training to personnel for operation and maintenance of HVAC equipment and systems.

1.3 Contractor Scope of Work: Contractor shall perform all testing and demonstrate system operation to support the Commissioning Authority. Furnish labor and materials to support complete HVAC commissioning as specified herein. Support interim commissioning of HVAC systems during initial season operation and follow-up commissioning of required HVAC systems during additional season operation.

1.4 Documentation:

1.4.1 Provide the following to the Commissioning Authority:

1.4.1.1 Project plans and specification (contract documents), authorized revisions, approved HVAC shop drawings and submittals, Startup Reports, Test and Balance Reports, factory start-up and certification reports, etc.

1.4.1.2 Records of required code authority inspections, documentation sign-offs, etc.

1.5 Submittals:

1.5.1 HVAC Commissioning Authority will provide the following to the Contractor prior to starting the commissioning process.

1.5.1.1 Commissioning Plan consisting of specific equipment and system checklists.

1.5.1.2 Training Plan outlining required training and documentation.

1.5.2 Contractor shall submit the following prior to starting the commissioning process.

1.5.2.1 O & M Manuals.

1.5.2.2 Startup Reports per Division-23 section 23 08 05.

1.5.2.3 Test and Balance Report per Division-23 section 23 05 93.

1.5.2.4 List of tools and spare parts required by other Division-23 sections.

1.5.3 Responsibilities:

1.5.4 Contractor:

1.5.4.1 Contractor shall verify completeness of the building envelope, perimeter and interior items which effect proper operation and control of HVAC equipment and systems.

1.5.4.2 The Contractor shall assure participation and cooperation of trade subcontractors (electrical, Test and Balance, controls/energy management, IAQ, and HVAC) under his contract as required for the commissioning process.

1.5.4.3 The Contractor shall secure the services of a professional video service to record all training sessions provided by the subcontractors. All training sessions shall be professionally videotaped and two copies provided to the Owner.

1.5.5 Subcontractors:

1.5.5.1 The subcontractors shall be responsible for providing labor, material, equipment, etc., required within the scope of their specialty to facilitate the commissioning process. The subcontractors shall perform tests and verification procedures required by the commissioning process when requested by the Commissioning Authority and directed by the Contractor.

1.5.6 Owner:

1.5.6.1 Owner will schedule their personnel to participate in the HVAC Commissioning process. This may include building security personnel, HVAC operation personnel and maintenance personnel. Personnel operating and maintaining equipment and systems will attend training sessions., factory schools, and educational institutions where indicated.

1.5.6.2 Owner shall advise HVAC Commissioning Authority regarding changes in building occupancy and/or usage.

2 PRODUCTS

2.1 Instrumentation: Instrumentation shall be provided by agency performing prior tests. Instruments shall be operated by the individual agency requested by the HVAC Commissioning Authority, as specified elsewhere herein.

3 EXECUTION

3.1 General: The HVAC Commissioning Authority will actively participate in construction phase of the project to assure compliance with HVAC Commissioning requirements.

3.2 Procedure:

3.3 The Contractor and designated subcontractors shall attend a pre-commissioning meeting and establish requirements for HVAC Commissioning. The meeting shall outline:

3.3.1 Responsibility of each trade affected by HVAC Commissioning, as required by appropriate section of the specification and indicated on equipment and system checklists provided by the Commissioning Authority.

3.3.2 Requirements for documentation as listed elsewhere herein.

3.3.3 Requirements for documentation of HVAC test and inspections required by code authorities.

3.3.4 Requirements for the HVAC Commissioning program during specified operational seasons, part and full loads and as further delineated in Paragraph 3.4.

3.3.5 Format for training program for operation and maintenance personnel.

3.4 HVAC Commissioning:

3.4.1 To assist in the commissioning process, Operation and Maintenance manuals shall be completed and turned over to the Commissioning Authority as soon as possible during the course of the project, but in no case later than one month prior to the initial date scheduled for substantial completion.

3.4.2 The Commissioning Authority will develop and submit a specific start-up, check-out and sign-off form for every piece of major equipment and system, as well as other equipment hereinafter listed. These forms and lists do not necessarily indicate all the activities, tests and procedures which will be required for the commissioning and start-up of each piece of equipment and system.

3.4.3 The Contractor shall develop a work plan to demonstrate system and equipment operation. Systems shall be operated under actual or simulated full load conditions. Identify the operating conditions in the work plan. Where appropriate, systems shall be operated, tested, and started up, to assure operation for each of their seasonal or different characteristics, (for example heating and cooling).

3.4.4 After all components and every system has been completely commissioned, provide a 2-week, 24-hour per day fully functional automatic operation period of all systems simultaneously. This shall be successfully concluded before systems are accepted by the Owner.

3.4.5 Execute the final approved start-up and commissioning plan.

3.4.6 HVAC Commissioning shall begin only after HVAC equipment and systems, along with related equipment, systems, structures and areas are complete. Systems may be commissioned individually if requested by the Contractor and approved by the Commissioning Authority.

3.4.6.1 Verify Test and Balance readings, such as:

3.4.6.1.1 Supply and return air volumes

3.4.6.1.2 Fan performance

3.4.6.1.3 Hydronic performance

3.4.6.1.4 Branch duct readings

3.4.6.2 Verify calibration of thermostats and related controls, such as:

3.4.6.2.1 VAV boxes

3.4.6.2.2 Fan coil units

3.4.6.2.3 Damper settings

3.4.6.2.4 Valve positions

3.4.6.3 Verify readings of Building Automation Systems (BAS), such as:

3.4.6.3.1 Temperatures

3.4.6.3.2 Air Flows

3.4.6.3.3 Damper positions

3.4.6.3.4 Differential pressures

3.4.6.3.5 Water temperatures

3.4.6.4 Verify that the total HVAC system is performing properly at seasonal full load and part load conditions, as follows:

3.4.6.4.1 Temperature

3.4.6.4.2 Humidity

3.4.6.4.3 Air changes

3.4.6.4.4 Air movement

3.4.6.4.5 Air quality

3.4.6.4.6 Zone control

3.4.6.4.7 Pressurization

3.4.6.4.8 Control response

3.5 HVAC Start-Up Procedures:

3.5.1 Prior to start-up of any air handling equipment, the Commissioning Authority and the Contractor shall inspect the installation and verify that:

3.5.1.1 Ductwork is complete, clean and pressure-tested per specifications.

3.5.1.2 Prefilters and final filters are installed by the Contractor per design specifications; prefilters are to be replaced by the Contractor as required during this start-up period. The final filters shall be replaced by the Contractor any time that the static pressure drop across the filter exceeds 1.0". The filters installed shall meet design specifications and shall be dated with a felt-tip marker upon installation.

3.5.1.3 All electrical work is complete.

3.5.1.4 Safety devices are in place and operational.

3.5.1.5 BAS is installed and have been verified to be operational by the controls contractor.

3.5.1.6 All piping has been installed and insulated per specifications.

3.5.2 Prior to Occupancy:

3.5.2.1 No less than two weeks prior to substantial completion, the HVAC system for the space to be occupied shall be approved by the Commissioning Authority to be operational under the start-up procedures and shall be set up by the Contractor to operate continuously on a 24-hour

basis. The following requirements shall be established by the Commissioning Authority and adhered by to the contractors during this period:

3.5.2.1.1 The Building Automation System is completely installed, and the BAS Contractor has submitted a statement verifying that the system is complete and operational.

3.5.2.1.2 The HVAC air side and water systems shall be balanced at design levels by the Contractor, all systems and devices shall be operating according to specifications, and the Contractor's TAB report has been submitted to an approved by the HVAC system Design Engineer.

3.5.2.1.3 Outdoor air shall be set at maximum design levels and maintained at those levels continuously during the two-week ventilation period.

3.5.2.1.4 Chilled water temperature (where applicable) shall be operating at design levels. Supply air off-coil temperatures shall be at design levels.

3.5.2.1.5 All exhaust systems are operational and functioning according to design CFM and specifications.

3.5.2.1.6 All hydronic reheat systems are installed and operational.

3.5.2.1.7 Prefilters shall continue to be replaced by the Contractor as required per the start-up schedule. The final filter shall be replaced by the Contractor at any time that the static pressure drop across the filter exceeds 1.0".

3.5.2.1.8 All interior spaces are secured with doors and windows normally closed.

3.5.2.1.9 Interior air quality shall be maintained at 75ºF and relative humidity less than 60%.

3.5.3 At Occupancy: Following the date of final completion and prior to occupancy, the Commissioning Authority shall verify all prefilters and final filters have been replaced with new, approved, specified filters.

END OF SECTION

SECTION 23 11 00 - PIPES AND PIPE FITTINGS

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 pipes and pipe fittings specified herein.

1.3 Extent of pipes and pipe fittings required by this section is indicated on drawings and/or specified in other Division-23 sections.

1.4 Codes and Standards:

1.4.1 Welding: Qualify welding procedures, welders and operators in accordance with ASME B31.1, or ASME B31.9, as applicable, for shop and project site welding of piping work.

1.4.2 Brazing: Certify brazing procedures, brazers, and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and job-site brazing of piping work.

1.5 Approval Submittals:

1.5.1 Shop Drawings: Submit coordinated shop drawings indicating method of pipe fitting. Submit certification for intended methods of installation.

1.6 Test Report and Verification Submittals:

1.6.1 Submit welding certification for all welding installers prior to commencing work.

1.6.2 Submit brazing certification for all brazing installers prior to commencing work.

2 PRODUCTS

2.1 Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or Class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards. All piping provided for a particular system shall be by the same manufacturer.

2.2 Pipe/Tube Fittings: Provide factory-fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.3 Piping Materials/Products:

2.3.1 Soldering Materials:

2.3.1.1 Tin-Antimony (95-5) Solder: ASTM B-32, Grade 95TA.

2.3.1.2 Silver-Phosphorus Solder: ASTM B-32, Grade 96TS.

2.3.2 Pipe Thread Tape: Teflon tape.

2.3.3 Protective Coating: Koppers Bitumastic No. 505 or equal.

2.3.4 Gaskets for Flanged Joints: ANSI B16.21; full-faced for cast iron flanges; raised-face for steel

flanges, unless otherwise noted.

2.3.5 Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials. Materials shall be determined by installer to comply with installation requirements.

2.3.6 Brazing Materials: Silver content of not less than 15%. Materials shall be determined by installer to comply with installation requirements.

2.4 Copper Tube and Fittings:

2.4.1 Copper Tube:

2.4.1.1 Copper Tube: ASTM B88; Type K or L as indicated for each service; hard-drawn temper unless specifically noted as annealed.

2.4.1.2 ACR Copper Tube: ASTM B280.

2.4.1.3 DWV Copper Tube: ASTM B306.

2.4.2 Fittings:

2.4.2.1 Wrought-Copper Solder-Joint Fittings: ANSI B16.22.

2.4.2.2 Copper Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4.2.3 Wrought-Copper Solder-Joint Drainage Fittings: ANSI B16.29.

2.4.2.4 Cast-Copper Flared Tube Fittings: ANSI B16.26.

2.5 Steel Pipes and Pipe Fittings

2.5.1 Pipes:

2.5.1.1 Black Steel Pipe: ASTM A53, ASTM A795, ASTM 135.

2.5.1.2 Black Steel Pipe 1 ½" and Smaller: ASTM A53, ASTM A795, ASTM A135.

2.5.2 Pipe Fittings:

2.5.2.1 Threaded Cast Iron: ANSI B16.4.

2.5.2.2 Threaded Pipe Plugs: ANSI B16.14.

2.5.2.3 Flanged Cast Iron: ANSI B16.1, including bolting.

2.5.2.4 Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing.

2.5.2.5 Wrought-Steel Buttwelding Fittings: ANSI B16.9, except ANSI B16.28 for short radius elbows and returns, rated to match connected pipe.

2.5.2.6 Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than schedule 80 pipe where length remaining unthreaded is less than 1 ½ inches, and where pipe size is less than 1 ½ inches, and do not thread nipples full length (no close-nipples).

2.5.2.6.1 Fittings: Precision, cold drawn, stainless steel with elastomer O-ring seals, suitable for working pressure to 500-psig. Victaulic Vic-Press for Schedule 10S pipe.

2.5.3 Victaulic Mechanical Couplings: Provide standard mechanical couplings consisting of two segments of cast ductile iron per ASTM A-536 with pressure-responsive synthetic rubber gaskets per ASTM-2000. Bolts shall be zinc plated per ASTM B-633 with heat treated carbon steel track head per ASTM A-449 and ASTM A-183 provided by Victaulic. Couplings shall comply with ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

2.5.3.1 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.1, B31.9, with Victaulic Style 107H/107N (Quick-Vic™), installation ready rigid coupling for direct stab installation without field disassembly. Gasket shall be Grade “EHP” EPDM designed for operating temperature from -30°F to +250°F.

2.5.3.2 Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in closed proximity to the vibration source. Victaulic Style 177 (Quick-Vic™), installation ready and Style 77 flexible coupling.

2.5.3.3 Victaulic AGS Mechanical Couplings: 14" (DN352) through 60" (DN1500). Couplings shall consist of two ASTM A-536 ductile iron housing segments with lead-in chamfer on housing key and a wide-width elastomer pressure responsive gasket. Victaulic Style W07 AGS rigid and Style W77 AGS flexible coupling.

2.5.3.4 Fittings shall be ductile iron to ASTM A536, Grade 65-45-12; wrought steel to ASTM A234, Grade WPB; or factory fabricated from ASTM A53 steel pipe.

3 EXECUTION

3.1 Installation

3.1.1 General: Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings, not bushings. Align piping accurately at connections, within 1/16" misalignment tolerance.

3.1.2 Comply with ANSI B31 Code for Pressure Piping.

3.1.3 Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to ½" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.

3.1.4 Concealed Piping: Unless specifically noted as “Exposed” on the drawings, conceal piping from view in finished and occupied spaces, by locating in column enclosures, chases, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated. Protect concealed piping from physical damage in accordance with the Florida Building Code - Plumbing.

3.1.5 Electrical Equipment Spaces: Do not run piping through transformer vaults and other electrical, communications, or data equipment spaces and enclosures unless shown. Install drip pan under piping that must run through electrical spaces.

3.1.5.1 Cut pipe from measurements taken at the site, not from drawings. Keep pipes free of contact with

building construction and installed work.

3.2 Piping System Joints: Provide joints of the type indicated in each piping system.

3.2.1 Solder copper tube-and-fitting joints where indicated, in accordance with ASTM B 828. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply non-acid type solder flux to joint areas of both tubes and fittings in accordance with ASTM B 813. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Solder shall conform to ASTM B 32 and shall be lead free. Wipe excess solder from joint before it hardens.

3.2.2 Thread pipe in accordance with ANSI B1.20.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed. Paint exposed threads to retard rusting.

3.2.3 Flanged Joints: Match flanges within piping system, and at connection with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets. Bolts shall project 1/8" to 3/8" beyond nut face when tight.

3.2.4 Weld pipe joints in accordance with recognized industry practice and as follows. Be guided by ANSI B.31.

3.2.4.1 Weld pipe joints only when ambient temperature is above 0°F.

3.2.4.2 Bevel pipe ends at a 37.5° angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.

3.2.4.3 Use pipe clamps or tack-weld joints; 4 welds for pipe sizes to 10". All welds shall be open-butt.

3.2.4.4 Build up welds with root pass, followed by filler pass and then a cover pass. Eliminate valleys at center and edges of each weld. Weld by procedures which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and non-metallic inclusions.

3.2.4.5 Do not weld-out piping system imperfections by tack-welding procedures; refabricate to comply with requirements.

3.2.4.6 At Installer's option, install forged branch-connection fittings wherever branch pipe is less than 3" and at least two pipe sizes smaller than main pipe indicated; or install regular "T" fitting. Weld-O-Let or equal.

3.2.5 Grooved Joints: Provide roll or cut grooved-end pipe and pipe fittings in accordance with the Victaulic written installation directions. If this system is chosen, all fittings are required to be insulated per the specification. Grooved ends shall be clean and free from indentations, projections, and roll marks. Gaskets shall be molded and produced by the coupling manufacturer, and shall be verified as suitable for the intended service. A factory-trained field representative of the mechanical joint manufacturer shall provide on-site training for contractor’s field personnel in the proper use of grooving tools and installation of grooved piping products. The factory-trained representative shall periodically review the product installation and ensure best practices are being followed. Contractor shall remove and replace any improperly installed products. A distributor’s representative is not considered qualified to conduct the training.

3.2.6 Braze copper tube-and-fitting joints where indicated, in accordance with ANSI B.31 using an approved flux and filler metal conforming to AWS A5.8.

3.3 Piping Installation

3.3.1 Install piping to allow for expansion and contraction.

3.3.2 Isolate all copper tubing from steel and concrete by wrapping the pipe at the contact point, and for one inch on each side, with at least two layers of plastic electrical tape. Isolate all copper tubing installed in block walls with a continuous plastic sleeve.

3.3.3 Underground Piping:

3.3.3.1 Provide plastic tape markers over all underground piping. Provide copper wire over all underground plastic piping. Locate markers 18" above piping.

3.3.3.2 Coat the following underground (uninsulated) pipes with a heavy coat of bitumastic or provide an 8 mil polyvinyl sleeve: black steel pipe, copper tubing.

END OF SECTION

SECTION 23 11 13 - TESTING AND CLEANING OF PIPING SYSTEMS

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.

2 PRESSURE TESTS

2.1 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.

2.2 Required test period is 2 hours.

2.3 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.

2.4 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.

2.5 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.

2.6 During heating and cooling cycles, linear expansion shall be checked at all elbows and expansion joints for proper clearance.

2.7 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.

2.8 Pressure Test Requirements:

2.8.1 Chilled Water, Heating Hot Water: Perform hydrostatic test at 150% of the normal operating pressure, but not less than 150 psig.

3 CLEANING AND STERILIZATION

3.1 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.

3.2 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.

3.3 Chilled Water and Heating Hot Water Pipe 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 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 and reheat coils. 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. Refer to individual mechanical systems specification sections for additional requirements.

END OF SECTION

SECTION 23 12 13 - HEATING HOT WATER AND CHILLED WATER SYSTEMS

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 insulation of hydronic piping; not work of this section.

1.4 Refer to other Division-23 sections for hydronic specialties; not work of this section.

1.5 Refer to other Division-23 sections for HVAC pumps; not work of this section.

1.6 Refer to other Division-23 sections for testing, adjusting, and balancing of hydronic piping systems; not work of this section.

1.7 Codes and Standards: Fabricate and install hydronic piping in accordance with ASME B31.9 "Building Services Piping."

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's product data for:

1.8.1.1 Valves

1.8.1.2 Meters and Gauges

1.8.1.3 Vibration Isolation

1.8.1.4 Access Doors

1.8.2 Shop Drawings: Submit scaled layout drawings of piping systems in mechanical rooms including, but not necessarily limited to, pipe sizes, location, offsets, connections, elevations, and hydronic specialties. Indicate interface and spatial relationship between piping and equipment. Coordinate with all other trades work and existing conditions. Field verify final location of pipe prior to submittal of layout drawings and fabrication.

1.9 Test Reports and Verification Submittals:

1.9.1 Submit welder's certificates.

1.9.2 Submit water treatment test report.

1.10 O&M Manual Submittals: Submit a copy of approval submittals. Include this data in O&M manual.

2 PRODUCTS

2.1 General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on hydronic piping systems maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in hydronic piping systems. Where more than one type of materials or products are indicated, selection is Installer's option.

2.2 Basic Identification: Provide identification complying with Division-23 Basic Mechanical Materials and Methods section "Mechanical Identification."

2.3 Basic Pipes and Pipe Fittings: Provide pipes and pipe fittings complying with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings", in accordance with the following listing:

2.3.1 Pipe Size 2" and Smaller: Black steel pipe; Schedule 40; Class 125 cast-iron fittings with threaded joints. Victaulic grooved joints are also acceptable.

2.3.2 Tube Size 3" and Smaller: Copper tube; Type L, hard-drawn temper; wrought-copper fittings with soldered joints. Use for runouts to terminal units only.

2.3.3 Pipe Size 2½" and Larger: Black steel pipe; Schedule 40; wrought-steel buttwelding fittings with welded joints. Victaulic grooved joints are also acceptable.

2.3.4 Underground Piping: All underground piping regardless of size shall be welded.

2.4 Basic Piping Specialties: Provide piping specialties complying with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties."

2.5 Basic Supports and Anchors: Provide supports and anchors complying with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors."

2.6 Basic Valves: Provide valves complying with Division-23 Basic Materials and Methods section “Valves” and the following list:

2.6.1 Standard Service Shutoff Valves: Type BA1, BF2, BF4.

2.6.2 Standard Service Drain Valves: Type BA1.

2.6.3 Standard Service Terminal Runout Valves (Steel Runouts): Type BA1.

2.7 Basic Meters and Gauges: Provide meters and gauges complying with Division-23 Basic Mechanical Materials and Methods section "Meters and Gauges", in accordance with the following listing:

2.7.1 Temperature gauges and fittings.

2.7.2 Pressure gauges and fittings.

2.8 Basic Vibration Control: Provide vibration control products complying with Division-23 Basic Mechanical Materials and Methods section “Vibration Isolation” and the following list:

2.8.1 Pump Connections: Type PF1.

2.8.2 Coil Connections: Type PF3.

2.8.3 Heating Hot Water Riser Hangers and Supports: Type PA1, PA2.

2.8.4 Acoustical Pipe Hangers: Type HA1, HA2.

2.9 Access Doors: Provide access doors to service all valves and other devices as required in accordance with Division-23 Basic Materials and Methods Section “Access Doors”.

3 EXECUTION

3.1 General: Examine areas and conditions under which hydronic piping systems materials and products are to be installed. Do not proceed with work until unsatisfactory conditions have been

corrected in manner acceptable to Installer.

3.2 Installation of Hydronic Piping:

3.2.1 General: Install hydronic piping in accordance with Division-23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings".

3.2.2 Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush. Do not use bushings anywhere in the system.

3.2.3 Install piping with 1/32" per foot (¼%) upward slope in direction of flow, or as indicated on the drawings. The intent is to install piping sloped to drains at low points in the system for a drainable system.

3.2.4 Connect branch-feed piping to mains at horizontal center line of mains, connect run-out piping to branches at horizontal center line of branches.

3.2.5 Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

3.3 Install piping specialties in accordance with Division-23 Basic Mechanical Materials and Methods section "Piping Specialties".

3.4 Install supports and anchors in accordance with Division-23 Basic Mechanical Materials and Methods section "Supports and Anchors".

3.5 Install valves in accordance with Division-23 Basic Mechanical Materials and Methods section "Valves".

3.5.1 Shutoff Valves: Install on inlet and outlet of each mechanical equipment item, and on inlet and outlet of each hydronic terminal, and elsewhere as indicated.

3.5.2 Drain Valves: Install on each mechanical equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain hydronic piping system.

3.5.3 Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

3.6 Install meters and gauges in accordance with Division-23 Basic Materials and Methods section "Meters and Gauges".

3.7 Equipment Connections:

3.7.1 General: Connect hydronic piping system to mechanical equipment as indicated on the drawings, and comply with equipment manufacturer's instructions where not otherwise indicated. Install shutoff valve and union on supply and return and a drain valve on the drain connection. Connections between dissimilar metals shall be made with dielectric devices.

3.7.2 Hydronic Terminals: Install hydronic terminals with shutoff valves, unions and related devices as shown on the drawings. Install manual air vent valve on element in accordance with manufacturer's instructions. Locate valves and balancing cocks for ease of maintenance. Where indicated, install automatic temperature control valve with unions on return line between coil and shutoff valve.

3.8 Provide sufficient swing joints, expansion loops and devices necessary for a flexible piping system. Install drain valves at all low points of each system to enable complete drainage, and air vents at all high points in the piping system to enable complete air venting.

3.9 Pipe drains from strainers, etc., to spill over an open sight drain, floor drain or other acceptable

discharge point, and terminate with a plain end (unthreaded pipe) 6" above the drain. Rigidly support all drains.

3.10 Testing, Cleaning, Flushing, and Inspecting: Test, clean, flush, and inspect hydronic piping systems in accordance with requirements of Division-23 Basic Mechanical Materials and Methods section "Testing, Cleaning, and Sterilization of Piping Systems."

3.11 Chemical Treatment: Refill hydronic piping systems. New piping shall be flushed, cleaned and pre-treated as recommended by the current University of Florida water treatment vendor. Contractor shall purchase the necessary chemicals from the vendor, and flushing, cleaning, and pre-treatment shall be witnessed by the vendor representative. Submit test report.

END OF SECTION

SECTION 23 12 16 - HEATING HOT WATER AND CHILLED WATER PREINSULATED PIPING AND CONDUIT SYSTEM

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 underground preinsulated piping system work, is indicated on drawings and by requirements of this section.

1.4 Verify all existing conditions prior to bidding. The Contractor shall include in his price for the underground preinsulated conduit sufficient elbows, offsets, and pipe to provide for unforeseen conditions. The drawings do not show the exact location or inverts of all existing utilities, conditions, etc. However, the contractor's bid shall include sufficient labor and material costs to allow for these conditions without causing additional cost for the Owner or delays in the project schedule.

1.5 Refer to other Division-23 sections for field-applied insulation, manholes, valves, hydronic specialties, and expansion compensation.

1.6 Codes and Standards: Fabricate and install piping in accordance with ASME B31.9 "Building Services Piping".

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data and installation instructions for systems, including: carrier pipe, conduit, insulation, materials and products.

1.7.2 Shop Drawings: Submit scaled layout drawings of underground preinsulated piping system including, but not necessarily limited to, pipe sizes, location, offsets, connections, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Indicate interface and spatial relationship between piping and manholes. Coordinate with all other site utilities and all existing conditions. Field verify final location of pipe prior to submittal of layout drawings and fabrication. Shop drawings shall indicate the existing conditions. Probe or excavate as required.

1.8 O&M Data Submittals: Submit a copy of approval submittals for conduit and piping materials and products. Include this data in O&M manual.

2 PRODUCTS

2.1 General: Provide factory-fabricated conduit, piping and insulation products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by manufacturer to comply with installation requirements. Provide materials and products complying with ASME B31.9 Code for Building Services Piping where applicable, base pressure rating on piping systems maximum design pressures. Provide fittings and materials which match pipe materials used in piping systems.

2.1.1 Chilled Water Piping: Black steel pipe; Schedule 40; ERW, wrought-steel buttwelding fittings, welded joints.

2.1.2 Heating Hot water Piping: Black steel pipe; Schedule 40; ERW, wrought-steel buttwelding fittings, welded joints.

2.2 Outer Conduit:

2.2.1 Conduit: Conduit shall be PVC Class 12454-B conforming to ASTM 1784 Type 1 Grade 1.

2.2.2 Fittings: Fittings shall be factory insulated. Fabricate of same material as conduit.

2.2.3 Expansion Loops and Ells: Furnish prefabricated ells, loops, and tees where shown and required. Fabricate of same material as conduit.

2.2.4 Anchors: Provide prefabricated plate anchors.

2.2.5 Pipe Support Guides: Provide standard manufacturer's full round guides.

2.3 Insulation:

2.3.1 Chilled Water Pipe Insulation: 2" thick polyurethane foam with minimum K = 0.13 and a density of 2 lb/ft^3.

2.3.2 Heating Hot Water Pipe Insulation: 2" thick fiberglass

2.3.3 Insulation shall be complete through all piping, expansion loops and fittings.

2.4 Acceptable Manufacturers: Subject to compliance with requirements, provide conduit systems of one of the following: Ricwil, Rovanco, Perma Pipe, Thermacor, Energy Task Force.

3 EXECUTION

3.1 Inspection: Examine areas and conditions under which products are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of Underground Conduit: Install in accordance with Division 23 Basic Mechanical Materials and Methods section "Pipes and Pipe Fittings" and "Excavation and Backfill". Use for underground chilled water pipe as an option to field insulated underground pipe.

3.2.1 Where possible, install piping with downward slope in direction of flow or to drain pits where indicated, 1/32" per foot (¼%). Terminate all conduit 2" beyond building and manhole walls.

3.2.2 Expansion loops and ells: Provide sufficient loops for a flexible piping system in accordance with ASME Code for pressure piping and the manufacturers recommendation.

3.2.3 Anchors: Provide anchors where shown on the plans or as determined by the manufacturers recommendations.

3.3 Testing: Carrier pipe shall be pressure tested hydrostatically in accordance with Division-23 Basic Mechanical Materials and Methods section "Testing, Cleaning and Sterilization of Piping Systems" after welding and prior to conduit closure. All conduit closures shall be field tested with air before backfilling. The Contractor shall provide all necessary equipment for the testing.

END OF SECTION

SECTION 23 21 23 - PUMPS

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 pumps work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Pumps furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division-23 sections.

1.5 Refer to Division-26 sections for the following work; not work of this section.

1.5.1 Power supply wiring from power source to power connection on pumps. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.5.2 Codes and Standards: UL and NEMA Compliance: Provide electric motors and components which are listed and labeled by Underwriters Laboratories and comply with NEMA standards.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's pump specifications, installation and start-up instructions, and pump characteristic performance curves with selection points clearly indicated. Submit manufacturer's assembly-type drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

1.6.1.1 Vertical In-Line Pump

1.7 O&M Data Submittals: Submit a copy of approval submittals. Submit maintenance data and parts lists for each type of pump; including "trouble-shooting" maintenance guide. Include these data in O&M manual.

2 PRODUCTS

2.1 General: Provide factory-tested pumps, thoroughly cleaned, and painted with one coat of machinery enamel prior to shipment. Type, size, and capacity of each pump is listed in pump schedule. Provide pumps of same type by same manufacturer. Select pumps to be non-overloading over the full range of the pump curve.

2.2 Motors: Provide high efficiency motors per Division-23 section “Electric Motors”. Coordinate with variable frequency drive supplier.

2.3 Vertical In-Line Pumps:

2.3.1 General: Provide bronze-fitted vertical in-line pumps where indicated, and of capacities as scheduled.

2.3.2 Type: Vertical mount, in-line, close-coupled, single stage, designed for 175 psi working pressure.

2.3.3 Body: Cast iron, 125 psi ANSI flanges of equal size, tappings for gage and drain fittings.

2.3.4 Shaft: Steel with replaceable shaft sleeve.

2.3.5 Seal: Mechanical seal with ceramic seal seat.

2.3.6 Motor: Open drip-proof, ball bearings, 15,000 hours bearing life, with lifting lug on top of motor.

2.3.7 Impeller: Bronze, enclosed type, hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.

2.3.8 Acceptable Manufacturers: Subject to compliance with requirements, provide in-line pumps of one of the following:

Armstrong Pumps, Inc.
Bell & Gossett.
Taco, Inc.

2.4 Vibration Isolation: Provide vibration isolation in accordance with Division-23 section “Vibration Isolation” and the following:

2.4.1 Equipment Mounting: Type BF2

3 EXECUTION

3.1 Examine areas and conditions under which HVAC pumps are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 Installation of Pumps: Install HVAC pumps where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to ensure that HVAC pumps comply with requirements and serve intended purposes.

3.3 Access: Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by manufacturer.

3.4 Pump Support:

3.4.1 Install in-line pumps directly in piping system. Provide additional pipe supports to properly support pump weight.

3.5 Piping Connections: Refer to Division-23 HVAC piping sections. Provide piping, valves, strainers, accessories, gauges, supports as indicated. Provide blowdown piping from suction strainers with ball valve. Pipe to floor drain.

3.5.1 Install 10-gauge black steel drip pan under chilled water pumps with ¾" drain line to floor drain.

3.6 Alignment: Check alignment, and where necessary, realign shafts of motors and pumps within recommended tolerances by manufacturer, and in presence of manufacturer's service representative.

3.7 Start-Up: Lubricate pumps before start-up. Start-up in accordance with manufacturer's instructions.

3.8 Refer to Division-23 section "HVAC Test-Adjust-Balance" for pump system balancing; not work of this section.

3.9 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 31 13 - HVAC METAL DUCTWORK

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:

1.6.1 SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork, unless otherwise noted.

1.6.2 NFPA 90A Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data and installation instructions for the following.

1.7.1.1 Factory-fabricated ductwork

1.7.1.2 Sealants

1.7.1.3 Flexible duct

1.7.1.4 Spin-in fittings

1.7.1.5 Side take-off fittings

1.7.2 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.

2 PRODUCTS

2.1 Ductwork Materials:

2.1.1 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.

2.1.2 Galvanized Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 653, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations. Stamp gauge and manufacturer's identification on each sheet. Break sheets so that identification is exposed.

2.1.3 Stainless Steel Sheet: Where indicated, provide 18-gauge stainless steel complying with ASTM A 167; Type 316; with No. 4 finish where exposed to view in occupied spaces. Provide No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

2.2 Miscellaneous Ductwork Materials:

2.2.1 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.

2.2.2 Duct Sealant: Provide 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. Comply with Division 1 requirements for low VOC content (FGBC).

2.2.3 Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork. For stainless steel ductwork, provide matching stainless steel support materials.

2.2.4 Flexible Ducts: Provide flexible ductwork with an R-value of R-6unless the ductwork is in a ceiling return plenum or if metal flexible duct is used. The use of flexible ductwork for connection of supply air and return air devices is acceptable only where shown on the drawings.

2.2.4.1 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, FBC Mechanical, SBCC, NFPA 90A and NFPA 90B.

2.2.4.2 Acceptable Manufacturers: Subject to compliance with requirements, provide R-6 flexible ductwork by: Atco 36, Flexmaster 8M-R6 or Thermaflex M-KE R6.

2.2.5 Spin-in and Side Take-off Fittings: Provide round branch run-outs as follows.

2.2.5.1 Supply air diffuser connections shall be conical with damper and one inch high insulation stand-off equal to Crown 3200 DS or Flexmaster CBD-BO.

2.2.5.2 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.

2.2.5.3 Exhaust air grille connections shall be straight sided with damper equal to Crown 724 or Flexmaster FLD.

2.2.5.4 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-BO.

2.2.6 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:

2.3.1 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.

2.3.2 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, supply duct from air conditioning units and all return and exhaust duct shall be minimum 2" pressure class unless otherwise noted.

2.3.3 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 1½ 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.

2.3.4 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.):

2.4.1 Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized.

2.4.2 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".

2.4.3 Elbows: One piece construction for 90° and 45° elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

2.4.4 Divided Flow Fittings: 90° tees, constructed with saddle tap spot welded and bonded to duct fitting body.

2.4.5 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.

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:

3.2.1 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 ⅛" 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.

3.2.2 Supports: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work. Install self-drilling screw anchors in prestressed concrete or existing work.

3.2.3 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 by welding.

3.2.4 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 ½" 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.

3.2.5 Electrical Equipment Spaces: Do not route ductwork through transformer vaults or other electrical equipment spaces and enclosures.

3.2.6 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 1½". Fasten to duct and substrate. Where ducts pass through fire-rated floors, walls, or partitions, provide firestopping between duct and substrate.

3.2.7 Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

3.2.8 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:

3.3.1 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.

3.3.2 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. Bends shall be made with at least one duct diameter.

3.3.3 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 securely tape the insulation outer jacket.

3.3.4 Seal all exposed edges of fiberglass insulation with glassfab and mastic.

3.4 Installation of exhaust ductwork serving shower rooms and autoclaves where moisture laden air is present shall provide watertight seams. Ducts carrying moisture laden air shall be welded stainless steel. Ducts shall be sloped to drain without pockets. Install 1¼" drains run to safewaste where required.

3.5 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 3% of system design air flow for low pressure systems and less than 1% for systems rated over 3".

3.6 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.

3.7 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.

3.8 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.

3.9 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

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SECTION 23 33 00 - DUCTWORK ACCESSORIES

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:

1.5.1 SMACNA Compliance: Comply with applicable portions of both SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.5.2 NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems" pertaining to installation of ductwork accessories.

1.6 Approval Submittals:

1.6.1 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:

1.6.1.1 Low pressure manual dampers

1.6.1.2 Control dampers

1.6.1.3 Fire dampers

1.6.1.4 Duct access doors

1.6.1.5 Flexible connections

1.6.2 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.

2 PRODUCTS

2.1 Dampers:

2.1.1 Low Pressure Manual Dampers: Provide 16 gauge dampers of single-blade type (12" maximum blade width) or multiblade type. Damper blades to be gang-operated from a single shaft with nylon or ball 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.

2.1.2 Control Dampers: Provide dampers with parallel blades for 2-position control or opposed blades for modulating control. Construct blades of 16-ga. steel. Provide heavy-duty molded self-lubricating nylon bearings and 1/2" diameter steel axles spaced on 9" centers. Provide sponge rubber or felt blade edges. 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-ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish with aluminum touch-up. Johnson Controls VD, Tamco 1500, Ruskin CD30 AF1/AF2, or equal. Actuators (motors) are provided by control contractor.

2.1.3 Acceptable Manufacturers: Subject to compliance with requirements, provide dampers by Air Balance, American Warming & Ventilating, Arrow Louver and Damper, Penn Ventilator Co., Ruskin Mfg. Co., or Greenheck.

2.2 Fire Dampers:

2.2.1 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:

1-1/2 HR: Ruskin IBD2 - Style B for rectangular, Style CR for round, Style CO for oval.

1-1/2 HR: Ruskin IBDT for transfer grilles in narrow partitions.

3 HR: Ruskin IBD23 - Style B for rectangular, Style CR for round, Style CO for oval.

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:

2.4.1 General: Provide duct access doors of size indicated, or as required for duty indicated.

2.4.2 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 L-handle-type latch for doors 12" high and smaller, and 2 L-handle-type latches for larger doors. Provide removable doors where hinges do not allow door to open at least 90 degrees.

2.4.3 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by one of the following: Duro Dyne Corp. SP-5 or SP-10 latches, Ruskin Mfg. Co. Ventlock 100 latches, or Acudor.

2.5 Flexible Connections:

2.5.1 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.

2.5.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following: Duro Dyne Corp., Flexaust (The) Co., or Ventfabrics, Inc.

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:

3.2.1 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.

3.2.2 Install balancing dampers at all main ducts adjacent to units in return air, outside air and where

indicated.

3.2.3 Install control dampers in the outside air duct and return air duct for each air handling unit. Damper actuators provided by control contractor.

3.2.4 Install turning vanes in square or rectangular 90° elbows in supply, return, and exhaust air systems, and elsewhere as indicated.

3.2.5 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. Install at fire dampers and smoke detectors. Install at control dampers and airflow measuring stations. Opening size shall be per NFPA 90A for servicing fire dampers and smoke detectors. Provide label with 1-1/2" letters to indicate location of fire protection devices.

3.2.6 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.

3.2.7 Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.2.8 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.

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:

3.5.1 Adjusting: Adjust ductwork accessories for proper settings.

3.5.2 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.

3.5.3 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.5.4 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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SECTION 23 33 05 - DUCT SILENCERS

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 duct silencer work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for ductwork and ductwork accessories and for external insulation of duct silencers.

1.5 Codes and Standards:

1.5.1 Provide duct silencers that conform to the requirements of NFPA 90A.

1.5.2 Provide duct silencers that have been tested in accordance with "Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers."

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, including performance data for each size and type of duct silencer furnished. Data shall include pressure drop, net insertion loss, and airflow generated sound power level for each octave band, all at specified air flow. Provide manufacturer's assembly type drawings showing all weights, dimensions, and methods of assembly.

1.7 O&M Data Submittals: Include a copy of the approval submittals in the O&M manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide duct silencers by Industrial Acoustics Company, Vibro-Acoustics, Price, or approved equal.

2.2 Rectangular Duct Silencers: Provide rectangular duct silencers of the sizes indicated constructed of galvanized steel outer casing, 26-gauge perforated galvanized steel baffles and inorganic acoustical/thermal fill meeting NFPA 90A requirements. Provide Mylar or Tedlar film with a ⅜" UL rated standoff between the perforated steel and the liner. See schedule on drawings. Basis of Design: Price RLT, RMT Series.

2.3 Round packless sound attenuator: Provide fully welded stainless steel packless sound attenuators (no fill of any kind), constructed of 18 gauge stainless steel utilizing controlled impedance membranes and broadly tuned resonators. Stainless steel type and/or coatings are shown in the schedule on the drawings. The casing shall be rated for 8 in. w.g. static pressure. Basis of Design: Price PCLS, PCMS, PCLB, PCMB Series.

2.4 Elbow packless sound attenuator: Provide fully welded stainless steel packless sound attenuators (no fill of any kind), constructed of 18 gauge stainless steel utilizing controlled impedance membranes and broadly tuned resonators. Stainless steel type and/or coatings are shown in the schedule on the drawings. The casing shall be rated for 8 in. w.g. static pressure. Basis of Design: Price PECLS, PECMS, PECLB, PECMB Series. Provide round duct connection.

3 EXECUTION

3.1 Coordinate with other work, including ductwork and ductwork accessories to provide all required transitions and connections.

3.2 Install duct silencers in accordance with the manufacturer's printed instructions. Provide all necessary supports.

3.3 Coordinate with insulation installer for external insulation of rectangular and single wall round duct silencers.

END OF SECTION

SECTION 23 34 00 - FANS

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 fan work required by this section as indicated on drawings and schedules, and by requirements of this section.

1.4 Coordination:

1.4.1 Refer to Division-7 sections for installation of prefabricated roof curbs; not work of this section. Furnishing prefabricated roof curbs is part of this section's work.

1.4.2 Refer to Division-23 section "Testing, Adjusting, and Balancing" for balancing of fans.

1.4.3 Refer to Division-23 HVAC control systems sections for control work required in conjunction with fans.

1.4.4 Refer to Division-26 sections for power supply wiring from power source to power connection on fans. Division-26 work will include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.5 Codes and Standards:

1.5.1 AMCA Compliance: Provide fans which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Ratings Seal.

1.5.2 UL Compliance: Provide fans which are listed by UL and have UL label affixed.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical data for fans, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

1.6.1.1 Fans

1.6.1.2 Vibration Isolation

1.7 O&M Data Submittals: Submit maintenance data and parts list for each type of fan, accessory, and control. Include these data, a copy of approved submittals, and wiring diagrams in O&M Manual.

2 PRODUCTS

2.1 General: Except as otherwise indicated, provide standard prefabricated fans of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation. Provide accessories as listed in the schedule on the drawings and as described herein. Motors shall be high efficiency per Division-23 section "Electric Motors".

2.2 Acceptable Manufacturers: Subject to compliance with requirements provide fans manufactured by Acme, Greenheck, Loren Cook, Penn, MK Plastics, Twin City or approved equal unless otherwise noted herein.

2.3 Centrifugal Roof Exhausters:

2.3.1 Housing: Provide heavy gauge aluminum hood, housing, and base with a galvanized steel frame.

2.3.2 Fan Wheels: Provide aluminum air foil type, statically and dynamically balanced.

2.3.3 Drive: Provide direct or belt drive as scheduled with pre-lubricated, ball bearing, continuous duty type motors. Provide vibration isolation equipment for the entire drive.

2.4 Centrifugal Wall Exhausters:

2.4.1 Housing: Provide heavy gauge aluminum weatherproof housing and base with external drip ring to prevent exhaust contaminants from running down the wall.

2.4.2 Fan Wheel: Provide aluminum air foil type, statically and dynamically balanced.

2.4.3 Drive: Provide direct or belt drive as scheduled with pre-lubricated, ball bearing, continuous duty type motors. Provide vibration isolation equipment for the entire drive.

2.5 Centrifugal Ceiling Exhausters:

2.5.1 Fan Assembly: Provide steel housing, plastic or aluminum grille, backdraft damper, statically and dynamically balanced fan wheel, permanently lubricated motor with internal thermal overloads, vibration isolation and all required mounting hardware and brackets. Provide acoustically treated housing for all fans larger than 60 cfm. Mounting type shall be as indicated on the drawings or on the schedule.

2.5.2 Connectors: Provide adaptors, connectors, and eave elbows as required to connect fan discharges to outlets.

2.5.3 Outlets: Provide where shown on the drawings (or required by the installation) wall caps, vent caps, or roof jacks, each with birdscreen, to match fans and surrounding construction.

2.6 Upblast Fume Exhaust Utility Sets:

2.6.1 Housing: Provide AMCA B construction. Provide welded steel fan housing with Eisenheiss coating on all surfaces exposed to the air stream. Provide flanged discharge. Fan configuration shall be as scheduled. Provide scroll drain and plug. Provide shaft seal. Provide companion flange for discharge duct.

2.6.2 Fan Wheel: Provide aluminum, non-sparking air foil type, statically and dynamically balanced.

2.6.3 Drive: Provide belt drive as scheduled, with prelubricated ball bearing motor. Provide non-sparking belts. Provide weatherproof drive enclosure. Provide vibration isolation equipment to mount entire fan assembly.

2.7 Fan Accessories and Features: Where indicated on the schedule or drawings provide accessories and features listed herein.

1 Belt drive: Belt drives shall include cast iron, variable pitch sheaves, heavy duty belts, and 1750 rpm motors. The drive shall be adjustable to plus or minus 20% of scheduled flow. Provide sheave changes as required to support TAB work in order to optimize system performance. Final sheave shall be fixed.

2 Direct drive: Direct drives shall have multispeed motors or speed controllers to achieve scheduled flow.

3 Curbs: Furnish 12 inch high, roofed over type, prefabricated aluminum curbs with treated wood nailer and 1-1/2" fire resistant fiberglass insulation sized to match the fans. For

deck slopes of 1/4" per foot and more, fabricate curbs to form level top edge.

4 Bird Screens: Provide bird screens of ½" mesh aluminum or galvanized steel hardware cloth.

5 Backdraft Dampers: Provide where indicated aluminum louvered dampers with felt-edged blades and nylon bearings.

6 Disconnect Switches: Provide factory installed local disconnecting means.

7 Thermal Overloads: Provide internal thermal overloads.

8 Speed Controller: Provide where indicated solid state speed controller for remote mounting.

9 Motorized Dampers: Provide where indicated aluminum louvered dampers with felt-edged blades and nylon bearings with 120 volt motors wired to operate with the fan. Provide limit switch to prevent fan starting until damper is at least half open.

10 Explosion-proof motor: Provide where indicated explosion proof motors.

2.8 Vibration Isolation: Mount fans on vibration isolators in accordance with the requirements of Division-23 section "Vibration Isolation" and the following list.

2.8.1 Equipment Mountings: Type EM4.

2.8.2 Hangers: Type HA3.

2.8.3 Bases and Frames: Type BF3.

3 EXECUTION

3.1 General: Except as otherwise indicated or specified, install fans in accordance with manufacturer's installation instructions and recognized industry practices to insure that fans serve their intended function.

3.2 Coordinate fan work with work of roofing, walls, and ceilings as necessary for proper interfacing. Framing of openings, caulking, and curb installation is not work of this section.

3.3 Ductwork: Refer to Division-23 section "Ductwork". Connect ducts to fans in accordance with manufacturer's installation instructions. Provide flexible connections in ductwork at fans.

3.4 Install fans on vibration isolation equipment as required. Set level and plumb. Install fans for best service access to motor and drive assembly.

3.5 Roof Curbs: Furnish roof curbs to roofing Installer for Installation.

3.6 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division-26 sections. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

3.7 Remove shipping bolts and temporary supports within fans. Adjust dampers for free operation.

3.8 Testing: After installation of fans has been completed, test each fan to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, then retest to demonstrate compliance. Provide sheave changes as

required to balance at required conditions with minimum noise and energy use. Replace units which cannot be satisfactorily corrected. Coordinate with TAB procedure and provide variable pitched sheaves and final fixed sheave and belt assembly as required to minimize fan speed while meeting the specified flow.

3.9 Cleaning: Clean factory-finished surfaces. Remove all tar and soil. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 34 25 - SPECIFIC USE HOODS

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 hood work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Coordination:

1.4.1 Refer to Division-23 section "Testing, Adjusting, and Balancing" for balancing of fans.

1.5 Codes and Standards:

1.5.1 Comply with requirements of the "Industrial Ventilation Manual".

1.5.2 Comply with NFPA 70, National Electric Code.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical data for products including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions. Submit assembly-type drawings for hoods showing unit dimensions, construction details, methods of assembly of components, and field connection details.

1.6.1.1 Canopy hoods

2 PRODUCTS

2.1 General: Except as otherwise indicated, provide hoods of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.

2.2 Sheetmetal: Fabricate hoods of sheet steel complying with Division-23 section "Metal Ductwork".

2.3 Job-Built Hoods: This specification generally refers to factory-built hoods. The Contractor may, at his option, provide job built hoods complying with the requirements specified herein. Demonstrate compliance by shop drawing submittal.

2.4 Canopy Hoods: Provide canopy hoods where indicated on the drawings of the sizes shown.

2.4.1 Fabricate hood of 18-gauge stainless steel with No. 4 finish. Weld, grind and polish all joints and seams.

2.4.2 Provide 1" deep x 2" wide full perimeter drip trough.

2.4.3 Taper inside the hood (45° minimum) to form a smooth transition from hood opening to exhaust collar.

2.4.4 Fabricate 24" high enclosure (unless otherwise specified) to surround the hood of material to match hood. Provide weld nuts for hanger rods.

2.4.5 Acceptable Manufacturers: Subject to compliance with requirements, provide equipment by one of the following: Greenheck, Loren Cook, Greasemaster, Captive Aire, Duo Aire, or approved equal unless otherwise noted herein.

3 EXECUTION

3.1 Fabricate and install hoods as shown on the drawings and in accordance with referenced standards.

3.2 Refer to Division-23 section "Metal Ductwork" for connection to exhaust system. Refer to other Division-23 sections for Ductwork Accessories and Fans.

3.3 Hoods shall be of sizes shown on the drawings. The depth of the canopy shall be at least 24" from the lower to upper edge. Mount hoods at heights shown on the drawings.

3.4 All seams and joints shall have a liquid tight continuous external weld. All welds on stainless steel shall be ground and polished.

3.5 Supports: Provide channels and rods to support hoods as shown on the drawings.

END OF SECTION

SECTION 23 34 30 - CHEMICAL FUME EXHAUST DUCTWORK

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 chemical fume exhaust system work required by this section is indicated on drawings and by requirements of this section.

1.4 Codes and Standards

1.4.1 Comply with NFPA 91 requirements.

1.4.2 Comply with NFPA 45 requirements.

1.4.3 Approval Submittals:

1.4.4 Shop Drawings: Submit 1/4" scale ductwork layout shop drawings showing all duct sizes, transitions, offsets, location, test openings, control devices, equipment connections, and related equipment.

2 PRODUCTS

2.1 Stainless Steel Ductwork: Provide round or rectangular ductwork as indicated, of Type 316 stainless sheet steel. Refer to Division-23 section "Metal Ductwork". All ductwork, elbows, and angles to 18" diameter shall be 18 gauge.

2.2 Refer to other Division-23 sections for Fans, Ductwork Accessories, Air Cleaning Equipment. Coordinate equipment selections for complete ductwork systems.

3 EXECUTION

3.1 Install chemical fume exhaust ductwork systems as shown on the drawings and in compliance with the referenced codes. Comply with requirements of other Division-23 sections that specify duct system components.

3.2 Stainless Steel Ductwork: Continuously weld all joints to provide an air-tight and liquid-tight system; seal class A. All joints shall be ground and polished. All joints shall be butt-welded. Position longitudinal seams at the top of the duct. Elbows shall be 5 gore, long radius.

3.3 Equipment Connections: Provide flanged and bolted connections at all hoods and fans unless a flexible connection is indicated. Gasket material shall be 1/8" thick, 60-70 durometer, full face type suitable for the service.

3.4 Flexible Connections: Refer to Division-23 section, "Ductwork Accessories", except make double thickness and seal air tight.

3.5 Support ducts sufficiently to place no load on connected equipment and to prevent sagging of ducts.

3.6 Cleanouts: Provide cleanouts at changes in direction in horizontal duct runs unless accessible from hood or fan connections. Flanged, removable duct sections may be used instead of cleanouts.

3.7 Taper transitions 5" long for each 1" change in diameter.

3.8 Provide ductwork test openings in accessible locations and coordinate with Test and Balance company. Close test openings with corrosion-resistant plugs suitable for the service.

3.9 Testing: Pressure test ductwork as described in Section 23 31 13 and leave ready for Test and Balance company. Notify Engineer at least 24 hours in advance of tests. Leakage must be less than 1% of design air flow.

END OF SECTION

SECTION 23 36 00 - AIR TERMINALS

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 air terminals work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to other Division 23 sections for external insulation of air terminals; not work of this section.

1.5 Refer to other Division 23 sections for testing, adjusting and balancing of air terminals; not work of this section.

1.6 Refer to Division 25 sections for temperature controls which are to be furnished by others but installed as work of this section.

1.7 Refer to Division 26 sections for the following work; not work of this section. Power supply wiring from power source to power connection on air terminals. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.8 Codes and Standards:

1.8.1 ADC Compliance: Provide air terminals which have been tested and rated in accordance with ADC standards.

1.8.2 NFPA Compliance: Construct air terminals using acoustical and thermal insulations complying with NFPA 90A "Air Conditioning and Ventilating Systems".

1.9 Approval Submittals:

1.9.1 Product Data: Submit manufacturer's technical product data, including performance data for each size and type of air terminal furnished; schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished; and installation and start-up instructions. Submit manufacturer's assembly-type drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

1.9.1.1 Shutoff single duct air terminals

1.9.2 Short Circuit Current Ratings (SCCR):

1.9.2.1 All controls panels and enclosures shall have SCCR labeling per NEC.

1.9.2.2 Provide equipment with SCCR suitable for location installed.

1.9.2.3 Contact engineer for maximum available fault current at equipment prior to providing approval submittals so SCCR can be included in approval submittals.

1.9.2.4 In no case shall the SCCR be less than the following:

1.9.2.4.1 For equipment rated 100 amps and higher the minimum SCCR shall be 65 kA.

1.9.2.4.2 For equipment rated 50 amps and lower than 100 amps the minimum SCCR shall be 35 kA.

1.9.2.4.3 For equipment rated 20 amps and lower than 50 amps the minimum SCCR shall be 20 kA.

1.9.2.4.4 For equipment rated 20 amps the minimum SCCR shall be 10 kA.

1.10 O&M Data Submittals:

1.10.1 Wiring Diagrams: Submit ladder-type wiring diagrams for electric power and control components, clearly indicating required field electrical connections. Include in O&M manual.

1.10.2 Maintenance Data: Submit maintenance data and parts list for each type of air terminal; including "trouble-shooting" maintenance guide. Include this data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide air terminals of one of the following (unless otherwise noted): Trane, Price, Titus, Enviro-Tec, Nailor, Metalaire or approved equal.

2.2 General: Provide factory-fabricated and tested air terminals as indicated, selected with performance characteristics which match or exceed those indicated on schedule.

2.3 Shutoff Single Duct: Provide pressure independent single duct, shut-off variable volume terminal units with the following characteristics, features and accessories and as indicated on drawings and schedule.

2.3.1 Casings: The unit casing shall be 22 gauge galvanized steel, internally lined with 1½ pcf closed cell polymer foam insulation which complies with UL 181 and NFPA 90A. Casing shall be sealed to hold leakage to less than to 10 cfm at 1.0" w.g.

2.3.2 Air Dampers: Damper shall be heavy gauge metal, with shaft rotating in self-lubricating nylon or equal bearings, or cylindrical die cast aluminum air valve with integral actuator. Shaft shall be marked on the end to indicate the damper blade position. Unit shall be designed for field conversion from normally open to normally closed, or vice versa, without relocating the actuator, changing parts or adding relays. The damper shall seal against a closed-cell foam gasket, to limit close-off leakage to 10 cfm at 3.0" w.g. The damper shall not unseat at 6.0" w.g.

2.3.3 Provide hanger brackets for attachment of supports.

2.3.4 Access: Provide removable panels in casings to permit access to air dampers and other parts requiring service, adjustment, or maintenance.

2.3.5 Controls: Units shall have pressure independent DDC controls and shall be preset for minimum and maximum scheduled air flow rates. All settings shall be field adjustable.

At an inlet velocity of 2000 fpm, the differential static pressure for any size of unit shall not exceed 0.30" w.g. for the basic unit.

The unit inlet shall be equipped with a flow sensor with amplifying pressure pickup points connected to central averaging chambers. The sensor shall maintain control accuracy with the same size inlet duct in any configuration. The flow sensor shall have a minimum of three sensor points.

Direct digital controls shall be contained in a metal enclosure with access panel sealed from air flow and mounted on the side of the terminal unit. All controls, including DDC controls and actuator shall be factory mounted.

DDC controls shall be calibrated, tested, and checked by the terminal unit manufacturer.

Where reheat is required, the thermostat shall provide an adjustable dead band in the control

sequence for maximum energy savings.

Factory-mount and wire controls. Mount electrical components in control box with removable cover. Provide disconnect and single point electrical connection to power source. Provide 24 volt control transformer and coordinate with available voltage.

The unit manufacturer shall furnish and install an actuator. The damper shall move in a smooth, steady progression without dead spots.

DDC controls shall be compatible with the BAS specified in Division 25-sections.

2.3.6 Hot Water Reheat Coils: Provide factory mounted heating coils constructed of copper tubes and aluminum fins with galvanized steel casing.

2.3.6.1 Provide fused disconnect.

2.3.6.2 Provide stages of control shown on the Schedule on the drawings with contactors and related controls.

2.3.6.3 Provide SCR control as shown on the schedule on the drawings with solid state relays.

2.3.7 Noise Ratings: Provide terminals with the following room NC performance data at the minimum terminal pressure plus 0.75" water gauge:

	Valve Only		Valve w/HHW Coil	
Size	Disch.	Rad.	Disch.	Rad.
4	31	-	30	-
5	28	-	24	-
6	25	-	21	-
8	28	-	24	-
10	30	21	26	20
12	33	21	31	20
14	33	24	30	24
16	33	26	28	26
18	33	27	30	27
20	32	25	29	25
24	33	30	31	30

3 EXECUTION

3.1 Examine areas and conditions under which air terminals are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install air terminals as indicated, and in accordance with manufacturer's installation instructions.

3.3 Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer.

3.4 Duct Connections: Connect ductwork to air terminals in accordance with Division-23 ductwork sections.

3.5 Upon completion of installation and prior to initial operation, test and demonstrate that air terminals, and duct connections to air terminals, are leak-tight.

3.6 Repair or replace air terminals and duct connections as required to eliminate leaks, and retest to demonstrate compliance. Leave operational and ready for Testing and Balancing work.

3.7 Clean exposed factory-finished surfaces. Repair any marred or scratched surfaces with manufacturers touch-up paint.

3.8 O&M Training: Provide 16 hours divided into four sessions.

3.9 Spare Parts: Provide spare fuses per Section 23 05 12.

END OF SECTION

SECTION 23 36 19 - LABORATORY BLADE TYPE VARIABLE VOLUME TERMINALS

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 work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for external insulation of air terminals; not work of this section.

1.5 Refer to other Division-23 sections for testing, adjusting and balancing of air terminals; not work of this section.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, including performance data for each size and type of air terminal furnished; schedule showing drawing designation, room location, number furnished, model number, size, and accessories furnished; and installation and start-up instructions. Submit manufacturer's assembly-type drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.

1.6.1.1 Variable Volume Terminal

1.6.2 Coordination with Ductwork: The locations of the air terminals as shown on the drawings is diagrammatic. The selection of air terminals and the requirements to install them horizontally or vertically shall be fully coordinated with the ductwork shop drawings prior to making this submittal. All terminals required to be installed in the vertical position shall be so identified in this submittal.

1.7 O&M Data Submittals: Submit maintenance data and parts list for each type of air terminal; including "trouble-shooting" maintenance guide. Include this data, a copy of approval submittals and maintenance data in O&M manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide air terminals of one of the following: Siemens.

2.2 General: Provide factory-fabricated, tested and calibrated laboratory variable volume terminals as indicated, selected with performance characteristics which match or exceed those indicated on schedule.

2.3 Controls: Provide integrated Siemens controls with sensors, electronic actuators and control enclosures.

2.4 Performance: Provide pressure-independent blade type terminals that control air volume linearly suitable for tracking or differential pressure control.

2.4.1 Terminals shall have an accurate range of operation (minimum to maximum) of at least 7 to 1.

2.4.2 The response time to vary the terminal's air flow from its minimum to its maximum value or vice versa shall be no more than 3.0 seconds.

2.4.3 Airflow shall be maintained to ±5% of the specified maximum and minimum air quantity setting. Repeatability shall be +/- 0.15%.

2.4.4 Terminals shall be supplied as an assembly complete with electronic actuator and related devices all mounted on a common bracket. Loss of power shall cause supply terminals to fail closed and exhaust terminals to fail open.

2.5 The Owner reserves the right to test all air terminals for performance. If they do not meet specifications, the terminals shall be sent back to the manufacturer and replaced at the manufacturer's expense.

2.6 Supply Terminals:

2.6.1 Bushings: All critical moving parts shall ride on polyethylene bushings.

2.6.2 Casing: Construct of 22-gauge galvanized steel with single blade damper and mechanical stops. Casing and damper leakage shall be less than 3% of scheduled maximum air flow at 3.0" w.g.

2.6.3 Flow Measurement: Provide four quadrant airflow sensor with multipoint averaging and signal amplification.

2.6.4 Insulation: Provide 3/4" thick foil lined insulation meeting UL-181, NFPA 90A and ASTM E84 with all edges sealed by galvanized angles.

2.6.5 Hot Water Coils: Provide hot water coils complying with Division 23 section “Duct Mounted Coils”. Coordinate dimensions with terminal outlet opening.

2.7 Noise Ratings: Provide laboratory variable volume terminals with the following discharge sound power levels at 1.0" w.g.

2.7.1 Supply Terminals:

Size	CFM	2	3	4	5	6	7	(Octave Bands)
6	500	64	64	63	60	57	52	
8	775	65	64	61	61	57	53	
10	1150	66	63	61	60	58	54	
12	1350	66	63	62	60	59	54	
14	2000	68	63	63	62	60	56	
16	3000	68	63	63	62	60	56	

3 EXECUTION

3.1 Examine areas and conditions under which laboratory variable volume terminals are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install laboratory variable volume terminals as indicated, and in accordance with manufacturer's installation instructions.

3.3 Location: Install each unit level and accurately in position indicated in relation to other work; and maintain sufficient clearance for normal service and maintenance, but in no case less than that recommended by manufacturer. Install air terminals horizontally or vertically as directed by the manufacturer’s instructions.

3.4 Duct Connections: Connect ductwork to fume exhaust terminals with companion flanges and

connect supply and general exhaust terminals with slip and drive connections in accordance with Division-23 ductwork sections.

3.5 Upon completion of installation and prior to initial operation, test and demonstrate that laboratory variable volume terminals and duct connections to air terminals are leak-tight.

3.6 Repair or replace laboratory variable volume terminals and duct connections as required to eliminate leaks, and retest to demonstrate compliance. Leave operational and ready for Testing and Balancing work.

3.7 Clean exposed factory-finished surfaces. Repair any marred or scratched surfaces with manufacturers touch-up paint.

3.8 Coordinate with Test and Balance contractor to calibrate, align and set up exhaust terminals and supply terminals as part of the laboratory variable volume system.

3.9 Provide a total of 16 hours of Owner training divided into 4 sessions.

END OF SECTION

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SECTION 23 37 13 - GRILLES, REGISTERS AND CEILING DIFFUSERS

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 air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for ductwork and duct accessories required in conjunction with air outlets and inlets and for balancing of air outlets and inlets; not work of this section.

1.5 Codes and Standards:

1.5.1 ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual". Provide air outlets and inlets bearing ADC Certified Rating Seal.

1.5.2 NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data for air outlets and inlets indicating construction, finish, and mounting details.

1.6.2 Performance Data: For each type of air outlet and inlet furnished, provide aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections and data as required.

1.7 O&M Data Submittals: Submit cleaning instructions for finishes and spare parts lists. Include this data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 General:

2.1.1 Except as otherwise indicated, provide manufacturer's standard grilles, registers, and ceiling diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

2.1.2 Manufacturers not listed in the following specification will not be considered for approval unless accepted by addendum prior to bid.

2.1.3 Performance: Provide grilles, registers and ceiling diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device equal to the basis of design.

2.1.4 Ceiling and Wall Compatibility: Provide grilles, registers and diffusers with border styles that are compatible with adjacent wall and ceiling systems, and that are specifically manufactured to fit into ceiling module or wall with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems and walls which will contain each type of ceiling diffuser, grille, or register.

2.1.5 Appearance: All grilles and registers shall be aluminum construction and all diffusers shall be steel or aluminum construction, unless otherwise noted, with uniform matching appearance for each

type of outlet. Ceiling mounted grilles and registers shall be set to be sight tight from the predominant exposure.

2.1.6 Finish: All ceiling mounted grilles, registers, and diffusers shall be finished with baked white enamel. Wall and door mounted grilles and registers shall be finished with baked white enamel finish.

2.2 Acceptable Manufacturers: Subject to compliance with requirements, provide products by Titus, Metal Aire, or Price.

2.3 Square Ceiling Diffusers (CD-1): Provide square face, adjustable, 360 degree pattern diffusers with one-piece stamped cones, no corner joints, round necks. Provide lay-in panel as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Diffusers with 24 x 24 face: Titus TMSA, Metalaire 5700 A, Price SCDA. Diffusers with 12 x 12 face: Titus TMS, Metalaire 5800, Price SCD

2.4 Perforated Ceiling Diffusers (CD-2): Provide 24" x 24" square face, adjustable pattern, perforated face diffusers. If square neck diffusers are submitted, provide square-to-round adaptors as required. Provide trim ring for diffusers in hard ceilings to allow opening to be used for access. Titus PAS. Metalaire 7500, Price PDF

2.5 Return Grilles (RG-1): Provide return grilles with one set of 45 degree fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL or Metalaire RH and Price 630.

2.6 Exhaust Grilles (EG-1): Provide exhaust grilles with one set of 45 degree fixed louvers, parallel to the long dimension. Provide mounting frame for all wall and plaster ceiling installations. Titus 350 FL or Metalaire RH and Price 630.

2.7 Sidewall Supply Registers (SR): Provide supply registers with two sets of individually adjustable airfoil registers, spaced at ¾", with the front set parallel to the long dimension. Provide opposed blade damper, screwdriver operated from the face. Provide mounting frame. Titus 272-FL or Metalaire 4004.

3 EXECUTION

3.1 Coordinate installation with ceiling and light fixture installation. Locate ceiling outlets as indicated on architectural Reflected Ceiling Plans. Unless otherwise indicated, locate ceiling outlets in the center of acoustical ceiling modules with sides parallel to the grid.

3.2 Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

3.3 Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

3.4 Set air volumes to values shown on the drawings so that the system is functional. Leave ready for test and balance contractor.

3.5 Furnish to Owner three operating keys for each type of outlet and inlet that require them; obtain receipt.

END OF SECTION

SECTION 23 40 00 - AIR CLEANING EQUIPMENT

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 air cleaning work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to Division-23 air handling units section for filter boxes associated with air handling units; not work of this section.

1.5 Refer to Division-23 duct accessories section for duct access door work required in conjunction with air filters; not work of this section.

1.6 Control wiring specified as work of Division 25 for BAS and Controls is work of that section.

1.7 Codes and Standards:

1.7.1 NFPA Compliance: Comply with applicable portions of NFPA 90A pertaining to installation of air filters.

1.7.2 UL Compliance: Comply with UL Standards pertaining to safety and performance of air filter units.

1.7.3 ASHRAE Compliance: Comply with provisions of ASHRAE Standard 52 for method of testing, and for recording and calculating air flow rates.

1.8 Approval Submittals:

1.8.1 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.

1.8.1.1 Extended surface filters

1.8.1.2 Filter gauges

1.9 O&M Data Submittals:

1.9.1 Maintenance Data: Submit maintenance data and spare parts lists for each type of filter and rack required. Include this data, product data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide air cleaning equipment of one of the following: American Air Filter Co., Continental Air Filter Co., Cambridge Filter Corp., Farr Co., Filtrete or approved equal.

2.2 Extended Surface Filters: Provide medium 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 2" deep V-shaped pleats and held by self-supporting wire frames. Construct holding frames of 18-gauge galvanized steel and provide suitable fasteners and gasketing to hold media and media frame and to prevent unfiltered air passing between media frames and holding devices. Design holding frames which are suitable for bolting together into built-up filter banks. Provide filters with rated face velocity of 500 fpm, initial resistance of 0.25" w.g. with 60-65% dust spot efficiency (MERV 12) 0.60" w.g. with 90-95% dust

spot efficiency and final rated resistance of 1.2" w.g. Basis of design: Columbia Industries.

2.3 Provide Dial-Type Magnehilic filter gauges for each filter bank graduated to read between 50% and 75% of the scale range when the filters are fully loaded. Provide pressure tips, tubing, gauge connections and mounting bracket.

2.4 Filter Size: All filters of each type shall be the same size for the entire project.

3 EXECUTION

3.1 General: Comply with installation requirements as specified elsewhere in these specifications pertaining to air filters housing/casings, and associated supporting devices.

3.2 Install air filters and holding devices of types indicated, and where shown; in accordance with air filter manufacturer's written instructions and with recognized industry practices; to ensure that filters comply with requirements and serve intended purposes.

3.3 Locate each filter unit accurately in position indicated, in relation to other work. Position unit with sufficient clearances for normal service and maintenance. Anchor filter holding frames securely to substrate.

3.4 Coordinate with other work including ductwork and air handling unit work as necessary to interface installation of filters properly with other work.

3.5 Install filters in proper position to prevent passage of unfiltered air.

3.6 Install air filter gauge pressure tips 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 included gauges for proper readings.

3.7 Construction Filters: No systems that include filters shall be operated at any time unless the complete specified prefilters and after filters are installed. Maintain all filters during construction. Install clean prefilters and afterl filters just prior to test and balance work.

3.8 Spare Parts:

3.8.1 Extra Filters: Provide a complete spare set of filters for each system where filters are installed. Where the design includes prefilters and after filters, provide only prefilters. Obtain receipt from Owner that spare filters have been received.

END OF SECTION

SECTION 23 73 23 - CUSTOM AIR HANDLING UNITS

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 air handling unit work is indicated on drawings, and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for field-applied insulation to air handling units.

1.5 Refer to other Division-23 sections for condensate and chilled water piping required in conjunction with air handling units.

1.6 Refer to other Division - 23 Sections for HVAC equipment to be included as part of custom air handling units such as Air Cleaning Equipment and Variable Frequency Drives. The scope of work included as part of custom air handling units is described in this specification and shown on the drawings.

1.7 Refer to Division-26 sections for the following work; not work of this section.

1.7.1 Power supply wiring from power source to power connection on unit. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory installed by manufacturer.

1.8 Control wiring specified as work of Division 25 for Automatic Temperature Controls is work of that section.

1.9 Codes and Standards:

1.9.1 AMCA Compliance: Test and rate air handling units in accordance with AMCA standards.

1.9.2 ARI Compliance: Test and rate air handling units in accordance with ARI 430 "Standard for Central-Station Air Handling Units", and ARI 410 for coils, display certification symbol on units of certified models.

1.9.3 NFPA Compliance: Provide air handling unit internal insulation, adhesives, and coatings having flame spread rating not over 25 and smoke developed rating no higher than 50; and complying with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.9.4 UL and NEMA Compliance: Provide electrical components required as part of air handling units, which have been listed and labeled by UL and comply with NEMA Standards.

1.9.5 NEC Compliance: Comply with National Electrical Code (NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of air handling units.

1.10 Approval Submittals:

1.10.1 Product Data: Submit manufacturer's technical product data as follows showing dimensions, weights, capacities, certified ratings, sound data, fan performance with operating point clearly indicated, motor electrical characteristics, gauges and finishes of materials, and installation instructions. Submit assembly-type drawings showing unit dimensions, weight loadings, required clearances, construction details, and field connection details.

1.10.1.1 Air handling unit components including casings, fans, coils and all related equipment and piping.

1.10.2 Shop Drawings: Submit shop drawings showing the actual installation of each air handling unit, and other related HVAC equipment in plan and section. Show coil access, filter access, motor access, controls access and access to any other components requiring service. Show coordination with all related structural components of the building and show all unit supports. Show relationship to drains and other equipment. Show every electrical device and control panel with code-required service clearance clearly marked.

1.10.2.1 Units mounted in mechanical rooms.

1.10.3 Short Circuit Current Ratings (SCCR):

1.10.3.1 All controls panels and enclosures shall have SCCR labeling per NEC.

1.10.3.2 Provide equipment with SCCR suitable for location installed.

1.10.3.3 Contact engineer for maximum available fault current at equipment prior to providing approval submittals so SCCR can be included in approval submittals.

1.10.3.4 In no case shall the SCCR be less than the following:

1.10.3.4.1 For equipment rated 100 amps and higher the minimum SCCR shall be 65 kA.

1.10.3.4.2 For equipment rated 50 amps and lower than 100 amps the minimum SCCR shall be 35 kA.

1.10.3.4.3 For equipment rated 20 amps and lower than 50 amps the minimum SCCR shall be 20 kA.

1.10.3.4.4 For equipment rated 20 amps the minimum SCCR shall be 10 kA.

1.11 Test Reports and Verification Submittals:

1.11.1 Submit Shaft Alignment Report as required by Section 23 05 45.

1.11.2 Submit field Leakage Test Report.

1.11.3 Submit field Vibration Analysis Report.

1.11.4 Submit factory Sound Data Report.

1.12 O&M Data Submittals:

1.12.1 Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to air handling units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.

1.12.2 Maintenance Data: Submit a copy of approval submittals. Submit maintenance instructions, including instructions for lubrication, filter replacement, motor and drive replacement, and spare parts lists. Include these data and wiring diagrams in O&M manuals.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide air handling units of one of the following:

Energy Labs
Governair
Ventrol
Haakon
Ingenia

Temtrol

2.2 General:

2.2.1 Factory fabricated air handling units shall be constructed of solid steel, formed outer panels secured to a welded steel frame or to a bolted steel frame. Outer panels shall be removable without affecting the structural integrity of the units. All units shall come complete with a structural steel base around the entire perimeter. Construction shall result in a leakage rate of less than 1% of rated flow at maximum operating pressure.

2.2.2 Multiple sectioned units shall be as a single factory assembled piece (except where shipping limitations prevent) demounted into modular sections in the field by Contractor. Units shall be furnished with sufficient gasket and bolts for reassembly in the field by Contractor.

2.2.3 All units shall be UL or ETL listed.

2.2.4 All coil connections, access doors and drains shall be coordinated with field piping and electrical connections.

2.2.5 Unit exterior dimensions shall be the size as shown on the drawings.

2.3 Testing:

2.3.1 Provide a field leak test on all units after assembly at design operating static pressure. Cabinet leakage shall not exceed 1% of specified air flow on the positive and negative sides of the unit. Furnish a written report to the Engineer.

2.3.2 All fans shall be factory balanced to limit vibration across operating range to less than 0.2 in/sec, or as recommended by manufacturer, whichever is more stringent. Measure vibration in all three planes in the “filter out” condition. Provide field vibration analysis and submit report. AHU manufacturer shall provide vibration test results

2.3.3 Sound Data: The manufacturer shall submit sound data in accordance with industry standards and AMCA 300.

2.4 Unit Base / Framework

2.4.1 Unit base frame shall be structural steel cross members. The base shall include “Double Bottom” insulated floor. Base rails shall be fitted with lifting lugs at the corners of the unit or section (if demounted) with thermal break between floor and base assembly. The unit base shall be heavy duty walk-on floor made from 10 gauge aluminum checkerplate. Seams in floor shall be water tight.

2.5 Exterior Casing:

2.5.1 The air handling unit casing shall be 4" thick double wall construction of the “no-through-metal” design. The casing structure shall incorporate insulating thermal breaks as required so that, when fully assembled, there exists no path of continuous unbroken metal to metal conduction from inner to outer surfaces. Provide required structural frame and casing to withstand 8" static pressure. Panels shall be gasketed and secured to the frame with screws. Outer panels shall be constructed from 16 gauge G-90 galvanized steel. The exterior panels for indoor units shall be finished with industrial air dried (alkyd) enamel.

2.6 Unit Casing Insulation: Insulation shall not be disturbed if panels are removed. Entire unit shall be insulated with 4" thick insulation. The closed cell foam injected insulation shall have an effective thermal conductivity (C) of 0.15 BTU in/sq.ft. degree F (panel R value of R13). Insulation shall be UL 723 fire and smoke rated. Fiberglass insulation is not acceptable.

2.7 Liners: The units shall be double wall construction and include a 20 gauge solid galvanized liner

in the entire unit except for supply fan section. The liner in the supply fan section shall be perforated galvanized steel construction. Insulation facing perforated inner wall shall be covered by a Mylar or Tedlar film with spacers to preserve the acoustical properties of the assembly.

2.8 Condensate Pan: Condensate drain pan shall be 16 gauge Type 304 stainless steel. All pans shall be insulated "Double Bottom" construction with welded corners. The drain shall be sloped in two planes for complete drainage with no standing water in the unit. Drain connections shall be standard 1¼" NPT connection. Drain pans shall be provided under all sections.

2.9 Access Doors: The unit shall be equipped with double wall insulated, hinged access doors. Doors shall be located upstream and downstream of all coils and in all filter, access plenum and fan sections. The access doors shall include an extruded aluminum door frame. The doors shall be at least 5'-0" high (or the maximum allowed by unit size) with a minimum width of 24". The fan section door shall be large enough to allow the removal of the fan wheel and motor without disassembly of the unit casing. The door frame shall incorporate a built in thermal break barrier along with a gasket around the entire perimeter of the door. The door shall be hinged using a minimum of three heavy duty butt hinges. There shall be two heavy duty Ventlok (260/310) handles (or equal) per door. Provide an ETL, UL 1995, and CAL-OSHA approved tool operated safety latch on all fan section access doors. All doors shall have windows.

2.11 Fan Array System:

2.11.1 General: The system shall consist of multiple, direct driven, arrangement 4 plenum fans constructed per AMCA requirements for the duty specified, (Class I, II, or III). All fans shall be selected to deliver the specified airflow quantity at the specified operating total static pressure and specified fan/motor speed. The array shall be selected to operate at a system total static pressure that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan/motor speed. The quantity of fans shall be as shown in the schedule on the drawings. All motors shall be standard pedestal mounted type, TEAO, T-frame motors selected at the specified operating voltage, RPM, and efficiency as specified or as scheduled elsewhere. All motors shall include isolated bearings or shaft grounding. Each fan/motor assembly shall be dynamically balanced to meet AMCA standard 204-96, category BV-5, to meet or exceed Grade 2.5 residual unbalance.

2.11.2 The fan array shall provide the redundancy scheme as called for on the schedule and control diagrams. Manufacturers with other redundancy schemes will not be accepted.

2.11.3 The fan array shall be designed to meet the sound data shown in the schedule on the drawings. Manufacturers shall submit acoustical data for review and approval indicating that the proposed equipment can meet all specified performance requirements without impacting the equipment performance or design features including duct connection location, unit weights, acoustical performance, number of fans or specified total fan HP for each fan array. Submittals which indicate a higher connected fan HP than specified or scheduled will not be accepted.

2.11.4 The fan array shall consist of multiple direct drive fans and motors, spaced in the air way tunnel cross section to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein. The quantity of fans shall be as shown on the schedule on the drawings.

2.11.5 The fan array shall produce a uniform air flow profile and velocity profile within the airway tunnel of the air handling unit not to exceed the specified cooling coil and/or filter bank face velocity when measured at a point 12" from the intake side of the fan array intake plenum wall and a distance of 48" from the discharge side of the fan intake plenum wall.

2.11.6 Each fan/motor assembly shall be removable through a 24" wide free area access door.

2.11.7 Each fan/motor will be provided with an individual back-draft damper similar to a Ruskin BD6 Heavy Duty 6063T5 extruded aluminum frame, .125" wall thickness. The frame shall have galvanized steel braces on all corners. Blades shall be minimum .070" wall thickness 6063T5

extruded aluminum. Bearings shall be corrosion resistant long life synthetic. Linkage shall be ½" tie bar with stainless steel pivot pins.

2.11.8 Each fan assembly shall be supplied with a complete flow measuring system which indicates airflow in cfm. The flow measuring system shall consist of a flow measuring station with four static pressure taps and four pressure sensing tubes located on the face and in the throat of the fan inlet cone. The flow measuring station shall not obstruct the inlet of the fan and shall have not effect on fan performance (flow or static) or sound power levels.

2.11.9 Flow Readout:

2.11.9.1 The flow monitor system shall be unit mounted in a panel containing individual motor overloads and disconnects for each motor in the array. Panel shall include "Motor Fault" lights for each individual motor. Panel shall include signal to BAS of motor fault.

2.12 Electrical Requirements:

2.12.1 General: Provide disconnect switches, variable frequency drives, motor starters, relays, contactors, wiring and conduit complying with the requirements of Division 26. The minimum size wire used for line voltage devices needing external power connections (such as lights, UV lights, receptacles) shall be #12AWG.

2.12.2 Motors: Provide premium high efficiency motors per Division 23 Section "Electric Motors". Provide motors suitable for inverter duty.

2.12.3 Fan Array Systems with Variable Frequency Drive Control:

2.12.3.1 Variable Frequency Drives shall be furnished as called for in Division 23 section "Variable Frequency Drives."

2.12.3.2 Electrical Requirements: All VFDs for each air handling unit shall be mounted in a common enclosure with appropriate cooling. The VFD enclosure shall be mounted on the air handling unit fan section and shall have a single point electrical connection and disconnecting means. Provide short circuit protection at a rating of 65,000 AIC.

2.12.3.3 Provide one variable frequency drive for each fan in the array. Provide control wiring and control circuitry for each fan motor and VFD. Provide short circuit protection for each VFD by means of fuses with fuse blocks or circuit breakers.

2.12.3.4 Control Wiring: Provide control wiring and components required for complete operation of fan array system. System controls, controls components and control wiring shall include but is not limited to: auto mode or manual mode, cfm control mode, or BAS control mode. Controls and control wiring shall include: auto start/stop, manual start/stop, life safety shutdown, smoke shutdown, system alarms and VFD alarms. All control wiring shall be included in VFD enclosure provided with system. Provide interface to BAS system.

2.13 Coils:

2.13.1 All coil assemblies shall be tested under water at 315 psig and performance shall be certified under ARI Standard 410. Coils exceeding the range of ARI standard rating conditions shall be as noted on a coil computer printout. Select chilled water coils for design performance and to maintain heat transfer down to 25% flow.

2.13.2 Type WC (water coils) shall be constructed of seamless copper tubing mechanically expanded into fin collars. Fins shall be the die formed plate type fabricated of aluminum. Headers shall be seamless copper with die formed tube holes. Maximum fin spacing is 9 fpi. Connections shall be male pipe thread (MPT) Schedule 40 red brass.

Vents and drains shall be provided for complete coil drainage. Coils shall be suitable for 250 psig

working pressure. Intermediate tube supports shall be supplied on coils over 44" fin length with an additional support every 42" multiple thereafter. Coils shall have 5/8" O.D. x .025" wall copper tubes, .010" fins and 16 gauge Type 304 stainless steel casing. Coil tracks and supports shall be fabricated of Type 304 stainless steel.

2.13.3 Provide multiple sections of coils split vertically and horizontally. Coil length shall not require more than 60" of clear space in front of unit for removing coil. Safe off all spaces between coils to prevent air from bypassing coils.

2.13.4 Coatings: Provide Seacoast coating on all coils to prevent corrosion. Manufacturer's standard corrosion-resistant coating is acceptable.

2.13.5 Provide insulated intermediate stainless steel drain pans beneath each section of cooling coil above bottom section. Provide a drain tube from each intermediate pan down to the base drain pan. Intermediate drain pans shall extend a minimum of 8" past the downstream face of coil. Insulate casings at offset coils to prevent moisture blowoff.

2.14 Filter Boxes: Provide boxes to accommodate filters of the type indicated on the schedule. Factory fabricated filter sections shall be of the same construction and finish as the units. Side service filter sections shall include hinged access doors. Internal safing shall be permanently mounted by the manufacturer as required to prevent air bypass around the filters.

2.14.1 Filter Gauge: Each filter bank shall be furnished with one (1) Magnehelic filter gauge (Dwyer Series 2000).

2.15 Filters: Provide filters. Refer to Division - 23 section "Air Cleaning Equipment" for filters required for air handling units.

2.16 Ducted connections: Provide bellmouth connection of sizes shown on the drawings.

2.17 Lighting: Provide vapor-proof light fixtures and switches for all accessible sections. All lighting and switches shall be prewired to a single point 120 V electrical connection.

2.18 Drains: Provide a capped washdown drain in each section.

2.19 Trolley: Provide trolley/rail system to permit removal of fans and motors for motors 10 hp or larger

2.20 UVC Fixturing:

2.20.1 Acceptable Manufacturers: Subject to compliance with requirements, provide UV-C fixturing by:

Asco Freshair UV

2.20.2 Quality Assurance:

2.20.2.1 Qualifications: UV-C products supplier shall provide proof of 100% inbound and outbound testing of equipment.

2.20.2.2 Fixturing: The UV Power Supply shall have been tested, listed and labeled as compliant with UL.

2.20.2.3 Plenum Wiring Loom: The loom shall meet UL Standard 13 and 444, NEC Articles 725 and 800.

2.20.2.4 Lamps: Each lamp shall contain no more than 5 milligrams of mercury consistent with current environmental practices. Lamps shall include an inner protective layer comprising of at least one element from the series formed by magnesium, aluminum, titanium, zirconium, and rare earths which repels alkali metals (e.g. mercury) thereby extending lamp life. Lamps shall not produce ozone and shall be hermetically sealed within a thin layer of UV-C transmissble FEP material to protect against lamp breakage and to contain lamp contents should breakage occur.

2.20.3 Warranty; Power supply and fixturing shall be warranted to be free from defects for a period of five years. Lamps shall be warranted to be free from defects for a period of two years.

2.20.4 Design Requirements:

2.20.4.1 Irradiation: Lamps shall be installed in sufficient quantity and in such a manner so as to provide an equal distribution of UV-C energy. When installed, the UV-C energy produced shall be of the lowest possible reflected and shadowed losses and shall be capable of 360 degree UV-C irradiance within the UV cavity.

2.20.4.2 Intensity: The minimal UV-C energy striking a surface shall be sufficient to continuously destroy a mono-layer of mold and bacteria as typically found in HVAC system in less than one hour. Minimum average irradiance shall be 200 microwatt seconds per cm^2, and minimum irradiance at plenum sides shall be 50 microwatt seconds per cm^2 verifiable by third party mathematical modeling.

2.20.4.3 Installation: The power supply housing shall be capable of installation within the air stream and/or within a secondary compartment of the system. Lamps shall be mounted to irradiate the intended surface(s) as well as all of the available line of sight airstream by proper placement and incident angle reflection. The power supply shall be labeled for field wiring. Mount power supply and ballast on exterior of AHU.

2.20.4.4 Safety: To protect maintenance personnel, all access panels and doors to the UV-C assembly and/or within view of the UV-C assembly shall include mechanical interlock

2.20.4.5 Equipment:

2.20.4.5.1 Power Supply: Power supply shall be UL Listed, 120-277Vac +/- 10% - 50/60Hz, 800+mA high output type. They shall be High Power Factor, Low THD, Class P, Sound Rated “A” Type 1 Outdoor design with Inherent Thermal Protection and no PCB’s. They shall be capable of operating at temperatures of from 1-90 degrees C while producing the specified output and organism destruction at no more than 13 Watts of power consumption for each square foot of treated, cross sectional plane. The power supply shall be capable of ensuring a minimum of 9000 hours of lamp life, and with greater than 80% of its initial output. Power supply shall be protected against “end of lamp life” conditions, and warranted for 5 years, and be labeled for field wiring. Ballast shall be UL listed and rated for the type of lamp employed.

2.20.4.5.2 Plenum Wiring Loom: Shall be 20 foot length to facilitate lamp connection to a remote plenum mounted power supply. The Lamp and Loom shall be capable of being mounted anywhere in the system and/or as shown on the drawings UL Standard 13 and 444, NEC Articles 725 and 800. The loom shall be constructed of ozone and UV-C resistant materials.

2.20.4.5.3 Lamp Plug & Protector: Shall be of the 4- pin type capable of accommodating a single-ended lamp. The Protector shall of UV resistant materials and designed for protection against electrical shock, moisture (water tight) and separation.

2.20.4.5.4 Dielectric Grease: Dielectric Silicone Grease shall have excellent dielectric properties, oxidation resistance and water repellency. It shall be nontoxic and non-melting and retain its pliability even after extended service. Dielectric grease shall have a temperature range of 40 to 400ºF. It shall comply with the FDA, 21 CFR 175.300 and shall meet or exceed the requirements of Mil-S-8660C.

2.20.4.5.5 LampHolster: LampHolsters may be permanently affixed within the irradiated cavity. They shall be constructed of UV-C resistant materials and provide for maximum flexibility in quick Lamp positioning, removal and holding power.

2.20.4.5.6 Lamps: Shall be non-proprietary lamps (off the shelf) and manufactured by Phillips, Light Source International or GE. Each lamp shall contain less than 5 milligrams of mercury, consistent with current environmental practices. Lamps shall include an inner protective layer comprising of at least one element from the series formed by magnesium, aluminum, titanium, zirconium, and rare

earths which repels alkali metals (e.g. mercury) thereby extending lamp life. Lamp life shall be 18,000 hours with no more than a 20% output loss at the end of the lamps life (18 months of continuous use). Lamps shall be constructed with UV-C proof material bases and shall not produce ozone. Lamps shall produce specified output in moving air of 500 fpm and with temperatures of 0-70ºC. Lamps shall not produce ozone and shall be hermetically sealed within a thin layer of UV-C transmissible FEP material to provide protection against lamp breakage and to ensure lamp contents from a broken Lamp are contained.

2.20.5 Framing: Lamp array shall be provided with a framing system to permit mounting withing the AHU. Framing Shall be corrosion resistant material.

3 EXECUTION

3.1 Examine areas and conditions under which air handling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install air handling units where indicated, in accordance with equipment manufacturer's published installation instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes. The work of this section includes all equipment necessary for a complete, packaged system, including work and equipment specified in other Division 23 sections.

3.3 Coordination: Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of air handling units with other work. Fabricate and ship units in sections as required to install units at the jobsite. Coordination of opening size and scheduling is the Contractor's responsibility.

3.4 Access: Provide access space around air handling units for service as indicated, but in no case less than that recommended by manufacturer.

3.5 Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer. 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.

3.5.1 Service Lights: Provide dedicated circuits for service lights.

3.5.2 UV-C Fixturing: Provide safety interlock switches with signage at all doors accessing (or within view of sections) sections with UV-C fixturing. Signage shall state: “This unit contains UV-C lighting system. Disconnect all power sources before opening or entering. Disconnect is located at _____ to serve UV-C light circuits _____.” Post a UV-C lamp/ballast schedule on the AHU with location, circuit and warranty date. UV-C lights shall have dedicated circuits.

3.5.3 Radiometer: Provide a relative indicating UV-C radiometer and adjust/set per manufacturer’s written direction.

3.6 Piping Connections: Refer to other Division-23 sections. Provide piping, valves, accessories, gauges and supports as indicated. Eliminate strain on coil headers. Provide trapped, insulated, DWV copper condensate drain piping full size from the drain connection as shown and extend independently to disposal point as part of this section's work. Provide individual trap from each drain.

3.7 Insulate all piping within the AHU in accordance with Division 23 section “Insulation for Equipment and Piping”. Repair all cracks in insulation or covering at site after unit has been set.

3.8 Duct Connections: Refer to other Division-23 sections. Provide ductwork, accessories, and flexible connections as indicated.

3.9 Brush out fins on all coils.

3.10 Testing: Upon completion of installation, start-up and operate equipment to demonstrate capability and compliance with requirements. Perform field Leakage Tests and Vibration Analysis. Field correct malfunctioning units, then retest to demonstrate compliance.

3.11 Spare Parts:

3.11.1 Provide spare fuses per Section 23 05 12.

3.12 Provide two days of time for a factory trained service technician for site coordination of the installation of any unit requiring field assembly.

3.13 Owner Training: Provide 8 hours in two sessions.

END OF SECTION

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SECTION 23 82 19 - FAN COIL UNITS

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 fan coil unit work is indicated by drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for piping; ductwork; and testing, adjusting and balancing of fan coil units; not work of this section.

1.5 Refer to Division-26 sections for the following work; not work of this section.

1.5.1 Power supply wiring from power source to power connection on fan coil unit. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

1.6 Control wiring specified as work of Division 25 for Building Automation System is work of that section.

1.7 Codes and Standards:

1.7.1 ARI Compliance: Test and rate fan coil units in accordance with ARI Standard 440 "Room Fan Coil Air Conditioners."

1.7.2 UL Compliance: Construct and install fan-coil units in compliance with UL 883 "Safety Standards for Fan Coil Units and Room Fan Heater Units".

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's product data for fan coil units showing dimensions, capacities, ratings, performance characteristics, gauges and finishes of materials, and installation instructions. Submit assembly-type drawings showing unit dimensions, construction details, and field connection details.

1.8.1.1 Fan coil units

1.8.1.2 Vibration isolation

1.8.2 Short Circuit Current Ratings (SCCR):

1.8.2.1 All controls panels and enclosures shall have SCCR labeling per NEC.

1.8.2.2 Provide equipment with SCCR suitable for location installed.

1.8.2.3 Contact engineer for maximum available fault current at equipment prior to providing approval submittals so SCCR can be included in approval submittals.

1.8.2.4 In no case shall the SCCR be less than the following:

1.8.2.4.1 For equipment rated 100 amps and higher the minimum SCCR shall be 65 kA.

1.8.2.4.2 For equipment rated 50 amps and lower than 100 amps the minimum SCCR shall be 35 kA.

1.8.2.4.3 For equipment rated 20 amps and lower than 50 amps the minimum SCCR shall be 20 kA.

1.8.2.4.4 For equipment rated 20 amps the minimum SCCR shall be 10 kA.

1.9 O&M Data Submittals:

1.9.1 Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to fan coil units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.

1.9.2 Maintenance Data: Submit a copy of approval submittals. Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include these data in O&M Manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide fan coil units of one of the following:

VTS
Multi Aqua
Daikin
Trane
York
Williams
Titus
Price
International Environmental Corporation (IEC)

2.2 General: Provide fan coil units having cabinet sizes, and in locations indicated, and of capacities, style, and having accessories as scheduled. The basic unit shall include chassis, coils, fanboard, drain pan assembly, fans, housing, motor, filter, and insulation.

2.2.1 Chassis: Construct chassis of galvanized steel with flanged edges.

2.2.2 Insulation: Faced, heavy density glass fiber per NFPA 90A.

2.2.3 Cabinet: Construct of 18-gauge steel removable panels, 16-gauge front. Provide insulation over entire coil section. Clean cabinet parts, bonderize, phosphatize, and flow-coat with baked-on primer.

2.2.4 Coils: Construct of seamless copper tubes mechanically bonded to aluminum fins. Design for 300 psi working pressure, and leak test at 300 psi under water. Provide manual air vents.

2.2.5 Drain Pans: Construct of stainless steel. Insulate with polystyrene or polyurethane insulation and seal with mastic. Pans shall be pitched to drain completely and shall have connections on both sides.

2.2.6 Fans: Provide DWDI centrifugal forward curved wheels in galvanized steel fan scrolls, statically and dynamically balanced.

2.2.7 Manifold Piping: Construct of type L copper tubing. Manifold piping shall be provided by the unit manufacturer, but may be shipped separately as a sub-assembly to be fastened to coils in the field. Provide manually operated tight shutoff valves (150 psi working pressure) on each coil of each unit. Provide dielectric unions at all copper connections to steel pipe.

2.2.8 Motors: Provide high efficiency motors per Division-23 section “Electric Motors”.

2.3 Wall Mounted Fan Coil Units, Non-Ducted: Provide vertical console units with 1-inch thick

insulation, a low discharge opening and a perforated steel return air inlet panel. Provide removable access panels and washable filters, primary drain pain. Provide two-speed fan operation. Provide 24 volt remove thermostat and controls and relays. Provide chilled water control valve. Provide field installed condensate pump.

2.4 Accessories: Provide the following accessories where indicated or scheduled.

2.4.1 Controls: Provide electronic, modulating chilled water control valves (Erie or Belimo), primary drain pan float switch,secondary drain pan float switch, thermostat and local disconnecting means, all factory mounted. Provide control transformer coordinated with available power. The units shall have a single field electrical connection. Provide unions to remove control valves.

2.5 Vibration Isolation: Provide vibration isolation in accordance with Division-23 section “Vibration Isolation” and the following listing.

3 EXECUTION

3.1 Examine areas and conditions under which fan coil units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 General: Install fan coil units as indicated, and in accordance with the manufacturer's installation instructions. Install secondary drip pans under all units.

3.3 Locate units as shown and coordinate with other trades.

3.4 Provide vibration isolation hangers in accordance with Division-23 section "Vibration Isolation."

3.5 Install trapped, insulated, copper condensate drain piping as shown and extend to disposal point as part of this section's work.

3.6 Provide secondary drain pans under all units that are mounted above ceilings. Install float switches to shut down fan coil units when water is detected in the secondary drain pan.

3.7 Install hydronic piping as shown on the coil piping diagram.

3.8 Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to electrical Installer.

3.9 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.

3.10 After construction is completed, including painting, clean unit exposed surfaces, vacuum clean terminal coils and inside of cabinets.

3.11 Retouch any marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

3.12 Owner Training: Provide 2 hours in one session.

3.13 Spare Parts: Provide spare fuses per Section 23 05 12.

END OF SECTION

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SECTION 23 99 00 - LABORATORY FUME HOOD

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 fume hood work required by this section is indicated on drawings and schedules, and by requirements of this section.

1.4 Refer to other Division-23 sections for ductwork connections, plumbing connections, and controls, not work of this section.

1.5 Refer to Division-26 sections for power wiring and connections, not work of this section.

1.6 Codes and Standards

1.6.1 Comply with NFPA-45 requirements.

1.6.2 Comply with NFPA-70, NEC requirements.

1.7 Approval Submittals:

1.7.1 Product Data: Submit technical product data and assembly drawings of new hoods and hoods to be modified showing all features, accessories, dimensions, and roughing in locations for all mechanical and electrical services, and all hood modifications.

1.7.1.1 Restricted bypass fume hoods

1.7.2 Written certification that all new fume hoods meet the ASHRAE test requirements.

1.8 O&M Data Submittals: Include maintenance data and a copy of approval submittals in the O&M manual.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide fume hoods by: Labconco, Kewaunee Scientific, Hamilton, Jamestown, BMC or approved equal.

2.2 General Design: All fume hoods shall be of airfoil design with radiused foil sections at the bottom and sides of the hood opening to insure maximum operating efficiency and minimum eddying of air currents. They shall be the restricted bypass type to provide variable volume operation.

2.3 Construction:

2.3.1 Double wall end panels shall be provided for all fume hood superstructures, with the front of the panel at the hood opening radiused, providing a streamlined section and insuring a smooth, even flow of air into the hood. The hood interior and panels shall be flush with the entrance shape to prevent eddy currents and back flow of air. The area between the double wall ends shall be closed to house the sash counter-balance weight and remote control valves as are required.

2.3.2 An airfoil which presents a streamlined appearance similar to the sides, shall be installed at the bottom of the hood opening. This foil shall be mounted with approximately a 1 inch open space between the foil and the top front edge of the working surface to direct an air stream across the hood work top to prevent any back flow of air at this point. The airfoil shall extend back under the sash, so that the sash closes on top of the foil, and thus does not close the approximate 1-inch opening.

2.3.3 An automatic air bypass shall be furnished for the hood at the top of the sash opening. This air bypass shall limit the maximum air velocity through the face of the hood and provide a relatively constant volume of air through the hood (regardless of sash position) when hood exhaust system is in operation. The hood air bypass shall not be dependent on mechanical or electrical linkage, and shall be completely positive in operation. The bypass shall provide an effective sight-tight barrier between the area outside the hood and the hood interior. The bypass shall also provide an effective barrier capable of controlling transfer of flying debris from inside the hood.

2.3.4 A removable baffle, with one fixed opening and two adjustable openings (one upper and one lower) shall be furnished at the rear of the hood. The adjustable baffle openings shall be provided so that the flow of air through the hood can be adjusted to compensate for various types of gases, apparatus, or heat sources used in the hoods.

2.3.5 The hood exterior shall be constructed of cold-rolled steel and shall have the component parts either screwed together or fastened by button-hole fasteners to allow the removal of the end panels, front vertical fascia pieces, bypass grille, and airfoil. The intent is to allow replacement or to provide access to the plumbing piping and fixtures. Spacers or reinforcements shall be welded to these main parts. After the fabrication of all cold-rolled steel parts, but before final assembly, component parts shall be given an acid, alkali and solvent resistant finish on both exterior and interior surfaces.

2.3.6 A vertical sliding sash shall be provided for the hoods unless otherwise specified. Glass used in the sash shall be a minimum of 7/32" thick combination sheet. The sash shall be composed of a minimum of 18 gauge painted steel rolled shape which is mitered, welded, and ground smooth at the corners to provide a complete frame with no visible joints. Glass shall be sealed into the frame with an extruded vinyl channel. The sash shall be counterbalanced with two sash weights suspended one from each end of the sash by stainless steel cables operating over ball bearing sheaves. The sash frame shall be equipped with plastic guides, which operate in stainless steel sash guides to insure proper operation of the sash and prevent metal-to-metal contact. Provide sash stops to prevent sash opening above 16" unless bypassed by user.

2.3.7 The hood interior lining shall be non-asbestos similar to "Kemliner" unless otherwise scheduled. The end panels, back panel, baffle and top panels shall be not less than 1/4" thick, and shall be screwed together with cleats or steel angles to form a completely rigid assembly to which the exterior cold rolled steel parts can be mounted and to prevent open spaces or joints.

2.3.8 An exhaust outlet constructed of type 304 stainless steel or suitable plastic shall extend 2" above the top panel. The outlet shall be located in the top of the hood in the plenum chamber area behind the upper sloping baffle. If transitions are provided, they shall comply with Division -23 section “Chemical Fume Exhaust Duct Ductwork”.

2.3.9 A sash enclosure shall be provided at the top of the hood to receive the vertical sliding sash when it is in the up position. The sash enclosure shall contain two removable panels; one each on the front and rear surfaces for access to the fluorescent light fixture for relamping and cleaning. Access to internal wiring in a central junction box shall be through removable gasketed panels.

2.3.10 Removable flush panels shall be provided in both interior end panels to provide access to service piping and valves to facilitate installation and maintenance.

2.3.11 Removable partial end panels shall be provided at the exterior ends of hoods to facilitate piping, wiring and installation.

2.3.12 Low Flow Alarm: Provide built-in low flow audible and visual alarm with an alarm silence and reset switch. Mount in vertical fascia panel.

2.3.13 The hood working surface shall be molded epoxy resin made in the form of a watertight pan, not less than 3/8" deep to contain spillage. The raised surface shall be provided all around the recessed pan area. It shall be 2" to 6" wide across the front edge.

2.4 Dimensions:

2.4.1 The superstructure outside dimensions for bench mounted fume hoods shall not exceed 87" in height, 45" in depth, 48", 60" or 72" in length as selected.

2.4.2 Provide base cabinets such that the fume hood work surface is 34" above finished floor to meet ADA requirements.

2.4.3 The interior clear working height shall not be less than 44" for the interior of the hood as measured from the work surface. The depth of the working surface shall be at least 25".

2.4.4 The sash opening (including space below bottom air foil) shall be not less than 28" in height.

2.5 Acid Storage Cabinets: Cabinets shall have a corrosion-resistant interior lining and door louvers or other means of providing natural ventilation. A 1-1/2" lead or PVC fume vent at the rear of the cabinet shall extend up into the exhausted portion of the fume hood.

2.6 Flammable Storage Cabinets: Cabinets shall be UL-listed and labeled for storage of flammable liquids.

3 EXECUTION:

3.1 Install hoods as shown on the drawings and schedule in accordance with printed instructions of manufacturer.

3.2 Contractor shall provide fluorescent light bulbs.

3.3 Coordinate connection of all plumbing piping with the plumbing contractor.

3.4 Coordinate connection of light fixtures, switches, lights, and receptacles with the electrical contractor.

3.5 Refer to other Division-23 sections for fume hood control requirements. Coordinate cutouts and mount all switches, alarms and indication lights on the front of the hood to be easily seen by the user.

3.6 Base Cabinets: Install base cabinets where indicated. Coordinate with work surfaces to properly vent the acid storage area.

3.7 Startup:

3.7.1 Leave hood operational and ready for testing and balancing.

3.7.2 A representative of the hood manufacturer shall verify that hoods and hood modifications are properly installed prior to testing.

3.7.3 Calibrate flow alarms and verify operation.

3.7.4 EH&S will certify all fume hood installations. Contact EH&S at (352) 392-1591 at least 24 hours in advance to arrange for certification. All TAB work shall be complete prior to certification.

END OF SECTION

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SECTION 23 99 15 - ACCESS DOORS

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 access panels specified herein.

1.3 Approval Submittals:

1.3.1 Product Data: When required by other Division-23 sections, submit product data for access doors. Submit with Division-23 section using access doors, not as a separate submittal. Include rating data.

1.4 O&M Data Submittals: Submit a copy of approval submittal. Include this data in O&M Manuals.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide access doors by Milcor, Jay R. Smith, Zurn, BOICO, Elmdor, or approved equal.

2.2 General: Where floors, walls and ceilings must be penetrated for access to mechanical work, provide types of access doors indicated. Furnish sizes indicated or, where not otherwise indicated, furnish adequate size for intended and necessary access. Furnish manufacturer's complete units, of type recommended for application in indicated substrate construction, in each case, complete with anchorages and hardware.

2.3 Access Door Construction: Except as otherwise indicated, fabricate wall/ceiling door units of welded steel construction with welds ground smooth; 16-gauge frames and 14-gauge flush panel doors; 175° swing with concealed spring hinges; flush screw-driver-operated cam locks; factory-applied rust-inhibitive prime-coat paint finish.

3 EXECUTION

3.1 Access doors shall be installed to operate and service all mechanical equipment including valves, dampers, duct access panels, and other items requiring maintenance that are concealed above or behind finished construction. Access doors shall be installed in walls, chase and floors as necessary, but are not required in accessible suspended ceiling systems. Access doors shall have factory applied protective phosphate coating and baked enamel primer suitable for field painting.

3.2 Access doors shall be installed by the Division installing the substrate construction. However, responsibility for furnishing and determining location of access doors is part of this Division's work. The style of access door shall be suitable for construction into which installed.

3.3 Access doors shall be sized and located as required to provide proper maintenance and service access in accordance with the manufacturer's recommendations and code authority requirements for all devices and equipment.

END OF SECTION

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SECTION 25 00 00 - BUILDING AUTOMATION SYSTEM AND CONTROLS GENERAL

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 Integrated Automation work as herein called for and shown on the drawings as the Building Automation System (BAS).

1.2 Definitions:

1.2.1.1 Provide: Furnish and install, complete and ready for intended use.

1.2.1.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.

1.2.1.3 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 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.

1.4 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.

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

1.6 Field Measurements and Coordination:

1.6.1 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 from full compliance of work indicated on any of the drawings or in any section of the specifications.

1.6.2 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.

1.6.3 Coordinate work in this division in proper sequence to ensure that the total work is completed within contract time schedule and with minimum cutting and patching.

1.6.4 Locate all apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on Instrument Controls (IC) drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

1.6.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval.

1.6.6 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.

1.6.7 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 controllers, sensors, actuators 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 will not fit, 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.

1.7 Guarantee:

1.7.1 The Contractor shall guarantee labor, materials and equipment for a period of two (2) years 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.

1.7.2 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.

1.8 Approval Submittals:

1.8.1 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.

1.8.1.1 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 and the following.

1.8.1.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.8.1.1.2 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.8.1.1.3 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.

1.8.1.1.4 Submittals shall have been reviewed and approved by the Construction Manager (or Prime Contractor). Evidence of this review and approval shall be an "Approved" stamp with a signature and date on the cover sheet.

1.8.1.1.5 Submittals that include a series of devices (such as sensors or valves) shall be organized by the device number or valve type and be marked accordingly. Each device must include all items associated with that system regardless of whether or not those items are used on other systems.

1.8.1.1.6 It shall be the responsibility of this Contractor to provide any additional power (120 VAC or 24 VAC) incidental to the BAS and not already shown on electrical contract drawings.

1.8.1.1.7 The electrical design shown on the drawings supports the Building Automation System (BAS) basis of design specifications at the time of design. If BAS equipment is submitted with different electrical requirements, it is the responsibility of the 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 BAS submittal with a written statement that this change will be provided at no additional cost. BAS 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.

1.8.1.1.8 Submittals shall be in searchable PDF format and not a scanned copy.

1.8.1.1.9 Submittals shall ONLY contain relevant product data. Remove or strikeout irrelevant product data.

1.8.2 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.

1.8.3 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.

1.8.4 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 ¼" 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, materials, and proposed low voltage communication rating and power routing.

1.9 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.

1.10 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” document shall be used. Contractor shall organize these data by specification number. Prepare O&M Manuals as required by Division 1 and as described herein. Submit O&M Manuals on a searchable CD-ROM. Submit manuals prior to Substantial Completion inspection.

2 PRODUCTS

2.1 All materials shall be new 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:

2.2.1 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 manufacturer 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.

2.2.2 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.

2.2.3 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.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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.

2.2.8 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:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.2.1 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.2.2 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.

2.3.2.3 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.

2.3.3 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:

Principal of operation.
Materials of construction or finishes.
Thickness of gauge of materials.
Weight of item.
Deleted features or items.
Added features or items.
Changes in other work caused by the substitution.
Acuators when applicable.

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.

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:

3.2.1 The Contractor shall be responsible for full coordination of the BAS and related systems with shop drawings of the related systems so that provisions for piping, ductwork, or other equipment are made.

3.2.2 Any additional steel supports required for the installation of any BAS equipment shall be furnished and installed under the section of the specifications requiring the additional supports.

3.2.3 It shall be the Contractor's responsibility to see that all equipment such as valves, dampers, sensors 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.

3.2.4 All connections to 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.

3.2.5 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.

3.2.6 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.

3.2.7 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 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.

3.5 Cutting and Patching: Contractor shall provide 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 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under this section. 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.

3.7 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.

3.8 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, safety, and operating control shall be included in start-up check.

3.9 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.

3.10 Record (As Built) Drawings:

3.10.1 During the progress of the work the Contractor shall record on their field set of drawings the exact location, as installed, of all controls, equipment, and other systems which are not installed exactly as shown on the contract drawings.

3.11 Acceptance:

3.11.1 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.11.2 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.

3.11.3 Operation and Maintenance Manuals: Furnish searchable PDF manuals with Table of Contents, organized, and tabbed by specification section.

Detailed operating instructions and instructions for making minor adjustments.
Complete wiring and control diagrams.
Routine maintenance operations.
Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.
Copies of approved submittals.
Copies of all manufacturer's warranties.
Copies of test reports and verification submittals.

3.11.4 Record Drawings: Submit record drawings.

3.11.5 Acceptance will be made on the basis of tests and inspections of job. Contractor shall furnish necessary mechanics to operate system, make any necessary adjustments and assist with final inspection.

PROJECT NAME
PROJECT NUMBER

This is a sample cover sheet. Use one for each shop drawing.

SAMPLE

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

Use whatever standard headings you want here

SUBCONTRACTOR: ABC Controls Contractor

SUPPLIER: Jones Supply Co.

MANUFACTURER: Various

DATE: 2/15/95

SECTION: 25 09 60/Building Automation System

1. Controllers

List each item separately

2. Temperature Sensors

Typical - list mfr name & model number

3. Control Valves

4. Control Dampers

M&A will list all comments on this sheet and will only stamp approvals on this sheet

5. Control Diagrams

Leave space after each individual item for M&A comments

General Contractor's APPROVAL stamp must be on this sheet.

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SECTION 25 00 10 - BUILDING AUTOMATION SYSTEM AND CONTROLS CODES AND STANDARDS

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 Building Automation System and Controls Requirements section. Provisions of this section apply to work of all Division 25 sections.

2 CODES

2.1 All work under Division 25 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 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.

2.3 Where code conflict exists, generally the most restrictive requirement applies. Comply with current code edition, unless noted.

2.4 Additional codes or standards applying to a specific part of the work may be included in that section.

2.5 The following codes govern the work:

2.5.1 The following codes govern the work:

2.5.2 Florida Building Code - Building - Seventh Edition (2020).

2.5.3 Florida Building Code - Mechanical - Seventh Edition (2020).

2.5.4 Florida Building Code - Energy Conservation - Seventh Edition (2020).

2.5.5 National Electric Code (NFPA 70) - 2017.

2.5.6 Installation of Air Conditioning and Ventilation Systems (NFPA 90A) - 2015.

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 Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)

3.4 Bacnet: Comply with latest version of ASHRAE 135.

END OF SECTION

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SECTION 25 05 00 - BUILDING AUTOMATION SYSTEM AND CONTROLS RELATED WORK

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 Building Automation System and Controls Requirements section. Provisions of this section apply to work of all Division 25 sections.

1.3 Coordinate all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 23- HVAC

2.1 Division 23 Contractor shall install all control dampers and control valves.

2.2 Division 23 Contractor shall install all wells and flow meters in piping.

2.3 Provide the following support for Testing, Adjusting and Balancing(Section 23 05 93) as work of this section, complying with the requirements of this section. Contractor shall provide all services as required to assist Testing, Adjusting and Balancing Contractor during TAB work.

3 DIVISION 26 - ELECTRICAL

3.1 Contractor shall coordinate the exact electrical requirements of all BAS 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 BAS equipment basis of design. If BAS equipment is submitted with different electrical requirements, it is the responsibility of the 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 BAS submittal with a written statement that this design will be provided at no additional cost. BAS 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.

3.2 Contractor shall provide all HVAC control wiring including the BAS sensors, alarms, and input/output signals and all relays, interlocks, warning lights, and control devices, complying with the requirements of Division 26.

3.3 Electrical Contractor shall provide circuit breakers, disconnect switches, and contactors for BAS equipment under Division 26 unless specifically noted as being furnished as part of mechanical equipment.

3.4 Electrical Contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all BAS equipment, switches, transformers, contactors, controllers, and similar equipment.

END OF SECTION

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SECTION 25 05 53 - BUILDING AUTOMATION SYSTEM AND CONTROLS IDENTIFICATION

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-25 Basic BAS and Controls Materials and Methods section, and is part of each Division-25 section making reference to or requiring identification devices specified herein.

1.3 Extent of BAS and Controls identification work required by this section is indicated on drawings and/or specified in other Division-25 sections. BAS device names shall be consistent on drawings, graphics and all other documents.

1.4 Refer to Division-26 sections for identification requirements of electrical work; 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.

2 PRODUCTS

2.1 General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-25 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 Engraved Plastic-Laminate Signs:

2.2.1 General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

2.2.2 Thickness: 1/16" for units up to 20 sq. in. or 8" length; ⅛" for larger units.

2.2.3 Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.3 Stamped Nameplates: Provide equipment manufacturer's standard stamped nameplates for all equipment.

3 EXECUTION

3.1 Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including work 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 Stamped Nameplates: Equipment manufacturers to provide standard stamped nameplates on all major equipment. 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.

3.3 Adjusting and Cleaning:

3.3.1 Adjusting: Relocate any identification device which has become visually blocked by work of this division or other divisions.

END OF SECTION

SECTION 25 09 61 - BUILDING AUTOMATION SYSTEM

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-25 Basic Building Automation requirements sections apply to work of this section.

1.3 Extent of Building Automation System work required by this section is indicated on drawings and by requirements of this section. Control sequences are located on the Contract Drawings. .

1.4 Provide the following electrical work as work of this section, complying with requirements of Division-26 sections: Control wiring between field-installed controls, equipment, indicating devices, and DDC panels.

1.5 Definitions and Abbreviations:

1.5.1 A/E - Architect/Engineer
1.5.2 AI - Analog Input
1.5.3 AO - Analog Output
1.5.4 Analog - A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values
1.5.5 Auto-Tune - Software routine used to adjust tuning parameters based on historical or real-time data
1.5.6 ASC - Application Specific Controller typically used in terminal unit devices (i.e. VAV, FCU, Reheat Coils, etc...)
1.5.7 BAS - Building Automation System, also referred to as Energy Management Control System (EMCS). A generic term typically used to describe all DDC controllers, instruments, PCs, Newtworks combined to automate an entire building.
1.5.8 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.
1.5.9 Control Sequence - An BAS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
1.5.10 DDC - Direct Digital Control
1.5.11 Binary - 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. Binary Inputs and Binary Outputs are discrete.
1.5.12 BI - Binary Input
1.5.13 BO - Binary Output
1.5.14 EEPROM - Electronically Erasable Programmable Read Only Memory
1.5.15 FO - Fail Open
1.5.16 FC - Fail Closed
1.5.17 FTL - Fail To Last Position
1.5.18 GUI - Graphical User Interface
1.5.19 IP - Internet Protocol
1.5.20 HOA - Hand Off Auto
1.5.21 IT - Information Technology
1.5.22 LOT - Local Operator Terminal
1.5.23 Modulating - Movement of a control device through an entire range of values proportional to an infinitely variable input value.
1.5.24 NC - Normally Closed
1.5.25 NO - Normally Open
1.5.26 Node - DDC panel, user workstation, or other control device connected to communication's network.
1.5.27 O&M - Operation and Maintenance
1.5.28 Operator - Same as actuator

1.5.29 OWS - Operator's Work Station (desktop PC with intranet / Internet capability)

1.5.30 PC - IBM-compatible Personal Computer from a recognized major manufacturer. PC "clones" assembled by a third-party subcontractor are not acceptable

1.5.31 PDA - personal digital assistant

1.5.32 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.

1.5.33 P - proportional control - Control mode with continuous linear relationship between observed input signal and final controlled output element.

1.5.34 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).

1.5.35 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).

1.5.36 Point - Analog or discrete instrument with addressable database value.

1.5.37 Protocol - The term "protocol" and its derivatives when used in this Section shall mean a defined set of rules and standards governing the on-line exchange of data between control systems of the same or different manufacturers.

1.5.38 Router - Device for implementation of Network Layer Protocol (BACnet/IP)

1.5.39 Solenoid - Electric two position actuator.

1.5.40 Software - The term "software" and its derivatives when used in this Section shall mean 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.

1.5.41 Tier 1 - LAN and/or WAN communication network. Building to building communication or high speed Ethernet communication network running within a specific building.

1.5.42 Tier 2 - Building level communication or low speed tier running under a building level supervisory controller.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data for each BAS panel and control device furnished, indicating dimensions, capacities, performance characteristics, electrical characteristics, finishes of materials and any other characteristic required by this Section. Include installation instructions and start-up instructions. Provide technical specification data for each component and software module organized with major tabs to separate major sections and a master index indicating all elements of submittal. Product cut sheets shall indicate specific model numbers, options and accessories proposed for project.

1.6.2 Shop Drawings: Submit shop drawings for the BAS containing the following information:

1.6.2.1 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.

1.6.2.2 Identification of immersion wells, pressure taps, 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.

1.6.2.3 Setting or adjustable range of control for each control device.

1.6.2.4 All required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed. The point-to-point wiring diagram shall show all interconnections.

1.6.2.5 Details of faces of BAS panels, including controls instruments and labeling.

1.6.2.6 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.

1.6.2.7 BAS network architecture diagrams including all Tier 1 nodes, Tier 2 interconnections, 3rd party integration, and power distribution.

1.6.2.8 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.

1.6.2.9 Samples of graphic display screen types and associated menu penetrations to show hierarchy and functional interrelationships.

1.6.2.10 Detailed bill of material list for each system, identifying quantity, complete part number, description, and accessories.

1.6.2.11 Control Damper Schedule including a separate line for each damper and a column for each of the following damper attributes: code number, fail position, damper material, blade type, duct size, damper size and actuator type.

1.6.2.12 Control Valve Schedule including a separate line for each valve and a column for each of the following valve attributes: code number, valve type (ball, globe, butterfly, solenoid), fail position, pipe size, valve size, close off pressure, pressure rating, CV, design pressure drop, actual pressure drop at design flow, and actuator type.

1.6.2.13 Room Schedule including a separate line for each terminal unit indicating terminal identification, minimum/maximum cfm, thermostat/sensor location, heating/cooling setpoints and deadbands. The schedule shall include typical calibration factors to be filled in by Test, Adjust and Balance Contractor during startup and verification.

1.7 Test Reports and Verification Submittals:

1.7.1 Submit system verification letter from manufacturer's representative stating that all HVAC controls have been checked, calibrated, started up and verified for proper operation. State that the Owner training has been completed and provide a roster of attendees.

1.7.2 Submit the folliwong prior to on-site commissioning and functional performance testing.

1.7.2.1 Control logic/programming and point naming convention.

1.7.2.2 Screen shots of graphics

1.7.2.3 Initial settings/setpoints as configured.

1.8 O&M Data Submittals:

1.8.1 Maintenance Data: Submit inspection requirements, periodic preventive maintenance recommendations, fault diagnosis, instructions for repair or replacement of defective components, calibration instructions and spare parts lists for each type of control device. Include a copy of all approved submittals in O&M Manual. Include a hard copy of all programs specific to this project.

1.8.2 Software Data: Upon successful completion of acceptance testing, submit a minimum of two archive copies of all accepted versions of source code and compiled code for all application programs and data file on CD or DVD media. Software program files shall include all necessary sub-files needed to restore the system to its initial constructed state. Include a hard copy version of all programs in O&M manual

1.8.3 Electronic Data: Install all product operational and maintenance data in electronic PDF format on

vendor specific server. Provide means to access this data using intuitive operator interaction (quick links from main system graphics). Install and link all as-built control diagrams and as-built sequence of operations to specific system web page. The intent of this requirement is to give the 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.)

1.8.4 Service: Include in the O&M the name, address, and telephone number of the organization that will provide training and warranty period service for the system.

2 PRODUCTS

2.1 Acceptable Manufacturers: Subject to compliance with requirements, provide BAS control systems of one of the following:

Siemens Building Technologies

2.2 General: Provide BAS control products in sizes and capacities indicated as required for a complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer. Provide a BAS with the following indicated functional and performance features.

2.3 Quality Assurance:

2.3.1 Provide equipment of manufacturers regularly engaged in the manufacturing of BAS equipment, of types required, and whose products have been in satisfactory use in similar service for not less than three years.

2.4 Systems Description:

2.4.1 The control system shall be a complete system designed for use on the Owner’s LAN. This functionality shall extend into the equipment rooms where required by the project specific network architecture. Primary nodes (BLCs) located in equipment rooms and similar spaces shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure located in the facility. Contractor shall be responsible for coordination with the Owner’s IT staff to ensure that the BAS will perform in the Owner’s environment without disruption to any of the other activities taking place on that LAN.

2.4.2 This Contractor shall provide all required system software to support the existing server/client architecture, designed around the open standards of ASHRAE Standard 135 and specifically to the sections dealing with internet/Protocols. The BAS Building Level Controller (BLC) shall be configured with all software/hardware required to interface at the campus intranet level (Tier 1) using this BACnet/IP protocol. The BACnet data communication protocol shall also be used within the building environment (Tier 2). The BLC shall be accessible from the existing manufacturer’s specific server system.

2.4.3 The BAS shall consist of a communication network, modular designed DDC controllers with all points addressable and modifiable from existing server from the BLC using a laptop PC. The BAS shall be fully expandable with the addition of hardware and/or software. Expansion shall not require removal of existing BAS panels, sensors, actuators, or communication networks.

2.4.4 Servers shall be used for the purpose of providing a location for archiving system configuration data, historical trend data, historical alarm data, PDF documents, and operator transactions.

2.4.5 The BAS as provided shall incorporate, at a minimum, the following integrated features, functions and services: 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; enterprise-level information and control functions; information management including monitoring, transmission, archiving, retrieval, and reporting functions; diagnostic

monitoring and reporting of BAS functions; offsite monitoring and management; energy management.

2.5 System Performance Standards: The system shall conform to the following.

2.5.1 Text Display: The new system points shall display a text page with a maximum of 20 dynamic points with all current data within 10 seconds.

2.5.2 Object Command: The time between the command override of a binary object by the operator and the reaction by the device shall be less than 2 seconds and the subsequent update at the terminal shall be no more than 20 seconds (refresh rate).

2.5.3 Object Scan: All changes of state and change of analog values shall be transmitted over the existing campus Intranet such that any data used or displayed at a controller or workstation will have been current within the previous 60 seconds.

2.5.4 Alarm Response Time: The time from which an object goes into alarm to when it is annunciated at the designated client/user shall not exceed 15 seconds.

2.5.5 Program Execution Frequency: Custom and standard applications shall be capable of running as often as once per second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

2.5.6 Performance: Programmable controllers shall be able to execute PI or PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same rate.

2.5.7 Multiple Alarm Annunciation: All thin client PCs currently connected through the server shall receive alarms within 5 seconds of each other.

2.5.8 Reporting Accuracy: The system shall report all values with an end-to-end accuracy equal to or better than those listed below.

Space temperature	± 0.25 °F
Duct air temperature (single probe)	± 0.25 Deg F
Duct air temperature (averaging)	± 0.5 °F
Water temperature	± 0.1 °F
Water temperature difference (ΔT)	± 0.01 °F
Relative humidity (duct and space)	± 2%
Water flow	± 5% (GPM) of full scale
Air flow (terminal unit)	± 5% (CFM) of full scale
Air flow (measuring station)	± 5% (CFM) of full scale
Air pressure (ducts)	± 0.05 in w.g.
Electrical (A, V, W, PF)	± 5% of reading (not including utility supplied meters)
Carbon dioxide (CO_2)	±5% of full scale

2.5.9 Stability of Control: Control loops shall maintain measured variable at setpoint within the tolerances listed below.

Air pressure (ducts)	± 0.1 in w.g. (range of -6 to +6 in w.g.)
Air flow	± 100 CFM or 1% of setpoint (whichever is less)
Temperature	± 0.5 Deg F
Carbon dioxide (CO_2)	± 50 ppm (range of 100 to 2000 ppm)

2.6 BAS Architecture

2.6.1 The BAS shall be designed for use on intranets and the Internet. All networking technology used at the Tier 1 level shall be off the shelf, industry standard technology fully compatible with other Owner-provided network equipment in the facility.

2.6.2 All aspects of the user interface, whether to servers or to Tier 1 solid state devices, shall be via the existing web based browser software. Any PCs used as operator interface points shall not require the purchase of any special software from the manufacturer in order to provide the complete user interface as described herein.

2.6.3 The primary components of the system shall be the Building Level Controller (BLC) and existing servers located at the highest level of the network architecture. Both will use the same user interface and provide the same level of accessibility via the network. The BAS network shall at minimum be comprised of the following:

2.6.3.1 Network processing, data storage and communication equipment

2.6.3.2 Intelligent and addressable elements and end devices

2.6.3.3 Third-party equipment interfaces

2.6.4 The BAS network shall utilize an open architecture capable of utilizing standard Ethernet communications operating at a minimum speed of 10/100 Mbps and connecting via BACnet/IP at the Tier 1 level. The BAS network shall support both copper and optical fiber communication media at the Tier 1 level.

2.6.5 Third Party Interfaces: The Contractor shall integrate real-time data from systems supplied by other trades as required. The BAS system shall include necessary hardware equipment and software to allow data communications between the BAS and systems supplied by other trades. The trade contractor supplying other systems shall provide their necessary hardware and software and shall cooperate fully with the BAS contractor in a timely manner at their cost to ensure complete data integration. It shall be the responsibility of the Contractor to coordinate all other trades (prior to bid) to insure all aspects of integration have been achieved.

2.7 Operator Interface Software

2.7.1 General: The BAS operator interface shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the BAS by authorized users at any operator terminal.

2.7.2 User access to the BAS shall be protected by the existing Owner re-definable software-based password access protection program. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups. Provide updated priority groups consistent with the existing Owner groups. Provide the means to on-line management password access under the control of a master password.

2.7.3 The operator interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:

2.7.3.1 User access for selective information retrieval and control command execution

2.7.3.2 Monitoring and reporting

2.7.3.3 Alarm, non-normal, and return to normal condition annunciation.

2.7.3.4 Selective operator override and other control actions.

2.7.3.5 Information archiving, manipulation, formatting, display and reporting.

2.7.3.6 On-line access to user HELP menus

2.7.3.7 On-line access to system as-built control diagrams, sequence of operation and product manuals.

2.7.3.8 Means for the controlled re-programming, re-configuration of BAS operation and for the manipulation of BAS database information.

2.7.3.9 Producing reports and displays making use of simple English language descriptions and readily understood acronyms, abbreviations and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the BAS and consistent with existing Owner's naming standards.

2.7.4 Navigation Screens:

2.7.4.1 The system shall have the capability to display multiple navigation trees or graphical screens to aid the operator in navigating all new systems and points connected. At a minimum update any of the existing key maps to incorporate the new work.

2.7.4.2 Update the existing custom trees and graphic screens to accommodate the new work .

2.7.5 Alarms:

2.7.5.1 Alarms shall be routed directly from primary application controllers to designated PCs and servers. Contractor to coordinate with the Owner specific alarm routing requirements and update to meet the project requirements. The alarm message shall, at a minimum, provide the following functions.

2.7.5.2 Log date and time of alarm occurrence.

2.7.5.3 Generate a "pop-up" window, with audible alarm, informing a user that an alarm has been received.

2.7.5.4 Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.

2.7.5.5 Provide an audit trail on server hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.

2.7.5.6 Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop up window described above.

2.7.5.7 Any attribute of any object in the system may be designated to report an alarm.

2.7.5.8 The BAS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.

2.7.6 Reports: Reports shall be generated and directed to one or more of the following: user interface displays, printers or archive at the user's option. The system shall at a minimum provide the following reports:

2.7.6.1 All points in the BAS

2.7.6.2 All points in each BAS application

2.7.6.3 All points in a specific LAN

2.7.6.4 All points in a user-defined group of points

2.7.6.5 All points currently in alarm in any BAS application

2.7.6.6 All BAS schedules

2.7.6.7 All applicable standard reports provided by the BAS manufacturer

2.7.6.8 Custom report generation tools for authorized operators

2.7.7 Dynamic Color Graphics: Provide means to generate an unlimited number of graphic displays.

2.7.7.1 Values of real time attributes displayed on the graphics shall be dynamic and updated on the displays.

2.7.7.2 The graphic displays shall be able to display and provide animation based on real-time BAS data that is acquired, derived or entered.

2.7.7.3 The user shall be able to change values (setpoints) and states in system controlled equipment directly from the graphic display.

2.7.7.4 The BAS shall incorporate AutoCad floor plans provided by the A/E. They shall be sized to allow the operator to read room numbers and descriptions. They shall incorporate the capability to navigate section to section as required and to navigate floor to floor. Color shall be used to indicate normal and alarm conditions within all spaces.

2.7.7.5 Reference the Owner's Graphics standard package for specific graphic template examples and system samples.

2.7.8 Schedules:

2.7.8.1 The system shall provide multiple schedule input forms for automatic time-of-day scheduling and override scheduling of BAS operations. At a minimum, the following spreadsheet types shall be accommodated.

2.7.8.1.1 Weekly schedules

2.7.8.1.2 Temporary override schedules

2.7.8.1.3 Special "Only Active If Today Is A Holiday" schedules

2.7.8.1.4 Monthly schedules

2.7.8.2 Schedules shall be provided for each system or sub-system in the BAS. Each schedule shall include all commandable points residing within the system. Each point may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.

2.7.8.3 Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Selection of holidays and special days shall automatically reschedule equipment operation as previously defined on the weekly schedules.

2.7.9 Historical trending and data collection: The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.

2.7.10 Paging: Coordinate with the Owner and configure the alphanumeric paging for user defined personnel for user-defined BAS events.

2.7.10.1 System shall utilize pager schedules to send pages to the personnel that are "on-call".

2.7.11 E-mail: Provide the means for sending automatic e-mail messages to user selected personnel and user defined groups of personnel.

2.8 Servers

2.8.1 The server is existing.

2.9 Building Level Controllers (BLC) - Basis of Design Siemens PxC

2.9.1 The BLC shall be a general purpose multiple application direct digital controller (DDC) used to manage global programs, complex system control, local data storage, building level communications, and remote server interface. Controllers shall have a minimum 32-bit microprocessor. Controllers shall be capable of operating in a stand-alone capacity or within a networked Ethernet environment. Controller hardware, firmware and software shall support true, non-volatile flash memory, input/output, 12 bit A to D conversion, hardware clock/calendar and voltage transient and lightning protection devices. Units shall be equipped with full multi-tasking, multi-user real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers and power supplies.

2.9.2 The BLCs shall perform the function of monitoring all system variables, including but not limited to: real hardware points, software variables, and controller parameters such as setpoints.

2.9.3 The BLC shall manage and direct all information traffic on the Tier networks, between the Tier 1 and Tier 2 networks and to servers. Communication between BLCs on the Tier 1 network shall be peer-to-peer via 10/100 Ethernet using the BACnet/IP protocol.

2.9.4 Each BLC shall be able to extend its performance and capacity through the use of remote Advanced Application Controllers (AAC) and Application Specific Controllers (ASCs). The BLC may also act as an AAC as long as the required functions of the AAC are integrated into the BLC. See AAC requirements below.

2.9.5 Each BLC shall have a RS-232C serial data communication port or Ethernet RJ45 connection for operation of local operator I/O devices independent of the LAN used for primary access, such as industry standard printers, modems, OWSs and laptop PCs. The BLC shall allow temporary use of portable devices without interrupting the normal operation of permanently connected printers, modems, or laptop PCs.

2.9.6 Each BLC shall have sufficient memory to support its own operating system and databases including: control processes; energy management applications; alarm management applications including custom alarm messages for each level of alarm for each point in the system; historical/trend data for points specified; maintenance support applications; custom processes; operator I/O; Ethernet/Dial-up communications; manual override monitoring

2.9.7 Each BLC shall contain both software and firmware to perform global control strategies.

2.9.8 The BLC shall be capable of direct connection to multiple field busses.

2.10 General Purpose Advanced Application Controllers (AAC) Basis of Design Siemens PxC

2.10.1 AAC units shall be a general purpose multiple application direct digital controller (DDC) used to manage complex system control, local data storage, and building level communications. AAC units shall have no less than a 32-bit microprocessors. AACs shall be capable of operating in a stand-alone capacity, or within a Tier 1/Tier 2 environment. AAC hardware, firmware and software shall support true, non-volatile flash memory, input/output, 12 bit A to D conversion, hardware clock/calendar and voltage transient and lightning protection devices. Units shall be equipped with full multi-tasking, multi-user real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Firmware revisions to the module shall be made from the server remotely over the control network. AAC size shall be sufficient to fully meet the requirements of this specification and the required number of project I/O points plus 15% additional capacity. Each AAC shall accommodate multiple I/O expansion via a designated expansion I/O bus port.

2.10.2 Each AAC shall be able to extend its performance and capacity through the use of remote

Application Specific Controllers (ASCs).

2.10.3 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.

2.10.4 Each AAC shall provide an RS-232C serial data communication port for operation of local operator I/O devices independent of the LAN used for primary access, such as industry standard printers, operator terminals, modems and portable laptop PCs Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

2.10.5 The operator shall have the ability to manually override automatic or centrally executed BO commands at the AAC via local terminal connection or controller BO manual HOA switches. BO panel HOA switches are not required when a starter or VFD is used and includes a dedicated HOA switch.

2.10.5.1 The AAC shall monitor the status of all BO overrides or starter/VFD HOA switches and inform the operator that automatic control has been inhibited. The AAC shall also collect override activity information for reports.

2.10.6 The operator shall have the ability to manually override automatic or centrally executed AO commands at the AAC via local terminal connection or controller dials.

2.10.6.1 Dials shall be mounted either within the AACs key-accessed enclosure, to prevent unauthorized overrides.

2.10.6.2 The AAC shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. The AAC shall also collect override activity information for reports.

2.10.7 Each AAC shall have sufficient memory to support its own operating system and databases, Including:

2.10.7.1 Control processes

2.10.7.2 Energy management applications

2.10.7.3 Alarm management applications including custom alarm messages for each level of alarm for each point in the system

2.10.7.4 Historical / trend data for points specified

2.10.7.5 Custom processes

2.10.7.6 Operator I/O

2.10.7.7 Manual override monitoring

2.10.8 All AAC units shall be expandable and shall act as one control unit. In addition to the specified I/O point requirements and capacity requirements the Contractor shall provide two spare BIs, BOs, AIs, and AOs per controller.

2.11 Controller Requirements: Provide the following with all BLCs and AACs.

2.11.1 General:

2.11.1.1 All necessary software to form a complete operating system shall be provided.

2.11.1.2 The software programs specified in this section shall be provided as an integral part of the

controller and shall not be dependent upon any higher level device for execution.

2.11.1.3 Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

2.11.1.4 Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads (user selectable).

2.11.1.5 Power Fail-Motor Restart: Upon the resumption of normal power, the controller panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

2.11.1.6 Data Storage and Archiving: Trend data shall be stored at the stand alone controllers, and upload automatically to server hard disk storage when archival is desired or when local trend storage capacity drops below 20%.

2.11.2 Configuration and Download: The controller shall have the capability of receiving configuration and program loading by means of the following:

2.11.2.1 Locally, via a direct connect portable laptop PC

2.11.2.2 Over the network, from a portable laptop

2.11.2.3 From the server or associated thin client PC, via the communication networks

2.11.3 Configuration and Upload: The controller shall have the ability to upload configuration and programs to be archived on the server.

2.11.4 Each controller shall continuously perform self-diagnostics, including communication diagnosis of all panel components. The AAC shall provide both local and remote annunciation of any detected component failures, low battery condition or repeated failure to establish communication.

2.11.5 The controllers shall have the ability to perform all of the following energy management routines:

2.11.5.1 Time-of-day scheduling

2.11.5.2 Calendar-based scheduling

2.11.5.3 Holiday scheduling

2.11.5.4 Temporary schedule overrides

2.11.5.5 Start-Stop time optimization

2.11.5.6 Automatic Daylight Savings Time switch-over

2.11.5.7 Night setup and setback control

2.11.5.8 Economizer cycle

2.11.6 It shall be possible to 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.

2.11.7 Processes/Calculations/Algorithms: The controllers shall be able to execute custom, job-specific processes; to automatically perform calculations and to perform special control routines.

2.11.7.1 The controllers shall contain both software and firmware to perform the following pre-tested control

algorithms: two-position control; proportional control; proportional plus integral control; proportional, integral, plus derivative control and automatic tuning of control loops with enable disable capabilities.

2.11.7.2 A single process shall be able to incorporate measured or calculated data from any and all other controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other controllers on the network. The database shall support 30 characters and English language point names structured for searching and logs.

2.11.7.3 Processes shall be able to generate custom written operator alarm message (to be developed by the Contractor in cooperation with the Owner) and advisories to operator I/O devices. A process shall be able to directly send a text message to a specified device or cause the execution of an alarm message at any connected thin client PC, or cause the execution of a remote connection to a remote device such as a printer, pager, PDA or cell phone. Any additional software required for remote paging shall be provided as part of the base bid.

2.11.7.4 All BLC/AAC control logic programs shall incorporate comment lines for program clarity.

2.11.8 Alarms: Alarm management shall be provided to monitor and direct alarm information to operator devices. Each controller shall 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. At no time shall the ability of the controller to report alarms be affected by either a remote PC, local I/O device or communications with other panels on the network. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2.11.9 Data Storage and Archiving: A variety of historical data collection utilities shall be provided to manually or automatically sample, store, and display system data for points as specified in the I/O summary.

2.11.9.1 Any point, physical or calculated, shall be configured for trending. Any point, regardless of physical location on the network, shall be collected and stored in each controller point group. Two methods of collection shall be allowed: either by a pre-defined sample rate or upon a pre-defined change of value. All points shall be initially configured with a 5 minutes sample interval. Sample intervals of 1 minute to 7 days shall be possible. Each controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.

2.11.9.2 Controllers shall provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Loop tuning shall be initiated either locally at the controller or over the control network via a Web based command. For all loop tuning functions, access shall be limited to authorized personnel through password protection.

2.11.9.3 Controllers shall be capable of automatically accumulating and storing run time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the sequence of operations.

2.11.10 The building level network shall allow each controller to access any data from or send control commands and alarm reports directly to any other controller or combination of controllers on the network without depending upon a central or intermediate processing device. The building level network shall also allow any controller to access, edit, modify, add, delete, back up and restore all system point database and all programs.

2.11.11 Standalone operation:

2.11.11.1 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.

2.11.11.2 The controller shall automatically call for a new database download from the server upon loss or corruption of a database. An operator with sufficient access privileges may in addition, activate a database download manually from the server.

2.11.12 Loss of Power:

2.11.12.1 In the event of the loss of normal power, there shall be an orderly shutdown of all controllers to prevent the loss of database or operating system software. Nonvolatile flash type memory shall be incorporated for all critical controller configurations and battery backup shall be provided to support the real-time clock and volatile memory for a minimum of 72 hours.

2.11.12.2 Upon restoration of normal power, the BLC shall automatically resume full operation without manual intervention. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes. Provide any necessary time delays during startup.

2.11.13 Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress voltage transients consistent with IEEE Standards 587-1980

2.11.14 Communication Speed (Building Level Network): Local controllers shall communicate at a minimum of 115 Kbps.

2.11.15 BLC shall include a local UPS capable of no less than 5 min of backup power.

2.12 Application Specific Controllers (ASCs) Basis of Design Siemens TEC

2.12.1 Performance and capacity of BLCs and AACs shall be extended through the use of stand-alone remote ASCs.

2.12.2 Controllers shall be capable of field configuration and program uploads and downloads from the server or designated thin client PC.

2.12.3 Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each shall be a microprocessor-based, multi-tasking, real-time digital control processor. Provide the following types of application specific controllers (embedded or as a predefined software application) as a minimum:

2.12.3.1 Variable Air Volume (VAV) boxes

2.12.3.2 Reheat Coils

2.12.3.3 Fan Coil Units

2.12.3.4 Laboratory Controls

2.12.4 Alarm Management: Each ASC shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

2.12.5 ASCs shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 4-20 mA proportional signals, 0-5 Vdc or 0-10 Vdc proportional signals allowing for interface to a variety of modulating actuators.

2.12.6 Air Terminal Controllers:

2.12.6.1 The ASC used for Air Terminal 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 the sequence of operations.

2.12.6.2 Setpoints, flow limits, and occupancy schedules shall be maintained indefinitely in each controller's non-volatile memory. No batteries shall be required.

2.12.6.3 It shall be possible to monitor flow in cfm and to adjust flow limits, temperature setpoints, and schedules, without access to the terminal unit by plugging in a standard laptop computer or vendor specific service tool at the room temperature sensor.

2.12.6.4 Each controller shall control zone temperature by modulating the terminal unit damper and/or the electrically actuated hot water valve using a proportional/integral (PI) algorithm with programmable PI coefficients.

2.12.6.5 Zone temperature shall be controlled to +/- 1°F. Air terminal units with reheat shall include integral heating and cooling set-points and support pre-programmed deadbands.

2.12.6.6 If required by the sequence of operation, the air 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.

2.13 Control Valves

2.13.1 General:

2.13.1.1 Use two port (normally open or closed based on sequence of operation) or three port control valves with equal percentage contoured throttling plugs for all applications, unless otherwise noted.

2.13.1.2 Use two port (normally open or closed based on sequence of operation) or three port ball type valves with equal percentage contoured throttling plugs for terminal reheat control unless otherwise noted.

2.13.1.3 Butterfly valves may be used for water system control valves 2-1/2" and larger provided that valves meet pressure and temperature requirements. High performance butterfly valves shall be used for modulating applications. General-purpose butterfly valves may be used for two-position control.

2.13.2 Ball Valves:

2.13.2.1 Valves shall be bronze or brass body, 150 psi rating. Ball valves larger than 3" are not permitted.

2.13.2.2 Valves shall have stainless steel ball and stem, valve stem seals with dual EPDM O-Rings, rangeability must be greater than 150:1, and shall have equal percentage flow characteristics.

2.13.3 Water Valves: Modulating valve shall be sized based on the scheduled values indicated on the drawings. Design criteria for sizing modulating valves shall be based on two port, fail open or fail closed, as shown on plans, equal percentage valves unless otherwise specified. Control valves shall be full port ball valves (3-way or 2-way) and shall be selected for a minimum of 2 PSID and a maximum of 5PSID calculated at design flow conditions.

2.14 Damper and Valve Actuators: 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. Each actuator shall be full-proportioning or two-position type as required or specified, and shall be provided with spring-return for fail open or fail closed position for fire, freeze, occupant safety, equipment protection, moisture, heating or cooling protection on power interruption as indicated and/or as required.

2.14.1 Analog Electronic: Actuators shall be electric motor with gear drive which respond proportionally to analog voltage or current input. Stroke time for major equipment shall be 90 seconds or less for 90° rotation. Stroke time for terminal equipment shall be compatible with its associated local

controller, but no more than 6 minutes.

2.14.2 Provide spring return feature for fail open or closed positions as required by control sequence and for critical applications such as outside, return, or exhaust dampers, heating and cooling coils on major air handling units.

2.14.3 AHU control valve shall be similar to Siemens SKD62.

2.14.4 Reheat terminal units: Utilize factory assembled ball valve with horizontal mount; non-spring return proportional actuator (0-10 Vdc, 0-5Vdc, or 4-20ma). Electric actuator installed on ball valves shall have a separate and distinct operating handle used to position the valve into any desired position once power is removed or a valve failure occurs. Actuators for terminal heating/cooling equipment do not require spring return feature. Provide standard cable from actuator to controller unit.

2.14.5 Discrete Two-Position Electric: Actuators shall be hydraulic or electric motor with gear drive for two-position control. Stroke time shall be 90 seconds or less for 90° rotation. Provide spring return feature for fail open or closed positions as required by control sequence. Provide adjustable end switches as required by control sequence.

2.15 General Instrumentation:

2.15.1 Analog Electronic Instrument Indicators:

2.15.1.1 Electronic indicators, used for displaying sensor and/or output values as measured by current or voltage, shall be panel mount type and at least 2" square. Output may be analog needle type or digital with 1/2" high LED or backlit LCD displays.

2.15.1.2 Electronic indicators shall be marked in appropriate units (degrees, psi, %RH, gpm, cfm, etc.) and with appropriate range of values. Panel mounted indicators shall have minimum accuracy of 1% of scale range. Digital units shall be scaled to show 3 digits plus 1 decimal point.

2.16 Discrete Electric Instrumentation

2.16.1 General:

2.16.1.1 Electrical devices, switches, and relays shall be UL listed and of type meeting current and voltage characteristics of the project. Terminal connections shall be made at terminal blocks inside NEMA 1 enclosures unless otherwise specified. Outdoor unit enclosures shall be NEMA 4 with concealed adjustment.

2.16.1.2 Ratings of normally open and closed contacts shall be adequate for applied load (minimum 5 amps at 240 volts).

2.16.1.3 Accuracy of devices shall be ± 1% of scale with adjustable offset unless otherwise specified.

2.16.2 Relays:

2.16.2.1 Provide relays equal to Functional Devices RIBUIC, for all start/stop applications.

2.16.3 Pressure Differential Switches:

2.16.3.1 Provide adjustable set point, differential pressure type. Select switches for accuracy, ranges (20 to 80% of operating range) and dead-band to match process conditions, electrical requirements and to implement intended functions.

2.16.3.2 Pressure differential switches for air systems shall have pressure rating of at least 10" W.g.

2.16.3.3 Pressure indicating differential switches for air systems shall be equal to Dwyer Series 3000 photohelic gauge.

2.16.3.4 Pressure differential switches for water systems shall be rated for 150 psig unless otherwise noted. Chilled water pressure differential switches shall be provided with totally sealed vapor tight switch enclosure on 300 psi body. Differential pressure switches shall have three-valve manifold for servicing.

2.16.3.5 Maximum Temperature Rating: 300°F

2.16.3.6 Repeatability: ± 1%

2.16.4 Position Switches (End Switches): Provide damper position switches, door position switches, valve position switches, toggle switches, and wall switches as required to meet specified sequence.

2.16.4.1 Dampers: Integrated actuator end switches are preferred. If required, rotary switches shall consist of an encapsulated mercury switch mounted on a ½" damper crank arm (similar to Kele & Associates TS-470).

2.16.4.2 Door position switches shall be magnetic proximity type.

2.16.5 Current Switches:

2.16.5.1 Provide induction type sensor clamped over a single phase of AC electrical power conductor. Current switches shall be solid-state with adjustable threshold and normally open contacts. Each current switch shall be selected for proper operating range of current.

2.16.5.2 VFD Applications (Similar to Hawkeye Model 904,934)

2.16.5.3 The sensor shall be capable of detecting motor belt or coupling loss when mounted on the load side of variable frequency drives

2.16.5.4 The current sensor shall be factory programmed to detect motor undercurrent situations (belt or coupling loss) on variable or constant volume loads, no calibration required

2.16.5.5 The current sensor shall store the motor current operating parameters in non-volatile memory.

2.16.5.6 The current sensor shall have a push button reset to clear the memory if the operating parameters change or the sensor is moved to a different load.

2.16.5.7 Transition current: 75 mA at 1 A setpoint, 2.5 A at 10 A setpoint

2.16.5.8 Hysteresis: 0.015 A at 1 A setpoint, 0.20 A at 10 A setpoint

2.16.5.9 Response Time: less than 0.5 seconds

2.17 Electrical Digital Energy Monitors: Provide three phase power transducer designed to be installed inside electric panelboards to monitor kW and kWh equal to Siemens Series 1000. Provide the following:

2.17.1 Microprocessor - based wattmeter

2.17.2 Split core instrument grade current transformers, factory calibrated, with function indicator

2.17.3 Voltage leads with required fuses

2.18 Energy Metering:

2.18.1 General: The sensor /transducer shall be appropriately selected to most closely match the expected sensing range. If, upon startup and balancing, a sensor/transducer is operating below 20% or above 80% of its sensing range, the sensor/transducer shall be replaced at no additional

cost with an appropriate range such that the measured value (operating at normal conditions) is between 30% and 70% of the range.

2.18.2 Btu Energy Meter:

2.18.2.1 The entire energy metering system shall be built and calibrated by a single manufacturer, ONICON Incorporated, and shall consist of a flow meter, two temperature sensors, a Btu meter, temperature thermowells, and all required mechanical installation hardware. A certificate of NIST* traceable calibration shall be provided with each system. All equipment shall be covered by the manufacturer's two year warranty.

2.18.2.2 Btu Meter: Provide an ONICON System-10 Btu Meter. The Btu meter shall provide the following points both at the integral LCD and as outputs to the building control system: Energy Total [k ton hr/ klbs], Energy Rate tons, lb/hr, Flow Rate (GPM), Supply Temperature (DEGF) and Return Temperature (DEGF). Output signals shall be serial network (protocol conforming to BACnet® MS/TP, BACnet/IP, LONWORKS®, JCI-N2, MODBUS RTU, MODBUS TCP, or Siemens-P1). Each Btu meter shall be factory programmed for its specific application, and shall be re-programmable using the front panel keypad (no special interface device or computer required).

2.18.2.3 Temperature sensors: Temperature sensors shall be loop-powered current based (mA) sensors and shall be bath-calibrated and matched (NIST* traceable) for the specific temperature range for each application. The calculated differential temperature used the energy calculation shall be accurate to within ±0.15° (including the error from individual temperature sensors, sensor matching, input offsets, and calculations).

2.18.2.4 Flow Meter: Refer to flow meter sections for specific flow meter type. The flow meter shall be installed either in the supply or return pipe of the system to be measured following the manufacturer's instructions with particular attention to upstream and downstream straight pipe runs.

2.18.3 Chilled Water and Heating Hot Water Flow Meter

2.18.3.1 Provide an ONICON F-3100 Series Inline Electromagnetic Flow Meter complete with integral or remote Series 3900 Converter. The converter shall include a backlit graphic display and keypad. The flow meter shall be installed either in the supply or return pipe of the system to be measured following the manufacturer's instructions.

2.18.3.2 The flow meter size shall be selected based on the minimum and maximum flow range for the application.

2.18.3.3 Connections to the piping shall be ANSI class 150 flanges (*ANSI Class 300 where required)*.

2.18.3.4 The installing contractor is responsible for providing suitable mating flanges and any required reducer/expander.

2.18.3.5 The flow tube shall be epoxy coated steel; the sensing electrodes shall be 316SS; the liner shall be polypropylene for low temperature service, PFTE for hot water service.

2.18.3.6 Each flow meter shall be individually wet-calibrated and accurate to within ±0.2% of reading from 3 to 33 feet per second velocity. A certificate of calibration shall be provided with each flow meter.

2.18.3.7 Output signals shall be 4-20 mA and programmable pulse.

2.18.3.8 The flow meter shall be capable of measuring bi-directional flow.

2.18.3.9 For installations in non-metallic pipe, an internal grounding electrode shall be provided which eliminates the need for external grounding rings.

2.18.3.10 Each flow meter shall be factory programmed for its specific application, and shall be

reprogrammable using the integral keypad on the converter (no special interface device or computer required).

2.18.3.11 Flow Display: Provide a D-1200 Series Display Module for local or remote indication of flow rate and/or total.

2.18.4 Chilled Water and Heating Hot Water Flow Meter

2.18.4.1 Provide an ONICON Model F-3500 Insertion Electromagnetic Flow Meter, complete with all installation hardware necessary to enable insertion and removal of the meter without system shutdown.

2.18.4.2 The flow meter shall be hand-insertable up to 400 psi.

2.18.4.3 Materials of construction for wetted metal components shall be 316 SS.

2.18.4.4 The flow meter shall average velocity readings from two sets of diametrically opposed electrodes.

2.18.4.5 Each flow meter shall be individually wet-calibrated against a primary volumetric standard that is accurate to within 0.1% and traceable to National Institute of Standards and Technology (NIST). A certificate of calibration shall be provided with each flow meter.

2.18.4.6 Accuracy shall be within ±1% of rate from 2-20 ft/s.

2.18.4.7 Output signals shall be completely isolated and shall consist of the following:

2.18.4.7.1 High resolution frequency output for use with peripheral devices such as an ONICON display module or Btu meter.

2.18.4.7.2 Analog output; 4-20mA, 0-10V, or 0-5V jumper selectable.

2.18.4.7.3 Provide scalable dry contact output for totalization.

2.18.4.8 Flow Display: Provide a local or remote indication of flow rate and/or total.

2.19 Space Temperature Sensors:

2.19.1 Sensors shall be platinum or nickel RTD type, with the following minimum performance:

2.19.1.1 Temperature Coefficient of Resistivity (TCR): .00385 ohm/ohm/°C

2.19.1.2 Accuracy: ± 0.1% at 32°F (Class B)

2.19.1.3 Conformance: DIN-IEC 751

2.19.1.4 Operating Range: -50 to 500°F 0 to 99% RH

2.19.2 Thermistors are acceptable in lieu of platinum or nickel RTD provided thermistor carries a five 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.

2.19.3 Unless otherwise stated, space sensor covers shall be factory standard cover

2.20 Room Thermostats:

2.20.1 Setpoint 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. A ¾" conduit shall be run from sensor box to above the ceiling

where it shall stub out into an accessible area parallel with the ceiling.

2.20.2 Room temperature sensors shall incorporate a thermistor/RTD element and a portable operator terminal plug-in port under the cover.

2.20.3 Temporary override push-button/timers shall be incorporated into all thermostats. Set initial temporary override timer to 1 hour.

2.20.4 Provide warmer/cooler setpoint adjustment. Minimum and maximum adjustable range shall be set through the BAS.

2.20.5 Unless otherwise stated, room thermostat covers shall be factory standard cover

2.21 Duct Mounted Probe or Insertion Temperature Sensors:

2.21.1 Provide nickel or platinum RTD type, with the following minimum performance:

2.21.1.1 Temperature Coefficient: .00385 ohm/ohm/°C

2.21.1.2 Accuracy: +/- 0.1% at 32°F (Class B)

2.21.1.3 Conformance: DIN-IEC 751

2.21.1.4 Operating Range: -50 to 170°F, 0 to 99% RH

2.21.2 Install sensors in stainless steel probes or wells. Outside air sensors shall be weatherproof of noncorrosive construction and protected with solar shield.

2.21.3 Thermistors or nickel RTD are acceptable in lieu of platinum RTD provided thermistor carries a five 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.

2.22 Duct Mounted Averaging Temperature Sensors:

2.22.1 Averaging Elements in Ducts: Provide 36 inches long, flexible, 72 inches long flexible, 180 inches long flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.

2.22.2 Provide nickel or platinum RTD type, with the following minimum performance:

2.22.2.1 Temperature Coefficient: .00385 ohm/ohm/°C

2.22.2.2 Accuracy: ± 1.0% at 32°F (Class B)

2.22.2.3 Conformance: DIN-IEC 751

2.22.2.4 Operating Range: -50 to 170°F, 0 to 99% RH

2.22.3 Sensors shall be serpentined in duct to maximize coverage of measured area.

2.23 Space CO2, Humidity, Temperature Sensior:

2.23.1 Manufacturers: Vaisala Model GMW93RD.

2.23.2 Space multi-input sensors shall be wall mount type to match room thermostats.

2.23.2.1 Accuracy: CO2 ± (30ppm + 2% reading)
Temp ± (0.9°F)
Humidity ± (2.5% RH 0-60% RH)

2.23.2.2 Local display: Yes

2.23.2.3 Output: 0-10Vdc

2.23.2.4 Power: 18-35 VDC.

2.24 Duct Mounted Humidity Sensors/Transmitters:

2.24.1 Manufacturers: Vaisala.

2.24.2 Provide probe type, temperature compensated, resistive bulk polymer or thin film capacitive type. Sensor/transmitter shall have the following minimum performance:

2.24.2.1 Accuracy: ± 2% RH at 25°C over 20-95% RH including hysteresis, linearity and repeatability.

2.24.2.2 Temperature Effect: Less than 0.06% per °F.

2.24.2.3 Sensitivity: 0.1% RH.

2.24.2.4 Repeatability: 0.5% RH.

2.24.2.5 Hysteresis: Less than 1%.

2.24.2.6 Long Term Stability: Less than 1% drift per year.

2.24.2.7 Adjustment: ± 20% RH zero, non-interactive., ± 10% RH span, non-interactive.

2.24.2.8 Operating Range: 0-99% RH, non-condensing, sensor.
0-95% RH, non-condensing, electronics.

2.24.2.9 Output: 4-20 mA, 0-10Vdc, 0-100% linear, proportional

2.24.2.10 Power: 12-36 VDC.

2.25 Vortex Shedding Air Flow Sensors/Transmitters:

2.25.1 Manufacturers: Ebtron.

2.25.2 Velocity measured by each sensor shall be linearized, summed, averaged, and converted to 4-20 mA output signal proportional to air flow rate (cfm) by transmitter electronics. Measured value converted to airflow (cfm) shall have accuracy within 2% rate ± 0.1% full scale throughout velocity range and temperature and humidity change of 40 to 130°F, and 10-95% RH (non-condensing). Transmitter shall be provided as part of air flow sensor, and shall include integral diagnostics with on-line zeroing and sensor operation verification.

2.25.3 Manufacturer shall provide all cabling required to connect probe assemblies and transmitter electronics. Transmitter and/or systems, which require periodic calibration to maintain accuracy specified are not acceptable.

2.26 Ducted Air System Static Pressure Transmitters

2.26.1 Manufacturers: Modus, Setra, Dwyer, Ashcroft XLDP.

2.26.2 Provide transducers/transmitters to convert velocity pressure differential or static duct pressure relative to sensor location into electronic signal.

2.26.3 Units shall be capable of transmitting linear 4 to 20 mA DC output signal proportional to the differential (total minus static or static minus ambient) pressure input signals with the following

minimum performance and application criteria:

2.26.3.1 Span: Not greater than twice duct static or velocity pressure at maximum flow rate, nor more than 16 times velocity pressure at minimum flow rate.

2.26.3.2 Accuracy: ± 1.0% of span or 1.0% of full scale

2.26.3.3 Dead Band: Less than 0.5% of output

2.26.3.4 Hysteresis: Within 0.5% of span or within 0.5% of full scale

2.26.3.5 Linearity: Within 1.0% of span or within 0.5% of full scale

2.26.3.6 Repeatability: Within 0.5% of output

2.26.3.7 Response: Less than 1 second for full span input

2.26.4 Return and exhaust air system static pressure transducers/transmitters shall be furnished with protective integral air filters on pressure sensing lines from the static pressure sensing stations, and static air probes to prevent migration of moisture or particulate matter into transducers. Supply air system sensors do not require integral air filters.

2.27 Local Control Panels:

2.27.1 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 panels located above ceilings, NEMA 4 for panels located outside or in mechanical rooms.

2.27.2 Panel mounted controlling instruments, temperature indicators, relays, switches and gauges shall be factory installed and permanently labeled. Devices shall be located inside or mounted on face of panel.

2.28 Control Wiring: All control wiring shall have UL listed plenum rated teflon insulation. All instrumentation I/O conductors (24 volts and under) shall be no smaller than #18 AWG unless specified by instrument manufacturer. All communication cabling between control devices shall be minimum #24 AWG twisted pair cable, Category 5E or fiber optics. Provide additional shielding and grounding per applicable manufacturer’s recommendations and/or job site conditions.

2.29 Outdoor Locations: Provide weather protection cover or weatherproof control devices where required for control devices located outdoors. All control devices located outdoors shall be rated for the anticipated environment. The Contractor shall anticipate significant temperature increases within outdoor control panels and make provisions for supplemental ventilation when control devices must be located within these outdoor control panels.

3 EXECUTION

3.1 General:

3.1.1 Install control equipment and wiring in neat and workmanlike manner, and in accordance with manufacturer's recommendations. Maintain clearances, straight length distances, etc. required for proper operation of each device.

3.1.2 Coordinate timely delivery of materials and supervise activities of other trade contractors to install 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.

3.2 Examine areas and conditions under which BAS is to be installed. Do not proceed with work until

unsatisfactory conditions have been corrected in manner acceptable to installer.

3.3 Installation of BAS:

3.3.1 General: Install systems and materials in accordance with manufacturer's instructions, shop drawings, and details on drawings. Install electrical components and use electrical products complying with requirements of applicable Division-26 sections of these specifications. Mount panels at convenient locations and heights. All work shall be installed and operationally checked by factory-trained competent technicians skilled in the testing and adjustment of the specific manufacturer's devices and equipment.

3.3.2 Local Control Panels: Unless otherwise indicated, mount controllers, adjusting switches, temperature indicators and other indicating or manually operated devices inside panel with black phenolic engraved nameplates identifying device and controlled device or function. Other factory standard labeling methods are acceptable as long as the device name and function is clearly identified and is permanent. Labels shall correspond to control drawing tags and identifiers.

3.3.3 Control Wiring: All electrical wiring required for a fully functional control system, including power circuit, (line and low voltage) for field devices shall be provided in accordance with requirements of applicable Division-26 sections of these specifications with the following modifications.

3.3.3.1 All wiring used within control system shall contain a color-coded overall jacket (plenum rated).

3.3.3.2 All control wiring shall be labeled with unique tag to match I/O device identifier tag (e.g. sensor TE-1 wire shall be labeled at panel and device as “TE-1”). Communication cable shall be labeled with Loop/Trunk #, previous and destination device (e.g. L1VAV101/VAV102 would be used to label the communication bus between VAV101 and VAV102).

3.3.3.3 The sizing type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the Contractor subject to compliance with requirements.. If complications arise due to the incorrect selection of cable, cable trays, raceways and/or conduit, the Contractor shall be responsible for all costs incurred to replace the selected components.

3.3.3.4 Final connection points at devices and panels shall be made at terminal blocks either integral to device or separate terminal blocks mounted inside control panel enclosures.

3.3.3.5 Isolation shall be provided at all peer-to-peer network termination’s, as well as all field point termination’s to suppress voltage transients consistent with IEEE Standards 587-1980.

3.3.3.6 All low voltage control wiring, except wiring located above accessible ceilings, shall be installed in conduit. Low voltage control wiring above accessible ceilings may be installed without conduit, provided it is run at right angles to the building structure and is run within a j-hook pathway system spaced no more than 4 ft apart.

3.3.3.7 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.

3.3.3.8 BAS Network Communication Cable: Run communication cable in separate raceways or in j-hooks with proper clearances. Install special cable connectors in accordance with manufacturer's recommendations. BAS network communication cable shall not be spliced.

3.3.3.9 Raceway identification: All the covers to junction and pull boxes of the BAS raceway system shall be painted white.

3.3.4 Identification: Label all sensors, valves, dampers, safety devices and controllers matching the

shop drawings. Comply with “Mechanical Identification” section. Tags shall be engraved or be a permanent label with the same description in the software. For example “211-TMP” for the temperature sensor in Room 211. AHU devices shall be labeled as follows: DA=T, MA-T, RA-T. Terminal unit thermostats shall be labeled (Terminal Unit Identifier). Terminal unit labeling shall include terminal unit identifier and thermosat location.. Provide CAD-generated framed diagrams with plexiglass covers as follows:

3.3.4.1 Mechanical Rooms: Laminate and mount all system control diagrams (including sequence of operations) under 11x17 plexi-glass frame within associated mechanical space. Mount (within control panel or in separate enclosure) control panel wiring diagrams (also laminated) indicating all field points connected. The control panel wiring diagrams shall utilize the same field device tag names used within the associated control diagram.

3.3.5 Local Control Panels: 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. Mount panel on wall with suitable brackets or on floor with self-supporting stand. Mount top of panel no higher than 6 feet above floor. Install panels so front cover door can swing full open without interference and maintain a minimum of 36" clearance.

3.3.6 Actuators:

3.3.6.1 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.

3.3.6.2 Valve and damper operating speeds shall be selected or adjusted so operators will remain in step with controller without hunting regardless of load variations. Operators acting in sequence with other operators shall have adjustment of control sequence as required by operating characteristics of system.

3.3.7 Wall Mounted Space Sensors: Install space thermostats/sensors where indicated, as required to perform specified controls and meet job site conditions. Mounting height shall be 84" above finished floor in public corridors, stairways, toilet rooms and classrooms. Mounting height shall be 48" above finished floor for all other spaces. Any room thermostat/sensor mounted on exterior walls shall be mounted on thermally insulated sub-base. Relocate room thermostats/sensors as required to minimize draft, interferences with cabinets, chalkboards, etc., or improper sensing. Coordinate with any furniture layouts available prior to rough-in of thermostats/sensors. Room thermostats/sensors in gymnasium, locker rooms and other areas where protection is required shall be protected by heavy-duty cast and die formed guard.

3.3.8 Duct Temperature Sensors: Sensors shall be mounted in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. The sensor shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. For areas greater than 3 sq.ft. or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor. The sensor shall be mounted to suitable supports using factory approved element holders.

3.3.9 Air Flow Stations: Air flow stations shall be installed in strict accordance with manufacturer's published requirements. Where these stations serve as primary signals for airflow control loops the Contractor shall verify location and installation to assure that accurate primary signals are obtained.

3.3.10 Differential Air Pressure Switches: Where differential air pressure switches are used to sense fan operation and the fan static pressure operates at more than 1" in. w.g., the low side may be left open to the environment instead of connected to the fan suction.

3.3.11 Static Pressure Sensors: Duct static pressure transducer shall be installed in control panel. Duct

static pressure signal lines shall be copper and routed from sensing location to control panel.

3.3.12 Building or Room Static Pressure Control System: Extend 2" electric metallic tubing (EMT) or PVC pipe between spaces for room pressure control, or between space and outside for building static pressure control.

3.3.13 Water Flow Meters and Flow Switches: Install flow measuring devices with recommended straight pipe diameters upstream and downstream of elbows, tees, valves, or other fittings, which may cause erratic turbulent flow conditions. As a minimum provide 10 pipe diameters upstream and 5 pipe diameters downstream.

3.3.14 Sensor Wells: Wells mounted in pipe 3" and larger may be installed in horizontal or vertical lines provided element is always in flow (for condensate and other gravity return lines, install in bottom of pipe). Wells mounted in pipe 2-1/2" and smaller shall be installed at a 90° pipe junction consisting of tee fitting (2" minimum size) and appropriate reducing fittings. Install sensor well pointed upstream in tee.

3.3.15 Transmitters and Indicators: Locate transmitters at sensing device or within 100 ft for remote mounted transmitters. For hot systems (150°F and higher) mount electronics on side of pipe or remotely mount. For indicating type instruments, locate indicating element within 6 ft of floor with readout easily visible from floor level. Provide remote readouts if necessary.

3.3.16 All safety devices shall function in both auto and hand modes on motor starters. All safety devices shall function when VFD is in auto, hand or bypass mode. VFD shall be wired 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. Safeties and interlocks shall be wired on motor side of the VFD and Bypass.

3.3.17 Model numbers, horsepowers, voltages, and other equipment information where listed on the drawings are for Contractor's convenience. Verify all information in the field as necessary for preparation of shop drawings.

3.3.18 Digital Energy Monitors: Coordinate programming with Division 26 Contractor for voltage and phase of each panelboard. Division 26 Contractor will install voltage tops and current transformers. This Contractor shall program and tie-in output to BAS.

3.4 Programming of BAS:

3.4.1 The Contractor shall obtain operational schedules for the controlled equipment from the Engineer. Submittal data relevant to operational schedules shall be forwarded from the Contractor to the Engineer. Upon receipt of approval, the Contractor shall proceed with installation, setup, calibration and check out of the various control and monitoring systems. Having completed component and system installation, the Contractor shall submit a written request to the Engineer to inspect and approve their satisfactory operation.

3.4.2 The BAS shall perform all functions on the equipment as describes in Sequence of Operations. This, in conjunction with the control drawings, defines the scope and extent of the project with regard to the required number of panels, control point relays, and devices. Field verify voltages at point-of-interface and provide relays as required.

3.4.3 Graphic Displays:

3.4.3.1 Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. Provide a color graphic display for each floor in the facility. Indicate each HVAC zone, color coded to indicate zone values and status. User shall be able to access the various system schematics and floor plans via a graphical penetration scheme and/or menu selection starting with a site plan, building riser, or floor plan. User shall be able to penetrate from floor plan to associated HVAC system or room terminal unit.

3.4.3.2 Create color graphic floor plan displays and system schematics for each piece of mechanical equipment, including, but not limited to, air handling units, chilled water systems, hot water systems, and room level terminal units.

3.4.3.3 The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, point alarm association, or text-based commands. Graphics software shall permit the importing of Autocad or scanned pictures for use in the system.

3.4.3.4 Dynamic temperature values, humidity values, flow values and status indication shall be shown in their actual respective locations within the system schematics or graphic floor plan displays, and shall automatically update to represent current conditions without operator intervention and without pre-defined screen refresh rates.

3.4.3.5 Display real-time point values by animated motion or custom picture control visual representation wherever possible. Animation shall depict movement of mechanical equipment, or air or fluid flow. Picture Control shall depict various positions in relation to assigned point values or ranges. Animation shall reflect, ON or OFF conditions, and shall also be optionally configurable for up to five rates of animation speed.

3.4.3.6 Sizable analog bars shall be available for monitor and control of analog values; high and low alarm limit settings shall be displayed on the analog scale. The user shall be able to "click and drag" the pointer to change the setpoint. Setpoints and controlled variables shall be positioned on graphic adjacent to each other.

3.4.3.7 Establish linked blocks of miscellaneous program point data by defined point groups; alarm conditions shall be displayed by flashing point blocks.

3.4.3.8 Equipment state or values shall be changed by clicking on the associated point block or graphic symbol and selecting the new state (on/off) or setpoint.

3.4.3.9 Colors shall be used to indicate status and change as the status of the equipment changes. The state colors shall be user definable

3.4.3.10 Advanced linking within the Graphics application shall provide the ability to navigate to outside documents (e.g., .doc, .pdf, .xls, etc.), Internet web addresses, e-mail, external programs, and other workstation applications, directly from the Graphics application window with a mouse-click on a customizable link symbol.

3.4.3.11 The Windows environment of the PC operator workstation shall allow the user to simultaneously view several applications at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

3.4.4 Point List: Provide all points required to implement control sequences specified, whether or not they are shown on control diagrams or individually referenced in control sequence. All outputs, whether sequenced or not, shall have separate programmable hardware outputs.

3.4.5 Alarming:

3.4.5.1 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. Alarms shall occur only while systems are active and being supplied with chilled/hot water or steam at normal operating temperatures and pressures. 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.

3.4.5.2 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.

3.4.5.3 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.

3.4.5.4 In addition to the point's descriptor and the time and date, the Contractor shall create, print, display or 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.

3.5 Functional Requirements of BAS:

3.5.1 Provide all necessary relays, sensors, wiring and contacts to achieve proper operation.

3.6 Adjusting and Cleaning:

3.6.1 Startup: Startup, test, and adjust the BAS in presence of manufacturer's authorized representative. Demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.6.2 Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.6.3 Final Adjustment: After completion of installation, adjust the program, relays, interface devices, and similar equipment provided as work of this section for optimum operation.

3.7 VFD System Adjustment: The drive/controller supplier shall set all adjustments and setpoints for initial operation. The hydronic system and all pumps and control valves shall be monitored for proper operation. The ductwork and all fans and terminal units shall be monitored for proper operation. It shall be recognized that final settings will be obtained by trial-and-error by necessity. Call backs to achieve proper settings shall be included in the base bid.

3.8 Owner's Instructions:

3.8.1 During system startup and at such time as acceptable performance of the BAS equipment and software has been established, the Contractor shall provide on-site operator instruction. This instruction shall be performed during normal working hours and shall be conducted by a competent representative of the Contractor familiar with the system's software, hardware and accessories. The Contractor shall maintain a roster of all attendees at all training sessions.

3.8.2 At a time mutually agreed upon during system training as stated above, the Contractor shall give 8 hours (as needed) of instruction to the Owner's designated personnel on the operation of all equipment within the BAS and describe its intended use with respect to the programmed functions specified.

3.8.3 Operator orientation of the BAS shall include, but not be limited to, the overall operational program, equipment functions both individually and as part of the total integrated system, commands, advisories, and appropriate operator intervention required in responding to the BAS operation.

3.8.4 Submit a training plan including scheduled dates and times for Owner and Engineer approval at least 4 weeks in advance.

3.8.5 Training shall be readily available to each personnel responsible for the maintenance of the facility after warranty has expired. Maintenance personnel will coordinate the factory training needs and

schedule directly with the control system manufacturer without intervention or authorization from the local representative, regional office, or distributors of such product.

3.9 System Verification: The manufacturer's authorized representative shall state in writing to the Engineer that the BAS system is operating properly, final adjustments and calibrations are complete, and on-site Owner training has been accomplished.

3.10 Guarantee:

3.10.1 All components and parts shall be guaranteed against defects in material for a period of two years after acceptance. Expressed warranties are conditionally based on the requirement that the items covered within the guarantee are used and maintained in accordance with the manufacturer's recommendations. Guarantee commences at time of acceptance. Acceptance shall not occur until the Owner's operators are able to use the BAS and receive reliable information from inputs and outputs.

3.10.2 Contractor shall maintain an adequate material and parts inventory within its local office site during the warranty period. Any common materials (not including flow meters, differential pressure devices, gas monitors, specialty valves, etc.) shall be delivered to site and installed within 48 hours of receipt of written notice from Owner during the warranty period. Contractor shall respond to any emergency service calls during the warranty period within two hours. All operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies shall be provided at no additional cost during the warranty period.

3.10.3 The first year guarantee shall, as part of the base bid for the BAS, include full service and maintenance of the BAS. This service and maintenance shall include all necessary repair, reprogramming, calibration, cleaning, minimum (4) quarterly inspections, call back service, etc. This first year service, maintenance and guarantee shall be included in the base bid of the BAS.

3.11 Spare Parts: Contractor shall provide to the Owner the following spare parts:

3.11.1 One (1) each of each type of ASC controller.

3.11.2 One (1) each of each reheat control valve.

END OF SECTION

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SECTION 26 00 00 - ELECTRICAL GENERAL

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:

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

1.2.2 This is a Basic Electrical Requirements Section. Provisions of this section apply to work of all Division 26 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
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1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale electrical drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed

within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and 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 correlate this work with that of others.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Approval Submittals:

1.9.1 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 and the following.

1.9.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.9.1.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.9.1.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.9.1.4 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.

1.9.1.5 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 cover sheet.

1.9.1.6 Submittals that include a series of fixtures or devices (such as lighting fixtures) shall be organized by the fixture number 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.

1.9.1.7 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 electrical contractor to coordinate with the mechanical contractor and resolve all required electrical design changes (wire and conduit size, breaker size, type of disconnect or overload protection, point(s) of connection, etc.) and clearly show the new electrical design on the electrical submittal(s) with a written statement that this change will be provided at no additional cost. Electrical submittals made with no written reference to the actual mechanical equipment being supplied will be presumed to work with the electrical design. Any corrections required will be at no additional cost.

1.9.1.8 Submittals shall be in searchable PDF format and not a scanned copy.

1.9.1.9 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.9.2 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.

1.9.3 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.

1.9.4 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 ¼" 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. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 All materials and equipment shall be UL Certified, UL Listed, UL Labeled, UL Recognized, or UL Classified. The UL label shall be attached to the equipment or product.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.2.1 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.2.2 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.

2.3.2.3 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.

2.3.3 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:

2.3.3.1 Principal of operation.

2.3.3.2 Materials of construction or finishes.

2.3.3.3 Thickness of gauge of materials.

2.3.3.4 Weight of item.

2.3.3.5 Deleted features or items.

2.3.3.6 Added features or items.

2.3.3.7 Changes in other work caused by the substitution.

2.3.3.8 Performance curves.

2.3.4 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 The Contractor shall be responsible for full coordination of the electrical systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any supports required for the installation of any electrical equipment, fixtures or conduit shall be provided by the Contractor. Where there is no architectural/structural elements available, the Contractor shall construct support structures as required. For example, an exterior panelboard may require embedded concrete support posts and galvanized unistruts.

3.2.3 It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Work Required for Equipment Furnished by Other Divisions:

3.3.1 Provide raceway boxes, fittings, devices and conductors for the electrical power to equipment furnished and installed in the other Divisions.

3.3.2 Make connections for the electrical power to equipment furnished and installed in other Divisions.

3.3.3 Verify voltage, phase, and current requirements for all equipment being supplied by other divisions. Any modifications shall be incorporated into the electrical submittals with references to any modification and reason. The electrical system is designed around the specified equipment. Any change in the equipment shall be coordinated so that the proper electrical installation is obtained. In addition, if the supplied equipment has higher minimum circuit ampacity that the equipment specified, the contractor shall call the modification to the Engineer's attention and make necessary conduit, wire, circuit breaker and equipment changes to accommodate the higher ampacity requirements.

3.3.4 Any change from the specified equipment requirements shall be the responsibility of the contractor.

3.3.5 The electrical contractor shall meet with the Divisions 21-25 contractors and fully coordinate locations of mechanical equipment, duct work and piping to ensure that proper working clearance as required in the NEC is obtained. Any conflict shall be reported to the Engineer in writing prior to the installation of any of the equipment. Refer to additional requirements for planning drawings.

3.3.6 Coordinate exact locations and electrical rough-in requirements with other Divisions prior to installation to ensure proper clearances and code requirements are met.

3.4 Related Work:

3.4.1 All Division 01 Sections apply to all Division 26 Sections.

3.4.1.1 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

3.4.2 Perform the following as part of Division 26 work, complying with the requirements of Division 03, Concrete.

3.4.2.1 Curbs, foundations and pads for electrical equipment.

3.4.2.2 Encasement of electrical work.

3.4.2.3 Underground structural concrete to accommodate electrical work.

3.4.2.4 Rough grouting in and around electrical work.

3.4.2.5 Patching concrete cut to accommodate electrical work.

3.4.3 Refer to Division 04, Masonry for:

3.4.3.1 Patching openings to accommodate electrical work.

3.4.4 Refer to Division 05, Metals for:

3.4.4.1 Supports for electrical work.

3.4.4.2 Framing openings for electrical equipment.

3.4.5 Refer to Division 06, Wood for:

3.4.5.1 Supports for electrical work.

3.4.5.2 Framing openings for electrical equipment.

3.4.6 Division 07 - Thermal and Moisture Protection for:

3.4.6.1 Installation of all supports for electrical work.

3.4.6.2 Caulking and waterproofing of all wall and roof mounted electrical work.

3.4.6.3 Perform the following as part of Division 26 work, complying with Division 7 requirements.

3.4.6.3.1 Fire barrier penetration seals.

3.4.6.3.2 Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

3.4.7 Refer to Division 08, Doors & Windows for:

3.4.7.1 Installation of all access doors for electrical work.

3.4.8 Refer to Division 09, Finishes for:

3.4.8.1 Painting exposed conduit and equipment.

3.4.8.2 Painting structural metal and concrete for electrical work.

3.4.8.3 Painting access panels.

3.4.8.4 Colors shall be selected by the Architect for all painting of exposed electrical work unless specified herein.

3.4.8.5 Perform the following as part of Division 26 work.

3.4.8.5.1 Touch up painting of factory finishes.

3.4.9 Division 21 - Fire Protection

3.4.9.1 Contractor 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 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.

3.4.9.2 Contractor shall provide disconnect switches, starters, and contactors for fire protection equipment under Division 26 unless specifically noted as being furnished as part of fire protection equipment.

3.4.9.3 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.

3.4.10 Division 22 - Plumbing

3.4.10.1 Contractor 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 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.

3.4.10.2 Contractor shall provide disconnect switches, starters, and contactors for plumbing equipment under Division 26 unless specifically noted as being furnished as part of plumbing equipment.

3.4.10.3 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.

3.4.11 Division 23 - Mechanical

3.4.11.1 Contractor 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 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.

3.4.11.2 Contractor shall provide disconnect switches, starters, and contactors for mechanical equipment under Division 26 unless specifically noted as being furnished as part of mechanical equipment.

3.4.11.3 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.

3.4.12 Division 25 - BAS and Controls

3.4.12.1 Contractor shall coordinate the exact electrical requirements of all BAS and Controls 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 BAS and Controls equipment basis of design. If BAS and Controls equipment is submitted with different electrical requirements, it is the responsibility of the 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 submittal with a written statement that this design will be provided at no additional cost. BAS and Controls 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.

3.4.12.2 Contractor shall provide disconnect switches, starters, and contactors for BAS and Controls equipment under Division 26 unless specifically noted as being furnished as part of BAS and Controls equipment.

3.4.12.3 Contractor shall provide all power wiring, raceway and devices, and make final electrical connections to all BAS and Controls equipment, switches, starters, contactors, controllers, and similar equipment.

3.4.13 Division 27 - Communications

3.4.13.1 Wiring raceways and cabling as indicated on the communications drawings shall be furnished and installed by the Communications Contractor, complying with the requirements of Division 26 specifications.

3.4.14 Division 28 - Electronic Safety and Security

3.4.14.1 Wiring raceways and cabling as indicated on the electronic safety & security drawings shall be furnished and installed by the Electronic Safety & Security Contractor, complying with the requirements of Division 26 specifications.

3.4.15 Division 33 - Sitework

3.4.15.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 26 05 50.

3.4.15.2 The following is part of Division 26 work.

3.4.15.2.1 Underground electrical utilities.

3.5 Construction Electrical Utilities: Provide all temporary wiring for power and light required for construction purposes and remove such temporary wiring when use is no longer required.

3.6 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.7 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.

3.8 Phasing: Provide all required temporary conduit, wiring, 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.

3.9 Cutting and Patching: Contractor shall provide 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.

3.10 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.11 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 by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean,

prime, and paint, as required.

3.12 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 and leave premises free from debris and in a safe condition.

3.13 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.

3.14 Record (As Built) Drawings:

3.14.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings. Contractor shall review the record (asbuilt) drawings with the Engineer and the field conditions at every regular job-site meeting. Pay requests will not be processed if record drawings are not accurate and current.

3.14.2 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.15 Acceptance:

3.15.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.15.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.15.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.15.3.1 Submit training syllabi prior to training for owner review.

3.15.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.15.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.15.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and organized and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.15.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.15.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.15.4.1.2 Complete wiring and control diagrams.

3.15.4.1.3 Routine maintenance operations.

3.15.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.15.4.1.5 Copies of final approved version of Approval Submittals.

3.15.4.1.6 Copies of all manufacturer's warranties.

3.15.4.1.7 Copies of Test Reports and Verification Submittals.

3.15.4.2 All included information shall comply with the following:

3.15.4.2.1 Remove all non-related information from O&Ms.

3.15.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.15.5 Basic Electrical Tests: In addition to specific tests required in other sections:

3.15.5.1 Test together and separately to determine that:

3.15.5.1.1 System is free from short circuits and other faults.

3.15.5.1.2 Motor starter overload devices are sized correctly.

3.15.5.1.3 Motors rotate correctly.

3.15.5.1.4 All equipment operates correctly and as specified.

3.15.6 Record Drawings: Submit "Record Drawings".

3.15.7 Control Diagrams: Laminate and mount on equipment room wall.

3.15.8 Single Line Diagram: Laminate 11"x17" and mount on electrical room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses Engineering

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Electrical

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 2/12/17

SECTION: 26 05 20 / Interior Lighting

Use whatever standard headings you want here

1. Type A
2. Type B
3. Type C
4. Type D
5. Type E

List each item separately

Typical - list mfr name & model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 26 00 10 - ELECTRICAL CODES AND STANDARDS

1 GENERAL

1.1 All work under Division 26 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 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.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

2 CODES

2.1 Florida Building Code - Building - Seventh Edition (2020).

2.2 Florida Building Code - Test Protocols for High Velocity Hurricane Zones - Seventh Edition (2020).

2.3 National Electrical Code (NFPA 70) - 2017

2.4 National Fire Alarm Code (NFPA 72) - 2016

2.5 Florida Fire Prevention Code - Seventh Edition (2020).

2.5.1 Fire Code (NFPA 1) - 2018 Florida Edition

2.5.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

2.6 National Electrical Safety Code (NESC)

3 STANDARDS

3.1 All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

3.1.1 American National Standard Institutes (ANSI)

3.1.2 Illuminating Engineering Society (IES).

3.1.3 Institute of Electrical and Electronics Engineers (IEEE).

3.1.4 National Electrical Manufacturer's Associations (NEMA).

3.1.5 National Fire Protection Association (NFPA).

3.1.6 National Electrical Contractor’s Association (NECA)

3.1.7 Occupational Safety and Health Act (OSHA).

3.1.8 Underwriter's Laboratories, Inc. (UL).

3.1.9 University of Florida Construction Standards.

3.1.10 University of Florida Telecommunications Standards.

3.1.11 University of Florida Access Control Standards.

END OF SECTION

SECTION 26 05 11 - REINFORCED CONCRETE FOUNDATIONS FOR ELECTRICAL EQUIPMENT

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.

2 PRODUCTS

2.1 Concrete:

2.1.1 Concrete shall have a minimum 28-day compressive strength of 3,000 psi when cured and tested per ASTM C 31 and C 39.

2.1.2 Concrete shall be placed within 1-1/2 hours after adding cement.

2.1.3 Slump range shall be 2 to 4 inches and air entrainment between 3 percent and 6 percent by volume.

2.2 Reinforcing Steel:

2.2.1 Shall be deformed bars conforming to ASTM A 615, Grade 60 size #4 (unless shown on drawings).

2.2.2 Reinforcing steel shall be supported with concrete blocks of the same strength as the concrete mix. Use of broken concrete, brick or stone for supporting reinforcing steel shall not be permitted.

2.3 Expansion Joint Filler: Shall conform to ASTM D 994, 1/2-inch thick.

2.4 Nonshrink Grout:

2.4.1 Nonshrink grout shall conform to the Corps of Engineers Specification for Nonshrink Grout, CRD-C586-78.

2.4.2 Grout shall be fluid and shall be nonmetallic. Grout shall be nongas-liberating type, cement base, premixed product, requiring only the addition of water for the required consistency. All components shall be inorganic.

2.5 Forms: Use new plywood for exposed areas, and shiplap or plywood for unexposed areas. Materials shall produce tight forms and an acceptable finish.

2.6 Form Ties:

2.6.1 Form ties shall be constructed so the tie remains embedded in the wall, except for the removable portion at each end.

2.6.2 Form ties shall have conical or spherical type inserts. Inserts shall be fixed to remain in contact with forming material, and shall be constructed so that no metal is within one inch of the concrete surface when forms, inserts, and tie ends are removed.

2.6.3 Wire ties shall not be used.

2.7 Anchor Bolts:

2.7.1 Unless otherwise indicated on the Drawings, anchor bolts shall have a minimum yield strength of 75,000 psi.

2.7.2 The thread area plus 6 inches of the bolts shall be hot-dip galvanized. In no case shall less than the top 18 inches of the bolt be galvanized. The remainder of the bolt shall not be galvanized, painted, or coated with oil.

3 EXECUTION

3.1 Exterior On-grade Pads:

3.1.1 Remove all mud, organic silt, organic clay, peat or unprepared fill if they exist below pad and replace with clean fill.

3.2 Forms:

3.2.1 Forms shall be constructed accurately with tight joints to prevent the escape of mortar and to avoid the formation of fins.

3.2.2 Brace forms to prevent distortion during concrete placement.

3.3 Placing Reinforcing Steel:

3.3.1 Reinforcing steel shall be placed in accordance with CRSI, Recommended Practice for Placing Reinforcing Bars.

3.3.2 Minimum length of splices shall be 18 inches. Splices shall be tied with 18-gauge annealed wire.

3.4 Placing Concrete:

3.4.1 Prior to placing concrete, remove water from excavation and all debris and foreign material from forms.

3.4.2 Before depositing new concrete on old concrete, clean surface and pour a 1-inch layer of cement sand grout over the surface of the old concrete.

3.4.3 Place concrete in 2 ft. layers without segregation or loss of ingredients and without splashing forms or steel above. Vertical drop to final placement shall not exceed 6 feet.

3.4.4 Do not place concrete when ambient temperature is below 40 degrees F or approaching 40 degrees F and dropping.

3.4.5 Compaction: Concrete shall be vibrated in place until it becomes uniformly plastic. Vibrators shall penetrate the fresh placed concrete and into the previous layer of concrete below.

3.5 Concrete Finishing:

3.5.1 Screed surfaces to true level planes. After absorption of initial water, float with wood float and trowel with steel trowel to a smooth finish.

3.5.2 Do not absorb wet spots with neat cement.

3.5.3 Foundation shall not vary from level more than 1/4 inch in 10 feet.

3.6 Removal of Forms: Forms shall not be removed until the concrete has set sufficiently to carry the dead load and construction load it has to sustain. Forms shall be removed with care to minimize scarring or other surface damage.

3.7 Finishing Formed Concrete Surface:

3.7.1 Cut out honeycombed and defective areas. Cut edges perpendicular to surface at least 1 inch deep, no featheredge shall be allowed. Soak area to be patched for 24 hours. Allow surface to drain free of standing water and patch with nonshrink grout.

3.7.2 When forms are removed, remove fins or projections from surface of exposed areas and rub

surface with wood float to provide a uniform surface texture.

3.8 Concrete Protection and Curing: Protect fresh concrete from direct rays of the sun, drying winds, and wash by rain. When forms are removed and finishing completed, cure formed surfaces with curing compound applied in conformance with manufacturer's directions.

3.9 Concrete Quality Control: Contractor shall furnish certified test reports for the concrete used. Cost of taking, storing, and testing of sample cylinders shall be included in the bid price.

3.10 Concrete Testing:

3.10.1 Three representative cylinders of each batch of concrete shall be taken and tested as follows:

3.10.1.1 1 at 7 days

3.10.1.2 1 at 28 days

3.10.1.3 1 Spare

3.10.2 Test cylinders shall be taken at the site of the pour and shall be prepared and cured in a manner similar to the concrete work being done.

3.10.3 Cylinders shall be tested by an approved testing laboratory to verify the strength of the concrete.

3.11 Anchor Bolts:

3.11.1 Anchor bolts shall be set level, square, plumb, to the correct elevation, and properly spaced. Anchor bolts shall not be reinforcing bar.

3.11.2 After concrete is set, no force shall be applied to anchor bolts in an attempt to move them and correct their separation.

3.11.3 Boltholes on equipment base plates shall not be reamed or redrilled to fit an improper anchor bolt installation.

END OF SECTION

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SECTION 26 05 12 - ALTERATIONS AND ADDITIONS TO EXISTING WORK

1 GENERAL

1.1 The provisions of this Section are in addition to the provisions of Division 1, Building Modifications.

1.2 Building will be occupied by owner during construction.

2 PRODUCTS

2.1 See appropriate sections.

3 EXECUTION

3.1 General:

3.1.1 All necessary additions and alterations to existing work shall be included as required to provide and maintain a complete and proper electrical installation. As necessary, relocate existing electrical work so other trades can pursue their work and maintain building in service, when occupied.

3.1.2 The work shall include, but not be limited to, the following:

3.1.2.1 Relocation of fixtures, pull boxes, electrical ducts, and other similar items, to permit the installation of new equipment.

3.1.2.2 Installation of new conduits, conductors, wiring, and wiring devices, in order to maintain temporary and permanent use of electrical facilities.

3.1.2.3 Disconnection and reconnection of circuits as required for continued operation of services.

3.1.2.4 Provision for the relocation of all mechanical work as required for proper installation of electrical work where not shown or specified in other sections or on other drawings.

3.1.3 Unused, existing, surface mounted work shall be removed and concealed. Outlets shall be blanked up.

3.1.4 Existing work to be maintained shall be reconnected and shall have all outlets, boxes and devices accessible after completion of work by other trades.

3.1.5 Within NEC limitations, existing conduits may be reused after cleaning.

3.1.6 All new work in existing areas shall be exposed on walls in unfinished areas and concealed in finishes in finished areas. Where cutting and patching are required, finishes shall match existing surface finishes. In existing finished areas, all work shall be concealed in new finishes.

3.1.7 Consolidate existing and new building ground systems.

3.1.8 In general, all new work is intended to be concealed in finishes to be added under this project.

3.2 Existing Building Power Outages:

3.2.1 Refer to Section 01016.

3.2.2 Where portions of buildings are altered, and remainder of building continues in operation, temporary wiring shall be provided to maintain all necessary building functions. Provide all equipment, material, labor for a continuous functional system.

3.3 Temporary Wiring for Remodeled Areas:

3.3.1 Progress of the work will require temporary wiring installations to utilize a portion of the remodeled area. Wiring may not be the final, permanent installation, and shall be included as necessary to supply required electrical function.

3.4 Planning for Sequence of the Work:

3.4.1 Electrical feeders, branch wiring, signal wiring, and other similar work as shown and specified shall be scheduled to correspond with the sequence of work necessary to demolish, remove and construct new work.

3.4.2 Close coordination in scheduling is required between the Owner, Contractor, and other trades to assure a smooth work flow with minimum interference and interruption to building power and communication systems.

3.5 Openings in Existing Work:

3.5.1 Provide cutting and patching of existing work as required. Verify exact locations and materials before performing work. Cutting of structural members and bearing walls shall not be done without written approval of the Engineer.

3.6 Verification of Existing Work:

3.6.1 Where shown on the Drawings, work which is "existing" is assumed to be in place and suitable for the necessary alterations and additions required. Contractor shall carefully field check these items and include alterations as may be necessary for proper installation and guarantee.

3.7 Removal and Ownership of Existing Work:

3.7.1 Where indicated on the Drawings, existing electrical work shall be removed. Unless otherwise specified, all equipment and materials shall remain the property of the Owner except as that judged obsolete or unusable by the Engineer or Owner.

3.7.2 Property of Owner shall be delivered to a location where directed by the Owner and all other items shall be promptly removed from the job site.

3.8 Cutting of Concrete Materials:

3.8.1 Holes for materials and supports shall be made with uniform speed rotation drilling equipment which does not provide effects associated with impact type equipment.

3.8.2 The use of impact drills, air drills, and the like is not acceptable for this project.

3.9 Maintenance of Existing Lighting Systems and Electric Outlets:

3.9.1 Where new lighting layouts are not shown on the Drawings, the existing lighting fixtures and wiring controls shall be reused. If necessary, these items shall be temporarily removed, if necessary, and shall be reinstalled. New wiring from existing sources shall be provided where remodeling operations require. These items are not shown on the Drawings and shall be site determined by the Contractor.

3.9.2 Where existing electrical outlets are located in areas of remodeling, these shall be maintained in service. This work is not shown on the Drawings and shall be site determined by the Contractor.

3.10 System Program Modifications:

3.10.1 Where space or room numbers change, appropriate changes shall be made to the fire alarm system, security system, access control system, etc. software database to reflect the new updated room numbers with respect to device locations.

3.11 Existing Panelboards

3.11.1 Update directories with accurate circuit information. Provide computer generated directories.

END OF SECTION

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SECTION 26 05 16 - SERVICE ENTRANCE METHODS AND MATERIALS - UNDERGROUND

1 GENERAL

1.1 Related Documents

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

1.1.2 Division-26 Basic Electrical Materials and Methods Sections apply to work of this Section.

1.1.3 Review all project drawings to be aware of conditions affecting work herein.

2 PRODUCTS

2.1 Materials for this section are specified in the Section "Basic Materials and Methods."

3 EXECUTION

3.1 Installation shall comply with the requirements of the Utilities Company and the applicable paragraphs in Article "3.0 EXECUTION" of the Section "Basic Materials and Methods."

3.2 Comply with NEC (NFPA 70) - Underground Services.

3.3 Comply with the Section "Excavation and Backfill."

3.4 The electrical contractor shall provide the raceways and service conductors from the reinforced concrete transformer pad to the service equipment as indicated on the Drawings.

3.5 The Electrical Contractor shall provide the raceways from the transformer pad to the meter cabinet. Minimum conduit size is 1”. Conduit shall be RGS.

3.6 Raceways shall be schedule 40 PVC or bitumastic coated rigid metal conduit for straight lengths and bitumastic coated rigid metal conduit for any bends of 45 or 90 degrees.

3.7 The 45 or 90-degree bends shall have a minimum radius of 36 inches.

3.8 Rigid metal conduit shall receive two undiluted coats of bitumastic free from holidays and pinholes.

3.9 The Electrical Contractor shall provide 200# test poly cord in each spare raceway.

END OF SECTION

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SECTION 26 05 26 - GROUNDING AND BONDING

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 Quality Assurance

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

1.3.1.1 Comply with UL 467.

1.3.2 Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

1.3.3 Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

1.4 Approval Submittals:

1.4.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

1.5 Test Reports and Verification Submittals:

1.5.1 Perform the following field tests and inspections and prepare test reports:

1.5.1.1 Ground Resistance Test: Provide a written report.

1.6 O&M Data Submittals:

1.6.1 Provide ground system drawings.

2 PRODUCTS

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

2.1.1 Grounding Bus, Connectors, and Rods:

2.1.1.1 Harger Lightning Protection, Inc.

2.1.1.2 Erico Inc.; Electrical Products Group.

2.1.1.3 Thermoweld, Inc.

2.2 Grounding Conductors

2.2.1 For insulated conductors, comply with Division 26 Section "Basic Materials and Methods."

2.2.2 Material: copper.

2.2.3 Equipment Grounding Conductors: Insulated with green-colored insulation.

2.2.4 Grounding Electrode Conductors: Stranded cable.

2.2.5 Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

2.2.6 Bare Copper Conductors: Comply with the following:

2.2.6.1 Solid Conductors: ASTM B 3.

2.2.6.2 Assembly of Stranded Conductors: ASTM B 8.

2.2.6.3 Tinned Conductors: ASTM B 33.

2.2.7 Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators. (Harger HDGBI series)

2.3 Connector Products

2.3.1 Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

2.3.2 Bolted Connectors: Copper or bronze bolted-pressure-type connectors, or compression type. Do not use below grade.

2.3.3 Irreversible Compression Connectors: Equivalent to Burndy HyGround system. For use in above and below ground applications.

2.3.4 Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions. For use in below grade applications.

2.4 Grounding Electrodes:

2.4.1 Ground Rods: Copper clad steel, sectional type, 3/4" x 10'

3 EXECUTION

3.1 Application

3.1.1 In raceways, use insulated equipment grounding conductors.

3.1.2 Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.1.3 Grounding Busbar: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

3.1.3.1 Use insulated spacer support from wall 12 inches above finished floor, unless otherwise indicated.

3.2 Equipment Grounding Conductors

3.2.1 Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

3.2.2 Install equipment grounding conductors in all feeders and circuits.

3.2.3 Signal and Communication Systems: For telephone, alarm, voice and data, and other

communication systems, provide No. 6AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

3.2.3.1 Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4"x4"x12" grounding busbar.

3.2.3.2 Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.2.4 Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

3.2.5 Common Ground Bonding with Lightning Protection System (where provided): Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

3.3 Installation

3.3.1 Ground Rods:

3.3.1.1 At the main electrical service entrance, install rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

3.3.1.2 Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.

3.3.1.3 Interconnect ground rods with grounding electrode conductors. Make connections without exposing steel or damaging copper coating.

3.3.2 Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

3.3.3 Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

3.3.4 Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

3.3.5 Building Foundation: All new building foundations shall be connected to the electrical grounding system.

3.3.6 Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

3.3.7 Gas Piping: Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

3.3.8 Building Steel: The electrical service, transformers and remote buildings shall be tied to building steel.

3.3.9 Where normal and emergency panels serve the same patient care space, bond panels together

with a minimum #10 AWG conductor.

3.4 Connections

3.4.1 General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

3.4.1.1 Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

3.4.1.2 Make connections with clean, bare metal at points of contact.

3.4.1.3 Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.4.2 Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Inspect molds prior to use and discard if deformed.

3.4.3 Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

3.4.4 Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

3.4.5 Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.4.6 Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

3.5 Field Quality Control

3.5.1 Testing: Perform the following field quality-control testing: After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

3.5.1.1 Ground Resistance Test:

3.5.1.1.1 Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

3.5.1.1.2 Equipment Rated 500 kVA and Less: 10 ohms.

3.5.1.1.3 Equipment Rated 500 to 1000 kVA: 5 ohms.

3.5.1.1.4 Equipment Rated More Than 1000 kVA: 3 ohms.

3.5.1.1.5 Substations and Pad-Mounted Switching Equipment: 5 ohms.

3.5.1.1.6 Manhole Grounds: 10 ohms.

3.5.1.1.7 Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

3.5.1.1.8 Ground System Drawings:

3.5.1.1.8.1 Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

END OF SECTION

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SECTION 26 05 30 - BASIC ELECTRICAL MATERIALS AND METHODS

1 GENERAL

1.1 Related Documents

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

1.1.2 This Section is a Division-26 Basic Materials and Methods Section, and is part of each Division-26 Section making reference to or requiring products specified herein.

1.1.3 The requirements of these specifications also apply to Divisions 21, 22, 23, 25, 27 and 28, unless clearly indicated within those Divisions.

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Raceways.

1.2.1.2 Building wire and connectors.

1.2.1.3 Supporting devices for electrical components.

1.2.1.4 Concrete equipment bases.

1.2.1.5 Cutting and patching for electrical construction.

1.2.1.6 Touchup painting.

1.3 Definitions

1.3.1 EMT: Electrical metallic tubing.

1.3.2 FMC: Flexible metal conduit.

1.3.3 RGS: Rigid galvanized steel conduit.

1.3.4 LFMC: Liquidtight flexible metal conduit.

1.3.5 LFNC: Liquidtight flexible non-metallic conduit.

1.3.6 RNC: Rigid nonmetallic conduit.

1.4 Quality Assurance

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

1.4.2 Comply with NFPA 70.

1.4.3 All materials and equipment specified herein shall be UL listed or approved according to the requirements of applicable NEC articles.

1.5 Coordination

1.5.1 Coordinate chases, slots, inserts, sleeves, and openings with general construction work and

arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1.5.2 Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

1.5.3 Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

1.5.4 Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each product provided.

2 PRODUCTS

2.1 Manufacturers: Subject to compliance with requirements, provide products by the following:

2.1.1.1 Raceways and Conduit:

2.1.1.1.1 Allied Tube and Conduit

2.1.1.1.2 Republic Conduit

2.1.1.1.3 Wheatland

2.1.1.1.4 Alflex

2.1.1.1.5 Triangle PWC

2.1.1.1.6 Carlon

2.1.1.1.7 Cantex

2.1.1.1.8 Wiremold

2.1.1.1.9 Western Tube

2.1.1.1.10 Prime Conduit

2.1.1.2 Raceway Fittings and Boxes:

2.1.1.2.1 Appleton

2.1.1.2.2 Cantex

2.1.1.2.3 Carlon

2.1.1.2.4 Crouse Hinds

2.1.1.2.5 O.Z. Gedney

2.1.1.2.6 Raco

2.1.1.2.7 Republic Steel

2.1.1.2.8 Steel City

2.1.1.2.9 Thomas and Betts

2.1.1.2.10 Topaz

2.1.1.2.11 Bridgeport

2.1.1.2.12 Hoffman

2.1.1.2.13 Uni-Strut

2.1.1.2.14 Kindorf

2.1.1.2.15 Wiremold

2.1.1.3 Cable Trays:

2.1.1.3.1 Cablofil

2.1.1.3.2 Cooper B-Line

2.1.1.3.3 Cable Manager, Pro-10

2.1.1.3.4 Flextray

2.1.1.3.5 WBT

2.1.1.4 Exterior In-Ground Boxes (Handholes):

2.1.1.4.1 Quazite

2.1.1.4.2 CDR

2.1.1.4.3 Lindsay Pre-Cast

2.1.1.4.4 Highline

2.1.1.5 Conductors and Cables:

2.1.1.5.1 Alear

2.1.1.5.2 Alpha

2.1.1.5.3 Belden

2.1.1.5.4 General Cable

2.1.1.5.5 Southwire

2.1.1.5.6 Houston Wire

2.1.1.5.7 Superior Essex

2.1.1.5.8 Cerrowire

2.1.1.6 Conductor Connectors and Splices:

2.1.1.6.1 Hubbell

2.1.1.6.2 Ideal

2.1.1.6.3 Ilsco

2.1.1.6.4 NSI

2.1.1.6.5 O.Z. Gedney

2.1.1.6.6 3M

2.1.1.6.7 Tyco

2.1.1.6.8 Polaris

2.2 Raceways

2.2.1 EMT: ANSI C80.3, galvanized steel, protected inside and out. Maximum size of EMT shall be 4". Minimum size shall be ½" unless noted otherwise on the Drawings. EMT shall only be used with cables rated 600 volts or less and in indoor locations not subject to physical abuse.

2.2.2 FMC: galvanized steel protected inside and out. Reduced wall type. 1/2" minimum size, exception: light fixture “whips” which are permitted to be 3/8".

2.2.3 RGS: ANSI C80.1, galvanized steel, protected inside and out. 1/2" minimum size.

2.2.4 LFMC: galvanized steel protected inside and out with sunlight-resistant and mineral-oil-resistant plastic jacket. 1/2" minimum size.

2.2.5 RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings. 3/4" minimum size.

2.2.6 Raceway Fittings

2.2.6.1 Specifically designed for the raceway type with which used.

2.2.6.2 RGS: Shall have threaded fittings, galvanized steel or threadless compression galvanized steel or threadless compression cadmium or zinc plated malleable iron. Fittings shall be rain tight/concrete tight.

2.2.6.3 RNC: Shall have polyvinyl chloride (PVC) fittings suited for the purpose and joined together by a method approved for the purpose. Schedule 80 conduit sections may be joined together with threaded fitting connectors.

2.2.6.4 EMT: Federal Specification W-F-408, except only material of steel or malleable iron is acceptable. Use set screw type couplings and connectors with insulated throats. Provide couplings with four set screws each for conduit sizes over 2”. Use set screws of casehardened steel with hex head and cup point to firmly seat in wall of conduit for positive grounding. Indent type connectors or couplings are prohibited. Die-cast or pressure-cast zinc-alloy fittings or fittings made of “pot metal” are prohibited.

2.2.6.5 FMC: Shall be zinc plated steel or cadmium plated malleable iron screw type with insulated throat and angular wedge fitting between convolutions of conduit. Federal Specification W-F-406 and UL 5.

2.2.6.6 LFMC: Shall be cadmium plated, malleable iron or steel with compression type steel ferrule and neoprene gasket sealing rings, with insulated throat.

2.2.7 Bushings

2.2.7.1 Shall be provided at the end of all conduits prior to pulling cables to protect the insulation of the conductor. Exception: Conduits with insulated throat connectors.

2.2.7.2 Where required by code, properly ground metal raceways, boxes, and cabinets to insure that all metallic surfaces are effectively grounded.

2.2.7.3 Bushings shall be one of the following types:

2.2.7.3.1 Zinc plated steel, threaded or threadless

2.2.7.3.2 Zinc plated steel of threaded or threadless, thermoplastic insulated with temperature rating of 105 degree C

2.2.7.3.3 Cadmium plated malleable iron, threaded or threadless

2.2.7.3.4 Cadmium plated malleable iron, threaded or threadless, thermoplastic insulated, with temperature rating of 105 degree C

2.2.7.3.5 Thermoplastic with temperature rating of 105 degree C

2.2.7.3.6 Zinc plated steel, or cadmium plated malleable iron; threaded or threadless; non-insulated or insulated with grounding connector or grounding lug

2.2.7.3.7 Provide end bells for RNC.

2.3 Metal Wireways

2.3.1 Material and Construction: Shall be sheet metal troughs with hinged or removable covers, rust resistant undercoat and gray finish coat. Sizes shall be as indicated on the Drawings or determined by the Contractor based on NEC requirements according to the number of conductors enclosed. Exterior units shall be weatherproof. Steel shall be minimum 14 gauge.

2.3.2 Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

2.3.3 Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.4 Surface Raceways

2.4.1 Surface Metal Raceways: Aluminum with snap-on covers. Finish with manufacturer's standard coating.

2.4.2 Manufacturers:

2.4.2.1 Walker Systems, Inc.

2.4.2.2 Wiremold Company.

2.4.3 Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 Cable Trays:

2.5.1 Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing or hot-dipping, complying with ASTM B 633, Type 1 .

2.5.2 Basket Cable Trays: Minimum 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 inches by 4 inches. Category 6 compliant.

2.5.2.1 Provide all necessary transitions at 90-degree angles, tees and change of cable tray size so that the cable tray is continuous. The drawings do not reflect these requirements due to the small scale. Transitions shall also be provided at all change of elevations.

2.5.2.2 Supports: Cable tray shall be supported by trapeze style hanging clips on minimum ⅜" threaded rods on both sides of the tray. Center supports are prohibited. Exception: perimeter cable tray in TRs which shall be supported by wall brackets.

2.5.2.3 Coordinate installation with other trades to avoid conflicts prior to installation. Install as required to transition around, above or below other trades work.

2.6 Boxes, Enclosures, and Cabinets

2.6.1 Sheet Metal Outlet and Device Boxes: Galvanized, NEMA OS 1. Boxes shall be 4"x 4" x 1-1/2" deep or larger (4" wide x 4" long x 2-1/8" deep or larger for telecommunications, audio-visual and CATV). Use only in recessed interior applications or non-finished interior applications.

2.6.2 Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Use in exterior applications and interior finished surface mounted applications.

2.6.3 Small Sheet Metal Pull and Junction Boxes: NEMA OS 1. Use only in flush interior applications or non-finished interior applications.

2.6.4 Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover. Use in exterior applications and interior finished surface mounted applications.

2.6.5 Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

2.6.6 Metal Enclosures: Galvanized steel, finished inside and out with manufacturer's standard enamel.

2.6.7 Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6.8 Exterior In-ground Junction Boxes (Handholes): Polymer concrete construction, straight-wall, heavy duty cover (Tier 15 - 15,000 lbs over a 10" square), open bottom construction. Tested ANSI SCTE 77 2010. Equivalent to Quazite “PG” style. Size as indicated on the drawings. Top shall be imprinted with manufacturer, Tier rating and “ELECTRIC” or “TELECOM”.

2.6.9 Tombstone/Pedestal Table Boxes: Aluminum equivalent to Legrand Lab Bench Table Box.

2.7 Conductors

2.7.1 Conductors, No. 10 AWG and Smaller: 98% conductivity solid or stranded copper.

2.7.2 Conductors, Larger Than No. 10 AWG: 98% conductivity stranded copper.

2.7.3 Insulation: Dual rated THHN/THWN-2 unless noted otherwise on the Drawings.

2.7.3.1 Jacket Color: Provide phase colored jackets.

2.7.4 Low voltage Cables: Approved for use by system manufacturer. Provide plenum rated where required.

2.7.5 Wire Connectors and Splices: Connectors for 600-volt conductors Size No. 18 to No. 6 AWG shall be pressure type, spring connectors. Use 600 volt splicer-reducer pressure connectors for copper conductors to 500 KCMIL. Use rectangular, solderless pressure connectors or split bolt-copper alloy connectors for copper conductors to 1000 KCMIL. Connectors used below grade (in handholes, etc) shall be submersible rated.

2.8 Supporting Devices

2.8.1 Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

2.8.2 Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

2.8.3 Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.

2.8.3.1 Channel Thickness: Selected to suit structural loading.

2.8.3.2 Fittings and Accessories: Products of the same manufacturer as channel supports.

2.8.4 Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers. Tie wire used above grade is prohibited. Exposed on rooftops shall use Cooper Dura-Blok.

2.8.5 Conduit Straps: All conduit shall be secured with two hole galvanized straps where the following conditions exist:

2.8.5.1 All exterior locations.

2.8.5.2 All interior locations other than mechanical and electrical rooms where the conduit is below 10’. Conduit concealed in wall finishes and ceilings may use single hole strap if allowed by NEC.

2.8.5.3 All other locations not listed above and approved by the NEC may use single hole galvanized straps.

2.8.5.4 Single hole or double hole straps may not be used on direct grade. All conduits on grade shall be mounted to galvanized strut and properly attached and anchored.

2.8.6 Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

2.8.7 Expansion Anchors: Carbon-steel wedge or sleeve type.

2.8.8 Toggle Bolts: All-steel springhead type.

2.9 Concrete Bases

2.9.1 Concrete Forms and Reinforcement Materials: Shall be provided for all floor mounted electrical equipment including, but not limited to: switchboards, transformers, etc. Concrete bases and structural steel to support this Division's equipment and raceways, and not specifically shown on Structural or Architectural Drawings shall be furnished by the Contractor whose equipment or raceways is to be supported. Provide a raised reinforced 4" concrete base for all floor supported equipment. Equipment installed outdoors on concrete slabs shall be provided with a 4" raised concrete base. Pad shall exceed the equipment’s footprint by 4” on all sides.

2.9.2 Concrete: 3000-psi (20.7-MPa), 28-day compressive strength.

2.10 Touchup Paint

2.10.1 For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

2.10.2 Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.11 Equipment Backboards

2.11.1 Equipment Backboards shall be exterior grade 3/4" plywood. Paint backboard with two coats of fire retardant gray paint on all six sides before mounting. Exposed side of plywood shall be smooth interior grade. A copper ground bus shall be supplied with each backboard. The ground bus shall terminate the #6 AWG ground wire provided from the electrical system. Locate equipment backboards where indicated on the Drawings. Install straight and plumb. Secure to structure using screws, toggle bolts or masonry anchors. DO NOT use plastic or wood plugs in masonry or concrete. Do not install combustible backboards in air handling space, plenums or where prohibited by the local governing authority.

3 EXECUTION

3.1 Electrical Equipment Installation

3.1.1 Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

3.1.2 Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated. Materials and equipment shall be installed in a neat and workmanlike manner according to the standards of the industry. Materials and equipment installed and not meeting the standards of the industry may be rejected and required to be removed and reinstalled by the Contractor at no additional cost to the Owner. Minor location changes from those indicated may be necessary so that work can conform with the building as constructed, to fit work of other trades or to comply with the rules of authorities having jurisdiction. Refer to structural drawings for framed openings for raceways, etc., in floors and roofs. Contractor shall be responsible for locating and providing proper dimensions for all required electrical openings.

3.1.3 Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

3.1.4 Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 Raceway Application

3.2.1 Outdoors

3.2.1.1 Use the following raceways for outdoor installations (it is the intent of this specification to conceal all conduits where possible):

3.2.1.1.1 Exposed: RGS.

3.2.1.1.2 Concealed: RGS.

3.2.1.1.3 Underground: RGS. Feeders and branch circuit raceways installed below grade equal to and greater than 3/4" may be PVC, at the contractor's option (exception: Conduits to patient care areas shall be metallic). If PVC is used underground or below slab, elbows and risers through grade or slab shall be RGS, except as listed below in paragraph titled “Special PVC Requirements”. All exposed raceways penetrating concrete slab shall be rigid metal conduit. Communication raceways shall be run overhead within the building except for connection to floor boxes. Any raceway not meeting this requirement shall be replaced at the contractor's expense. Additional construction time and compensation for the correction of the deficiency will not be allowed. RGS installed underground shall be painted with two coats of alkali and acid resistant paint such as bitumastic or equal. Coating shall not be diluted and shall completely cover conduit. Minimum

burial depth shall be 30".

3.2.1.1.4 Site Lighting: Minimum size conduit for site lighting shall be 1.25".

3.2.1.1.5 Connection to Vibrating Equipment: LFMC.

3.2.1.1.6 Provide sealing fittings, or properly seal the conduit system, to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant temperature rooms, air conditioned spaces, building exterior walls, roofs or similar spaces.

3.2.1.1.7 Boxes and Enclosures: NEMA 250, Type 3R or Type 4.

3.2.2 Indoors

3.2.2.1 Use the following raceways for indoor installations:

3.2.2.1.1 Exposed: RGS. Except: EMT is acceptable in mechanical and electrical rooms above 6' AFF. Conduit may be exposed in equipment rooms, vertical chases, mechanical and electrical rooms, other similar spaces not normally habitable or exposed to public view, and where electrical drawings specifically note "exposed conduit."

3.2.2.1.2 Concealed: EMT.

3.2.2.1.3 Connection to Mechanical (including Controls), Plumbing and Fire Protection equipment in mechanical spaces (such as mechanical equipment rooms, mechanical mezzanines, etc): LFMC; Length of flexible conduit shall not exceed 3' without express written consent from engineer.

3.2.2.1.4 Connection to Mechanical (including Controls), Plumbing and Fire Protection equipment located outside mechanical spaces (such as above ceilings, custodial rooms & other non-mechanical equipment spaces): FMC; exceptions: in damp or wet locations which shall be LFMC. Use LFMC where subject to physical damage (ie: getting stepped on). Length of flexible conduit shall not exceed 3' without express written consent from engineer.

3.2.2.1.5 Connection to other vibrating equipment not meeting two paragraphs above: FMC, except in damp or wet locations which shall be LFMC. Length of flexible conduit shall not exceed 3' without express written consent from engineer.

3.2.2.1.6 Connection to light fixtures requiring a flexible connection: FMC, 6 feet maximum length. Exception: In hospitals, do not use flex on emergency system unless required for installation.

3.2.2.1.7 Damp or Wet Locations: RGS.

3.2.2.1.8 Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

3.2.2.1.9 Do not use PVC coated flex conduit in plenums, including air streams inside air handler units. Use FMC instead. Coordinate with HVAC equipment as required.

3.2.3 Hazardous Locations

3.2.3.1 Use the following raceways for hazardous installations:

3.2.3.1.1 Raceways in hazardous areas shall be rigid metal conduit.

3.2.3.1.2 Install UL approved sealing fittings that prevent passage of explosive vapors, in hazardous areas equipped with explosive proof lighting fixtures, switches, and receptacles as required by the NEC.

3.3 Raceway Installation

3.3.1 General:

3.3.1.1 Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

3.3.1.2 Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

3.3.1.3 Conductors shall not be installed until conduit system is complete. Bending radius of insulated wire or cable shall not be less than the minimum recommended by wire or cable manufacturer. Maximum pulling tension of any wire or cable shall not exceed manufacturer's recommended values. Do not injure insulation while installing wire in conduits.

3.3.1.4 Use temporary raceway caps to prevent foreign matter from entering.

3.3.1.5 Provide an equipment grounding conductor in all line voltage circuits and feeders which shall be separate from the electrical system neutral conductor. See corresponding specification section.

3.3.1.6 Make conduit bends and offsets so inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

3.3.1.7 Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

3.3.1.8 Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

3.3.1.9 Install pull wires in empty raceways. Use No.14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

3.3.1.10 Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 36-inches of flexible conduit. Install separate ground conductor across flexible connections.

3.3.1.11 Line voltage cables <600v: Provide colored insulation or phase tape at all terminations and pull through accessible junction box and cabinet locations.

3.3.1.12 Inverters & UPSs: All wiring on the load-side of inverters or UPSs shall be in dedicated conduit.

3.3.2 Raceways in Concrete Slabs (only with Structural Engineers approval)

3.3.2.1 Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.

3.3.2.2 Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

3.3.2.3 Space raceways laterally to prevent voids in concrete.

3.3.2.4 Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

3.3.2.5 Transition from nonmetallic conduit to rigid steel conduit before rising above floor.

3.3.3 Special PVC Requirements

3.3.3.1 Floor Penetrations: Rigid metallic conduit for all exposed conduits, regardless of size and concealed conduits greater than 1 ½". Schedule 40 PVC for conduits less than 1 ½" concealed in walls. All conduit concealed by floor mounted equipment may be schedule 40 PVC (if less than

1 ½") or rigid metallic conduit (if 1 ½" or greater).

3.3.3.2 Bends: Conduits less than 1 ½": Conduit elbows may be either PVC or RGS. Bends may be factory or field fabricated using manufacturer approved heat boxes. Field fabricated bends using blowtorch are not acceptable.

3.3.3.3 Conduits 1 ½" and larger: Conduit 90 elbows shall be RGS only, PVC shall not be used. For elbows <90°, PVC is acceptable.

3.3.3.4 Jointing: Pipe and fittings shall be cement welded or threaded (only for Schedule 80 conduit) and made watertight. All joints shall be cleaned with solvent or sanded smooth prior to application of cement.

3.3.4 Raceway Methods for Voice, Data and CATV

3.3.4.1 Cable tray: A conduit shall be stubbed up above ceiling from each outlet to the nearest cable tray. Each conduit shall serve one outlet only. Minimum conduit shall be 1". Conduit shall terminate at cable tray. Tray shall be provided with 6" clearance on all sides of tray.

3.3.4.2 Conduit bodies such as 'LB' fittings are not allowed.

3.3.4.3 Outlet device boxes shall be minimum 4" wide x 4" long x 2-1/8" deep.

3.3.4.4 Provide pullboxes for each run of conduit at every 100 feet on center and at each end of conduit runs containing a total of two 90 deg bends or a combination of lesser bends totaling 180 deg (minimum requirements - provide whether specifically indicated on the drawings or not). Conduit runs containing more than two 90 deg bend without a pullbox are not acceptable. Factory conduit elbows and all other bends shall have a minimum radius of six times the internal conduit diameter. Conduit offsets and pullboxes required to suit field conditions and to conform to these requirements shall be provided at no additional cost to the owner. Do not terminate conduits at right angles to each other except as specifically indicated. Do not use junction boxes at changes of direction of raceway. Unless specifically shown on the drawings, pull boxes shall be sized per applicable Table of the current edition of the BICSI TDMM.

3.3.5 Boxes

3.3.5.1 Attach boxes to concrete formwork, or to other surrounding building material. Provide additional junction and pull boxes where injury to insulation or deformation of wire would occur due to excessive pulling resistance.

3.3.5.2 When several feeders or circuits pass through a common pull box, tag each feeder or circuit separately, indicating electrical characteristics and destination. Group each feeder's and circuit's phase conductor(s) with its neutral and ground using tie-wraps.

3.3.5.3 Boxes shall be accurately located. Consult Architectural plans for dimensions.

3.3.5.4 Boxes above ceiling shall not be located directly above a ceiling tile containing a light fixture, sprinkler head, HVAC diffuser or other device.

3.3.5.5 Boxes located overhead shall not have cover facing upward.

3.3.5.6 Provide UL putty pads for outlet boxes in rated walls as required by NFPA 101.

3.3.5.7 Mount boxes in the course nearest to the height specified when installed in finished block, brick or tile walls. Do not violate ADA heights where required.

3.3.5.8 For larger recessed boxes, cabinets, panelboards, etc. in rated walls, provide UL putty pads or UL endothermic mat products.

3.3.5.9 Boxes for use with raceway systems shall be minimum 1 ½ inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets shall be minimum 4 inches square.

3.3.5.10 Pull boxes shall be at least the minimum size required by NFPA 70 and of code-gauge galvanized sheet steel, or compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified herein. Furnish boxes with screw-fastened covers.

3.3.5.11 Extension rings shall not be used, except when required on device boxes in walls and ceilings where standard mud rings, tile rings, masonry rings, etc will not work with the specific device type (for example: some manufacturer's fire alarm system horn/strobe devices require extension rings in masonry walls). Any extension rings found not meeting this requirement shall be removed and replaced with appropriately sized boxes at the contractor's expense. The intent of this requirement is to have the contractor plan the raceway system out ahead of time. A well planned and designed raceway system shall have boxes sized appropriately without the need for extension rings.

3.3.5.12 Recessed Installation: Boxes and covers shall be installed so that the covers are flush with the finished surfaces. Boxes in masonry or tile construction shall have masonry boxes or boxes with square cut tile covers. Do not cut concrete block through its entirety in order to accommodate any type box. "Handy" boxes shall not be used.

3.3.5.13 Boxes that are required to be mounted in the same stud cavity and face opposite directions (rooms) regardless of vertical separation shall have 3.5" thick sound attenuation batt insulation installed from stud to stud and to a minium of 12" above and 12" below the boxes. In no case shall these boxes be closer than 4" measured edge of box to edge of box.

3.4 Wiring Methods for Power, Lighting, and Control Circuits

3.4.1 Feeders: Type THHN/THWN-2 insulated conductors in raceway.

3.4.2 Underground Feeders and Branch Circuits: Type THWN-2 insulated conductors in raceway.

3.4.3 Branch Circuits: Type THHN/THWN-2 insulated conductors in raceway.

3.4.4 Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN-2 insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 Wiring Installation

3.5.1 Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5.2 Twist-on connectors shall only be allowed on 8AWG and smaller wires. Larger than 8AWG shall use insulated Polaris connectors.

3.5.3 Wire Pulling Lubrication: Shall be used when any wire is pulled by mechanical means. Wire and cable shall be carefully handled during installation. Soap flakes or vegetable soaps shall not be used for lubrication.

3.5.4 Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.

3.5.5 Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.5.6 Provide dedicated neutrals for all 120V and 277V circuits. Multiwire branch circuits are prohibited.

3.5.7 Install no more than three single-phase circuits per conduit (exception: nipples < 24" long). Wire size on drawings is based on one circuit per conduit. Contractor shall increase wire size as

required due to de-rating for more than 3 current carrying conductors in raceway.

3.5.8 Install no more than one three-phase circuit per raceway.

3.5.9 Where any wire, cable, or cord exits an electrical box, not through a raceway, a rubber grommet shall be installed at the box hole or knockout.

3.5.10 No splices, connections, or terminations of any kind shall be made outside of a listed box without written permission from the owner. This includes controls wiring.

3.5.11 Line Voltage Wires: The minimum size wire shall be No. 12 AWG. The following indicates the required minimum wire sizes for branch circuits to achieve <3% voltage drop at full load. The contractor shall verify all circuit lengths prior to pulling wire. Wires found to be smaller than those indicated below shall be removed and repulled (including increased conduit size and/or box sizes as required) with the correct wire at the contractor's expense. The distances indicated below are to be measured to the center of the load.

3.5.11.1 For all 120V branch circuits that are longer than 100' and less than 150', the minimum wire size shall be No. 10 AWG.

3.5.11.2 For all 120V branch circuits that are longer than 150' and less than 200', the minimum wire size shall be No. 8 AWG.

3.5.11.3 For all 120V branch circuits that are longer than 200' , the minimum wire size shall be No. 6 AWG.

3.5.11.4 For all 277V branch circuits that are longer than 150', the minimum wire size shall be No. 10 AWG.

3.6 Expansion Joints

3.6.1 Conduits 3" and larger, that are secured to the building structure on opposite sides of a building expansion joint, require expansion and deflection couplings. Install couplings in accordance with the manufacturers' recommendations.

3.6.2 Provide conduits smaller than three inches with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5" vertical drop midway between end. Flexible conduit shall have a green copper ground-bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for three inches and larger conduits are acceptable.

3.6.3 Expansion fittings shall be provided for raceways to compensate for thermal expansion and contraction in conduit runs 200 feet or greater and at building expansion joints. Bonding jumpers shall be provided for electrical continuity of the raceway system at the expansion fittings.

3.7 Electrical Supporting Device Application

3.7.1 Damp Locations and Outdoors: Hot-dip galvanized materials.

3.7.2 Dry Locations: Steel materials.

3.7.3 Support Clamps for PVC Raceways: Click-type clamp system.

3.7.4 Selection of Supports: Comply with manufacturer's written instructions.

3.7.5 Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3.8 Support Installation

3.8.1 Install support devices to securely and permanently fasten and support electrical components.

3.8.2 Support no electrical work from piping, ductwork, etc. Where metal decking is used, provide supports independent of decking so that loads will not be transferred to decking. Drill through decking and secure supports to concrete slab.

3.8.3 Conduit through Slab Supports: Conduit supports for conduits routed from below grade up through concrete slabs shall be solid, metallic type. Metallic conduit shall not be used to support conduits through slab. After concrete slab has been poured and set, supports shall be cut flush with slab.

3.8.4 Vertical conduit inside building shall be supported at each floor level and at 10'0" intervals.

3.8.5 Unless code is more stringent, support conduit within 36" of changes of direction (one side only) and within 36" of each termination or enclosure to which it is connected.

3.8.6 Electrical devices in lay-in and gypsum board ceilings: Coordinate location of electrical outlets with architectural features of the building and with the equipment of other trades. Boxes or devices mounted between bar joists or "T" bars shall be supported from two bars or joists. Devices and associated boxes shall not be supported by the lay-in tiles or gypsum boards.

3.8.7 Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

3.8.8 Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

3.8.9 Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

3.8.10 Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

3.8.11 Install minimum ⅜-inch diameter or larger threaded steel hanger rods, unless otherwise indicated, or larger size if required due to load. (Exception - ¼” is acceptable for supporting individual conduit).

3.8.12 Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

3.8.13 Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

3.8.14 Simultaneously install vertical conductor supports with conductors.

3.8.15 Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

3.8.16 Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

3.8.17 Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

3.8.18 Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

3.8.18.1 Wood: Fasten with wood screws or screw-type nails.

3.8.18.2 Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.

3.8.18.3 New Concrete: Concrete inserts with machine screws and bolts.

3.8.18.4 Existing Concrete: Expansion bolts.

3.8.18.5 Steel: Welded threaded studs or spring-tension clamps on steel.

3.8.18.6 Field Welding: Comply with AWS D1.1.

3.8.18.7 Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.

3.8.18.8 Light Steel: Sheet-metal screws.

3.8.18.9 Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.9 Testing

3.9.1 Cables 600 volts or less and size #1/0 and larger shall be insulation tested using an industry approved “megger” with 1000V internal generating voltage. Readings shall be recorded and submitted to the Engineer for acceptance prior to energizing. If values are less than recommended NETA values notify Engineer. Submit PDF copy of tabulated megger test values for all cables.

END OF SECTION

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SECTION 26 05 50 - EXCAVATION AND BACKFILL

1 GENERAL

1.1 Related Documents

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

1.1.2 Review all project Drawings to be aware of conditions affecting work herein.

2 PRODUCTS

2.1 Sand: Clean, hard, uncoated grains free from organic matter or other deleterious substances. Sand for backfill shall be of a grade equal to mortar sand, with 95% passing a No. 8 sieve, and not more than 8% passing a No. 100 sieve.

2.2 Gravel: Clean, well-graded hard stone or lime rock gravel, free from organic material. Size range to be from No. 4 screen retentions to 1".

2.3 Earth: Must be free of stones, wood, roots or rubbish.

2.4 Underground-line Warning Tape: See specifications Section 26 05 53 / Electrical Identification.

3 EXECUTION

3.1 Ditching and Excavation: Shall be performed by hand wherever the possibility of encountering obstacles or any existing utility lines. The Contractor will be totally responsible to insure that no utility or service interruptions shall be caused and that no existing utilities or obstructions will prohibit installations of service under this Contract at proper grade and location. Where clear and unobstructed areas are to be excavated, appropriate machine excavation methods may be employed. Avoid use of machine excavations within the limits of the building lines except when machine weights and operation will not damage sub-surface structural components or piping.

3.2 Bedding: Excavate to bottom grade of raceway to be installed, and shape bed of undisturbed earth to contour of conduit for a width of at least 5% of the conduit diameter. If earth conditions necessitate excavation below raceway grade, bring the bed up to the proper elevation with clean, dry sand deposited in 6" layers and firmly tamped by mechanical means. If sub-cut exceeds 12" or if bed is of an unstable nature, a 6" minimum layer of rock will be required before sand bedding begins.

3.3 Placing: Conduit shall be carefully handled into place in the excavation. Avoid knocking loose soil from the banks of the trench into the conduit bed. Coated conduit shall have special handling slings to prevent damage to the coating. All holidays in the conduit coating shall be touched in before beginning back filling.

3.4 Backfilling: Deposit earth or sand carefully in 6" layers, maintaining adequate side support. Compact fill in 6" layers, using mechanical means up to the top elevation of the conduit and 12" layers to finish grade.

3.5 Identification: Provide identifying metalized plastic warning tape above conduit. Replace surface to the original condition, i.e., sodding, sprigging, and fine grading.

3.6 Excavation shall be maintained in satisfactory condition during the progress of the work. Sub-surface structures shall be constructed in adequately sized excavations and dewatering equipment shall be installed and properly maintained. Shoring shall be employed in the event of unstable soil conditions, and in all cases to protect materials and personnel from injury.

3.7 Conduits to be installed below the footings or foundations shall be installed prior to the installation

of the footings. All soil shall be compacted to meet the structural requirements for the footings. If it is not possible to install the conduit prior to pouring of the footings, it shall be necessary for the contractor to provide a bridge footing to span the excavation plus 2 feet on either side of the excavation. The footing modifications shall be approved prior to installation by the Structural Engineer.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Identification for raceway.

1.2.1.2 Identification for conductors and cables.

1.2.1.3 Underground-line warning tape.

1.2.1.4 Warning labels and signs.

1.2.1.5 Instruction signs.

1.2.1.6 Equipment identification labels.

1.2.1.7 Miscellaneous identification products.

1.3 Quality Assurance

1.3.1 Comply with ANSI A13.1 and ANSI C2.

1.3.2 Comply with NFPA 70.

1.3.3 Comply with 29 CFR 1910.145.

1.4 Coordination

1.4.1 Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

1.4.2 Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

1.4.3 Coordinate installation of identifying devices with location of access panels and doors.

1.4.4 Install identifying devices before installing acoustical ceilings and similar concealment.

1.5 Approval Submittals:

1.5.1 Product Data: For each electrical identification product indicated.

2 PRODUCTS

2.1 Raceway Identification:

2.1.1 Paint: Semigloss acrylic-enamel.

2.1.2 Marker for circuit identification on box covers: Permanent, waterproof, black paint marker (exception : brown and black painted covers which shall use permanent, waterproof, white paint based marker).

2.2 Conductor and Cable Identification Materials:

2.2.1 Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.

2.2.2 Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound “sleeve” not “flag” type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.2.3 Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking nylon tie fastener.

2.2.4 Write-On Tags: Polyester tag, 0.01 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

2.2.4.1 Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.3 Floor Marking Paint:

2.3.1 Semigloss Alkyd-Enamel Finish: Two finish coat(s) over a primer.

2.3.1.1 Primer: Interior concrete and masonry primer.

2.3.1.2 Finish Coats: Interior semigloss alkyd enamel.

2.4 Underground-line Warning Tape:

2.4.1 Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

2.4.1.1 Not less than 6 inches wide by 5.5 mils thick.

2.4.1.2 Compounded for permanent direct-burial service.

2.4.1.3 Embedded continuous metallic strip or core 3.5 mils thick.

2.4.1.4 Printed legend shall indicate type of underground line.

2.5 Instruction Signs:

2.5.1 Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

2.5.2 Engraved legend with black letters on white face.

2.5.3 Punched or drilled for mechanical fasteners.

2.5.4 Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 Equipment Identification Labels:

2.6.1 Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting.

2.7 Miscellaneous Identification Products:

2.7.1 Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

2.7.2 Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

3 EXECUTION

3.1 Accessible Raceways More Than 600 V:

3.1.1 Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches high, with self-adhesive vinyl labels. Repeat legend at 10-foot maximum intervals.

3.2 Accessible Raceways:

3.2.1 Color Coding:

3.2.1.1 Scope: Identify interior raceway systems with paint on all couplings and box covers (or conduit within 6" of the box) per the following color coding:

3.2.1.1.1 120/208 Volt Systems: Black.

3.2.1.1.2 277/480 Volt Systems: Brown.

3.2.1.1.3 Junction Boxes containing Emergency Circuits: Paint box cover color of voltage and provide a red stripe.

3.2.1.1.4 Junction boxes containing Legally Required circuits: Paint box cover color of voltage and provide orange stripe.

3.2.1.1.5 Junction boxes containing Optional Standby circuits: Paint box cover color of voltage and provide yellow stripe.

3.2.1.1.6 Fire Alarm System: Red.

3.2.1.1.7 Access Control & Security System: Yellow.

3.2.1.1.8 Telecommunication System: Blue.

3.2.1.1.9 Other Systems: Paint a unique color (do not use any of the above colors or green or white).

3.2.2 Source and Load Identification:

3.2.2.1 Box Covers:

3.2.2.1.1 For covers containing branch circuits: Hand write the panelboard/circuit numbers contained in the box (i.e. 2P1-15,17,19).

3.2.2.1.2 For covers containing feeder circuits: Hand write the feeding panel and load panel (i.e. 4D1 to 2P1A).

3.3 Conductors:

3.3.1 Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

3.3.2 Identify conductors within 3" of terminations to wiring devices.

3.3.3 Identify conductors within 3" of terminations to circuit breakers.

3.3.4 Use system of marker tape designations that is uniform and consistent with system used by

manufacturer for factory-installed connections.

3.3.5 Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

3.3.6 For conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

3.3.7 Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.

3.3.8 Tag and pair each neutral with its respective phase conductor (s).

3.3.9 Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data cabling.

3.4 Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

3.5 Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

3.6 Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, power transfer switches, controls with external control power connections.

3.7 Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

3.8 Instruction Signs:

3.8.1 Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

3.8.2 Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 1 inch high letters for emergency instructions at equipment.

3.9 Labeling Instructions:

3.9.1 Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide with minimum 1/4-inch high letters on 1-inch high label. Secure using minimum 2 screws (sticky tape or glue not allowed).

3.9.2 Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

3.9.3 Engraved label color coding:

3.9.3.1 Normal power systems: Black letters on white field.

3.9.3.2 Emergency/Life Safety power systems: white letters on a red field.

3.9.3.3 Legally Required power systems: white letters on orange field.

3.9.3.4 Optional Standby power systems: black letters on yellow field.

3.9.3.5 Grounding system: white letters on green field.

3.9.4 Equipment to Be Labeled:

3.9.4.1 Electrical cabinets and enclosures.

3.9.4.2 Access doors and panels for concealed electrical items.

3.9.4.3 Electrical switchgear, panelboards and switchboards.

3.9.4.4 Transformers.

3.9.4.5 Disconnect switches.

3.9.4.6 Enclosed circuit breakers.

3.9.4.7 Motor controllers.

3.9.4.8 Push-button stations.

3.9.4.9 Power transfer equipment.

3.9.4.10 Contactors.

3.9.4.11 Remote-controlled switches, dimmer modules, and control devices.

3.9.4.12 Fire-alarm control panel and annunciators.

3.9.4.13 Monitoring and control equipment.

3.9.4.14 Uninterruptible power supply equipment.

3.9.5 Devices to be Labeled:

3.9.5.1 General Wiring Devices (switches, receptacles, etc.): Write on the front of each device the corresponding circuit description (i.e.: 2P2-32) so that it is visible with the cover plate off and not visible with the cover plate on. Use fine point permanent felt-tip black marker.

3.9.5.2 Fire Alarm Devices: Label each device with its circuit number and/or address number. Label shall be visible on cover. Use heat transfer tape type labeler.

3.9.5.3 Devices above ceiling: Label the ceiling grid (not ceiling tile) directly below where a device is located. Use heat transfer tape type labeler. Example devices are:

3.9.5.3.1 Lighting relay or controller.

3.9.5.3.2 Light fixture remote driver.

3.9.5.3.3 Fire alarm device.

3.10 Installation:

3.10.1 Verify identity of each item before installing identification products.

3.10.2 Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

3.10.3 Apply identification devices to surfaces that require finish after completing finish work.

3.10.4 Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

3.10.5 Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

3.11 Wire Jacket Colors:

3.11.1 Color-Coding for service, feeder, and branch-circuit conductors:

3.11.2 Colors for 208/120-V Circuits:

3.11.2.1 Phase A: Black.

3.11.2.2 Phase B: Red.

3.11.2.3 Phase C: Blue.

3.11.2.4 Neutral: White.

3.11.2.5 Grounding Conductor: Green.

3.11.3 Colors for 480/277-V Circuits:

3.11.3.1 Phase A: Brown.

3.11.3.2 Phase B: Orange.

3.11.3.3 Phase C: Yellow.

3.11.3.4 Neutral: Gray.

3.11.3.5 Grounding Conductor: Green with stripe.

3.11.4 Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

3.11.5 Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

3.12 Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 18" to 30" above the line and not less than 6" below grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.

3.13 Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

3.14 Single Line Diagram: Provide one “as-built” single line diagram, 11" x 17", laminated, in main electrical room.

END OF SECTION

SECTION 26 22 00 - DRY-TYPE TRANSFORMERS < 600 V

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following types of dry-type transformers rated 600V and less, with capacities up to 1000 kVA:

1.2.1.1 Distribution transformers.

1.3 Quality Assurance

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

1.3.2 Comply with IEEE C 57.12.91.

1.4 Delivery, Storage, and Handling

1.4.1 Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.5 Coordination

1.5.1 Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.5.2 Coordinate installation of wall-mounting and structure-hanging supports.

1.6 Approval Submittals:

1.6.1 Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

1.6.2 Shop Drawings:

1.6.2.1 Wiring and connection diagrams.

1.7 Test Reports and Verification Submittals:

1.7.1 Output Settings Test: Provide a written report.

1.8 O&M Data Submittals:

1.8.1 Submit manufacturer's maintenance data. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

2 PRODUCTS

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

2.1.1 Eaton.

2.1.2 GE.

2.1.3 Square D.

2.1.4 Siemens.

2.2 Materials

2.2.1 Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

2.2.2 Cores: Grain-oriented, non-aging silicon steel.

2.2.3 Coils: Continuous windings without splices, except for taps.

2.2.3.1 Internal Coil Connections: Brazed or pressure type.

2.2.3.2 Coil Material: Copper.

2.3 Distribution Transformers

2.3.1 Comply with NEMA ST 20, and list and label as complying with UL 1561.

2.3.2 Transformers shall be premium, natural draft, dry type constructed and designed, manufactured, and tested in accordance with all applicable ANSI, NEMA & IEEE standards, and shall be listed by Underwriter's Laboratories and bear the UL label.

2.3.3 Cores: One leg per phase.

2.3.4 Enclosure: Ventilated, NEMA 250, Type 2.

2.3.4.1 Indoor Transformer Enclosure Finish: ANSI gray. Comply with NEMA 250 for "Outdoor Corrosion Protection."

2.3.5 Insulation Class: Transformers shall be insulated with a 220°C insulation system (220°C Temp. class), with winding temperature rise not exceeding 150°C, hot spot not to exceed 30°C under full-rated load in maximum ambient of 40°C.

2.3.6 Taps for Transformers: Transformers shall be provided with a universal tap arrangement, 2-1/2% above and 2-1/2% below normal primary voltage. Provide transformers with a minimum of 4 taps.

2.3.7 K-Factor Rating (where indicated on the drawings): Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.

2.3.7.1 Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.

2.3.7.2 Indicate value of K-factor on transformer nameplate.

2.3.7.3 K-factor transformers shall have an Electrostatic Shield per below.

2.3.8 Electrostatic Shielding (where indicated on the drawings): Transformers indicated to have electrostatic shielding: each winding shall have an independent, single, full-width copper

electrostatic shield arranged to minimize interwinding capacitance.

2.3.8.1 Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.

2.3.8.2 Include special terminal for grounding the shield.

2.3.8.3 Shield Effectiveness:

2.3.8.3.1 Capacitance between Primary and Secondary Windings: Not to exceed 33 picofarads over a frequency range of 20 Hz to 1 MHz.

2.3.8.3.2 Common-Mode Noise Attenuation: Minus 120 dBA minimum at 0.5 to 1.5 kHz; minus 65 dBA minimum at 1.5 to 100 kHz.

2.3.8.3.3 Normal-Mode Noise Attenuation: Minus 52 dBA minimum at 1.5 to 10 kHz.

2.3.9 Wall Brackets: Manufacturer's standard brackets.

2.3.10 Low-Sound-Level Requirements: Maximum sound levels, when factory tested according to IEEE C57.12.91, as follows:

2.3.10.1 30 to 50 kVA: 45dBA

2.3.10.2 51 to 150 kVA: 50 dBA

2.3.10.3 151 to 300 kVA: 55 dBA

2.3.10.4 301 to 500 kVA: 60 dBA

2.3.10.5 501 to 750 kVA: 62dBA

2.3.10.6 751 to 1000 kVA: 64dBA

3 EXECUTION

3.1 Examination

3.1.1 Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

3.1.2 Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

3.1.3 Examine walls and floors for suitable mounting conditions where transformers will be installed.

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

3.2 Installation:

3.2.1 Install ceiling-suspended fixtures level and plumb. Provide hardware as required. Coordinate mounting with architect and structural engineer.

3.2.2 Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.

3.2.3 Install floor-mounted transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches high.

3.2.4 Provide sound/vibration isolation pads under all floor mounted transformers. Use neoprene-jacketed isolation material bonded to a tapped steel load plate; Model N as produced by Consolidated Kinetics Corporation or approved equal. Use size recommended by pad producer for each size of floor-mounted transformer. Sound/vibration isolation pads are in addition to internal sound isolation pads supplied with transformers.

3.3 Connections:

3.3.1 Ground equipment according to Division 26 Section "Grounding and Bonding."

3.4 Testing:

3.4.1 Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

3.4.2 Output Settings Report: Prepare a written report recording output voltages and tap settings.

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

END OF SECTION

SECTION 26 24 20 - PANELBOARDS

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Distribution panelboards.

1.2.1.2 Lighting and appliance branch-circuit panelboards.

1.3 Definitions

1.3.1 EMI: Electromagnetic interference.

1.3.2 GFCI: Ground-fault circuit interrupter.

1.3.3 RFI: Radio-frequency interference.

1.3.4 RMS: Root mean square.

1.3.5 SPDT: Single pole, double throw.

1.4 Quality Assurance:

1.4.1 Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

1.4.2 Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated.

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

1.4.4 Comply with NEMA PB 1.

1.4.5 Comply with NFPA 70.

1.4.6 Panelboards shall be listed and labeled by Underwriters' Laboratories, Inc. in accordance with UL Standard 67.

1.4.7 Panelboards for use as service disconnecting means shall additionally conform to UL 869.

1.5 Project Conditions

1.5.1 Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1.5.1.1 Ambient Temperature: Not exceeding 104 deg F (40 deg C).

1.5.1.2 Altitude: Not exceeding 6600 feet (2000 m).

1.5.2 Service Conditions: NEMA PB 1, usual service conditions, as follows:

1.5.2.1 Ambient temperatures within limits specified.

1.5.2.2 Altitude not exceeding 6600 feet (2000 m).

1.6 Coordination

1.6.1 Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of:

1.7.1.1 Panelboard

1.7.1.2 Overcurrent protective device

1.7.1.3 Surge Protective Device

1.7.1.4 Metering device

1.7.2 Shop Drawings:

1.7.2.1 For each panelboard provide dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1.7.2.1.1 Enclosure types and details for types other than NEMA 250, Type 1.

1.7.2.1.2 Bus configuration, current, and voltage ratings.

1.7.2.1.3 Short-circuit current rating of panelboards and overcurrent protective devices.

1.7.2.1.4 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.7.2.1.5 Time-current curves, including selectable ranges for each type of overcurrent protective device equal to and greater than 250 amp frame.

1.7.2.1.6 Exact trip unit type for all electronic trip breakers.

1.7.2.1.7 Power, signal, and control wiring diagrams.

1.7.2.1.8 Panelboard schedules for installation in panelboards.

1.7.2.2 Electrical Room Layouts: For each electrical room and room containing a panelboard, provide ¼" scale drawing showing equipment layouts for clearance verification. Show all equipment including equipment in other specification sections.

1.8 Test Reports and Verification Submittals:

1.8.1 NETA Test: Provide a written test.

1.8.2 Insulation Resistance Test: Provide a written test.

1.9 O&M Data Submittals:

1.9.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.10 Training: Submit letter verifying that Owner training has been received by factory representative.

2 PRODUCTS

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

2.1.1 Panelboards and Accessories:

2.1.1.1 Eaton Corporation; Cutler-Hammer Products.

2.1.1.2 General Electric Co.; Electrical Distribution & Protection Div.

2.1.1.3 Square D.

2.2 Panelboards

2.2.1 Enclosures: Galvanized cabinets. NEMA 250, Type 1 .

2.2.1.1 Rated for environmental conditions at installed location.

2.2.1.2 Outdoor Locations: NEMA 250, Type 3R.

2.2.1.3 Hinged Front (Indoor units only): Trim shall have a hinged inner door over the branch disconnect area secured with one or two lockable flush latches. Tools shall not be required to open the inner hinged door. There shall also be a hinged outer door that covers the gutter area secured by screws. Tools shall be required to open the outer hinged door. All locks shall be keyed alike.

2.2.1.4 Skirt for Surface-Mounted Panelboards: Same gauge and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

2.2.1.5 Gutter Extension and Barrier: Same gauge and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

2.2.1.6 Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

2.2.1.7 Directory Card: Type written with transparent protective cover, mounted in metal frame, inside panelboard door.

2.2.1.8 Equipment Tag: Provide a plastic nameplate 1" high by 3" wide with minimum 1/2" letters indicating the panelboard identification and 1/4" letters indicating the voltage and upstream protective device. Locate tag above door. The panelboard shall also have a nameplate affixed to the panelboard with the following information stamped therein:

2.2.1.8.1 Nameplate: Manufacturer, Voltage, Ampacity, Type of Panelboard, Manufacturer's Order No. and Date, Interrupting Rating - RMS Sym.

2.2.2 Phase and Neutral Buses:

2.2.2.1 Material: Hard-drawn copper, 98 percent conductivity.

2.2.2.2 Neutral Bus: Neutral bus shall be rated 100 or 200 percent of phase bus as indicated on the drawings.

2.2.3 Equipment Ground Bar: Copper or tin plated copper. Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

2.2.4 Conductor Connectors: Suitable for use with conductor material.

2.2.4.1 Main and Neutral Lugs: Mechanical set-screw type. Crimp compression not allowed.

2.2.4.2 Ground Lugs and Bus Configured Terminators: Compression type.

2.2.5 Service Equipment Label (where indicated): UL labeled for use as service equipment for panelboards with main service disconnect switches.

2.2.6 Future Devices: Mounting brackets, bus connections, and necessary appurtenances "fully prepared" required for future installation of devices.

2.3 Panelboard Short-circuit Rating

2.3.1 Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 Distribution Panelboards

2.4.1 Main Overcurrent Protective Devices: Circuit breaker.

2.4.2 Branch Overcurrent Protective Devices: Circuit breaker.

2.5 Lighting and Appliance Branch-circuit Panelboards

2.5.1 Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.6 Surge Protective Device (SPD) - Panelboard Suppressors

2.6.1 Surge Protective Device Description: Modular design, UL 1449 3rd Edition Listed, mounted integral to panel enclosure with field-replaceable modules and the following features and accessories:

2.6.1.1 Fuses, rated at 200-kA interrupting capacity.

2.6.1.2 Fabrication using bolted compression lugs for internal wiring.

2.6.1.3 Type 2.

2.6.1.4 Integral disconnect switch.

2.6.1.5 Arrangement with direct bus connections to phase buses, neutral bus, and ground bus.

2.6.1.6 LED indicator lights for power and protection status.

2.6.1.7 Audible alarm, with silencing switch, to indicate when protection has failed.

2.6.1.8 One set of dry contacts rated at 2A, 24-V dc, for remote monitoring of protection status.

2.6.1.9 Surge-event operations counter.

2.6.1.10 The SPD system shall have EMI/RFI filtering, UL1283 listed and per MIL-STD-220A.

2.6.2 Peak Single-Impulse Surge Current Rating: 160kA per phase (L-N + L-G), 80kA per mode.

2.6.3 Voltage Protection Rating (VPR) for grounded wye circuits with voltages of 480Y/277 or 208Y/120; 3-phase, 4-wire circuits, shall not exceed:

2.6.3.1 Line to Neutral: 1,100V for 480Y/277, 600V for 208Y/120.

2.6.3.2 Line to Ground: 1,100V for 480Y/277, 600V for 208Y/120.

2.6.3.3 Neutral to Ground: 1,000V for 480Y/277, 700V for 208Y/120.

2.7 Overcurrent Protective Devices

2.7.1 Circuit breakers shall be molded case with trip units of size, type and quantity shown on the drawings. The circuit breakers shall be bolt-on type, equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other. Large permanent, individual circuit numbers shall be affixed to each breaker in a uniform position. Paper stickers are not acceptable for individual circuit numbers. Individual circuit numbers shall be phenolic. Trip indication shall be clearly shown by the breaker handle. Provisions for additional breakers shall be such that no additional connectors will be required to add circuit breakers. Breaker terminals shall be UL listed as suitable for type and size of conductor provided for.

2.7.2 The following are general/minimum requirements. Provide features trip units, etc. per the selective coordination study as required to achieve coordination.

2.7.3 Main Circuit Breaker: Unless indicated on the drawings, shall be a true main and not a branch-mounted main.

2.7.4 Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.7.5 Current-Limiting Circuit Breakers: Frame sizes 400A and smaller; let-through ratings less than NEMA FU 1, RK.

2.7.6 Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Unless indicated otherwise, breakers smaller than 250A frame shall be thermal-magnetic.

2.7.7 Adjustable Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting. Unless indicated otherwise, breakers smaller than 800A frame and at least 250A frame shall be adjustable thermal-magnetic.

2.7.8 Electronic Trip-Unit Circuit Breakers: Unless indicated otherwise, breakers 800A frame and larger shall be electronic trip type. RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

2.7.8.1 Instantaneous trip.

2.7.8.2 Long- and short-time pickup levels.

2.7.8.3 Long- and short-time time adjustments.

2.7.8.4 Ground-fault pickup level, time delay, and I^2t response (for 480V systems).

2.7.9 Multipole Breakers: Provide common trip-type with single operating handle. Breaker design shall be such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.7.10 Lockable CB: Where indicated on the drawings, provide a handle padlock attachment capable of being locked in the OFF position.

2.7.11 Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.

2.7.12 Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.7.13 Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

2.7.14 Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

2.8 Power Quality Meter with Panel Mounted Waveform Display

2.8.1 Switchboard shall be provided with a digital power monitoring device (Square D PM8240 or equal) in the switchboard fully connected with CT's with the following capabilities:

2.8.1.1 Panel mounted LCD alpha-numeric and waveform display.

2.8.1.2 RMS Sensing.

2.8.1.3 ANSI C12.20 Class 0.2% revenue accuracy.

2.8.1.4 Current per phase and neutral.

2.8.1.5 Volts L-L and L-N.

2.8.1.6 Real Power (kW) A, B, C, total.

2.8.1.7 Reactive Power (kVAR) A, B, C, total.

2.8.1.8 Apparent Power (kVA) A, B, C, total.

2.8.1.9 Power Factor (true) A, B, C, total.

2.8.1.10 Frequency (Hz).

2.8.1.11 Real Energy (kWh) 3 phase total.

2.8.1.12 Reactive Eneregy (kVARh) 3 phase total.

2.8.1.13 Apparent Energy (kVAh) 3 phase total.

2.8.1.14 RS-485 and ethernet communications.

2.8.1.15 THD voltage and current A, B, C.

2.8.1.16 Real power demand (kWd) 3 phase total present & peak.

2.8.1.17 Reactive power demand (kVARd) 3 phase total present & peak.

2.8.1.18 Apparent power demand (kVAd) 3 phase total present & peak.

2.8.1.19 Date and time stamping on peak demands.

2.8.1.20 Trending and forecasting.

2.8.1.21 Waveform capture.

2.8.1.22 Waveform display screen.

2.8.1.23 Harmonic Analysis screen

2.8.1.24 Sub-cycle disturbance capture.

2.8.1.25 Resolution to the 63^{th} harmonic.

2.8.1.26 Max and min readings.

2.9 Accessory Components and Features

2.9.1 Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

3 EXECUTION

3.1 Installation

3.1.1 Install panelboards and accessories according to NEMA PB1.1.

3.1.2 Mount top of panelboard 6'-6" above finished floor, unless otherwise indicated.

3.1.3 Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

3.1.4 Install overcurrent protective devices and controllers.

3.1.4.1 Set field-adjustable switches and circuit-breaker trip ranges.

3.1.5 Install filler plates in unused spaces.

3.1.6 Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.1.7 Provide four spare ¾" conduits from all recessed branch circuit panelboards to above accessible ceiling for future use.

3.1.8 Provide four spare 1.5" conduits from all recessed distribution panelboards to above accessible ceiling for future use.

3.2 Identification

3.2.1 Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.2.2 Create a directory to indicate installed circuit loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Indicate load type (REC, LTG, AHU-1, etc.) and room numbers served for every branch circuit and panelboard served for every circuit breaker.

3.2.3 Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 Connections

3.3.1 Ground equipment according to Division 26 Section "Grounding and Bonding."

3.4 Testing: Perform the following field tests and inspections and prepare test reports:

3.4.1 NETA ATS: Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers (Only Emergency system breakers 400A frame and larger shall be tested). Certify compliance with test parameters.

3.4.2 Insulation Resistance: Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit. Document results.

3.4.2.1 Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance;

otherwise, replace with new units and retest.

3.4.3 Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Document results.

3.4.3.1 Measure as directed during period of normal system loading.

3.4.3.2 Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.

3.4.3.3 After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

3.4.3.4 Tolerance: Difference exceeding 20 percent of the panel's rating between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.5 Cleaning

3.5.1 On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.6 Demonstration

3.6.1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain panelboards, overcurrent protective devices, SPD's, meters, and accessories. Training shall be one hour and video taped.

END OF SECTION

SECTION 26 27 00 - FUSES 600 VOLTS AND BELOW

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-16 Basic Electrical Materials and Methods Sections apply to work of this Section.

1.3 Approval Submittals:

1.3.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

2 PRODUCTS

2.1 Acceptable Producers:

2.1.1 Buss

2.1.2 Farraz Shamut

2.1.3 Littlefuse

2.1.4 Siemens.

2.2 General: Products listed herein are common to various Divisions and Specification Sections for this project and as shown on this project's Drawings.

2.3 All fuses furnished shall be by the same producer.

2.4 Voltage Rating:

2.4.1 Provide 600 volt fuses for 277/480 volt systems.

2.4.2 Provide 250 volt fuses for 120, 208 and 240 volt systems.

2.5 Ampere Ratings: Ampere ratings of fuses shall be as indicated on the Drawings.

2.6 Interrupting Ratings: Interrupting ratings of fuses shall be as indicated on the Drawings.

2.7 Current Limitation: Current limiting fuses shall be provided where indicated by C/L on the Drawings.

2.8 Rejection Fuse Clips: Provide fuse with rejection feature for switches required to have the rejection feature as indicated on the Drawings.

2.9 Class of Fuses: Provide fuses of Class J, L or R. Class J is preferred due to current limiting properties.

3 EXECUTION

3.1 Coordinate fuse type and ampacity with fuse holder.

3.2 Provide 10% spare fusing with a minimum of one set spare of the amount installed, based on the different voltages, amperage ratings, and types of fusing installed. Spare fusing shall be provided within weatherproof plastic containers for long-term storage (such as in ammo cans). Spray paint container with the wording “Spare Fuses” on the side.

END OF SECTION

SECTION 26 27 05 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following individually mounted, enclosed switches and circuit breakers:

1.2.1.1 Fusible switches.

1.2.1.2 Nonfusible switches.

1.2.1.3 Molded-case circuit breakers.

1.2.1.4 Enclosures.

1.3 Definitions

1.3.1 GFCI: Ground-fault circuit interrupter.

1.3.2 HD: Heavy duty.

1.3.3 RMS: Root mean square.

1.3.4 SPDT: Single pole, double throw.

1.4 Quality Assurance

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

1.4.2 Comply with NFPA 70.

1.4.3 All products shall be UL listed.

1.4.4 Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 Project Conditions

1.5.1 Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1.5.1.1 Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.5.1.2 Altitude: Not exceeding 6600 feet (2010 m).

1.6 Coordination

1.6.1 Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required

workspace clearances and required clearances for equipment access doors and panels.

1.7 Approval Submittals:

1.7.1 Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.7.1.1 Enclosure types and details for types other than NEMA 250, Type 1.

1.7.1.2 Time-current curves, including selectable ranges for each type of circuit breaker.

1.7.1.3 Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7.1.4 Current and voltage ratings.

1.7.1.5 Short-circuit current rating.

1.7.1.6 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.8 O&M Data Submittals:

1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.1.1.1 Square D Co.

2.1.1.2 Eaton Corp.; Cutler-Hammer Products.

2.1.1.3 General Electric Co.; Electrical Distribution & Control Division.

2.1.1.4 Siemens.

2.2 Fusible and Nonfusible Switches

2.2.1 Fusible Switch: NEMA KS 1, Type Heavy Duty, with equipment ground kit, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position. All fusible switches rated 100 thru 600 amperes at 240 volts, and 30 thru 600 amperes at 600 volts, shall have the capability of field conversion from standard Class H fuse spacing to Class J fuse spacing without affecting the UL listing. The switch also must accept Class R fuses and have field installable UL listed rejection feature to reject all fuses except Class R. UL listed short circuit ratings shall be minimum 100,000 ampere RMS symmetrical. 800 and 1200 ampere switches shall have provisions for Class L fuses.

2.2.2 Nonfusible Switch: NEMA KS 1, Type Heavy Duty, with equipment ground kit, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

2.2.3 Accessories:

2.2.3.1 Equipment Ground Kit: Copper material internally mounted and labeled for copper ground conductors.

2.3 Molded-case Circuit Breakers and Switches

2.3.1 Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

2.3.1.1 Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Unless indicated otherwise, breakers smaller than 250A frame shall be thermal-magnetic.

2.3.1.2 Adjustable Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting. Unless indicated otherwise, breakers smaller than 800A frame and at least 250A frame shall be adjustable thermal-magnetic.

2.3.1.3 Electronic Trip-Unit Circuit Breakers: Unless indicated otherwise, breakers 800A frame and larger shall be electronic trip type. RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

2.3.1.3.1 Instantaneous trip.

2.3.1.3.2 Long- and short-time pickup levels.

2.3.1.3.3 Long- and short-time time adjustments.

2.3.1.3.4 Ground-fault pickup level, time delay, and I^2t response.

2.3.1.4 Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

2.3.1.5 Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

2.3.1.6 GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

2.3.2 Molded-Case Circuit-Breaker Features and Accessories:

2.3.2.1 Standard frame sizes, trip ratings, and number of poles.

2.3.2.2 Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

2.3.2.3 Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.3.2.4 Shall have overcenter, trip free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle indication. All breakers shall be bolt-on type.

2.3.2.5 Provide with shunt trip features where indicated on the Drawings.

2.4 Enclosures

2.4.1 NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location and shall be dead front type.

2.4.1.1 Outdoor Locations: NEMA 250, Type 3R.

2.4.1.2 Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.4.1.3 Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

3 EXECUTION

3.1 Examination

3.1.1 Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.2 Installation

3.2.1 Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

3.2.2 Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

3.2.3 Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.3 Identification

3.3.1 Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.3.2 Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Basic Electrical Materials and Methods."

3.4 Adjusting

3.4.1 Set field-adjustable switches and circuit-breaker trip ranges.

3.5 Cleaning

3.5.1 On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

3.5.2 Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

SECTION 26 27 07 - CIRCUIT BREAKERS FOR EXISTING PANELS AND SWITCHBOARDS

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes group and individually mounted circuit breakers.

1.3 Definitions

1.3.1 GFCI: Ground-fault circuit interrupter.

1.3.2 HD: Heavy duty.

1.3.3 RMS: Root mean square.

1.3.4 SPDT: Single pole, double throw.

1.4 Quality Assurance

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

1.4.2 Comply with NFPA 70.

1.4.3 All products shall be UL listed.

1.4.4 Product Selection for Restricted Space: Drawings indicate maximum dimensions for circuit breakers, including clearances between adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.5 Project Conditions

1.5.1 Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1.5.1.1 Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).

1.5.1.2 Altitude: Not exceeding 6600 feet (2010 m).

1.6 Coordination

1.6.1 Coordinate layout and installation of circuit breakers and components with the existing panel or switchboard. Provide the appropriate frame size and any required mounting hardware as required for proper installation.

1.7 Approval Submittals:

1.7.1 Product Data: For each type of circuit breaker, accessory and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1.7.1.1 Time-current curves, including selectable ranges for each type of circuit breaker.

1.7.1.2 Manufacturer's written instructions for testing and adjusting circuit breakers.

1.7.1.3 Current and voltage ratings.

1.7.1.4 Short-circuit current rating.

1.7.1.5 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.8 O&M Data Submittals:

1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 Manufacturers: Provide as required to match existing panel or switchboard. Match kAIC of existing board. Provide any mounting hardware as required.

2.2 Molded-case Circuit Breakers and Switches

2.2.1 Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to match that of the panel or switchboard.

2.2.2 Molded-Case Circuit-Breaker Features and Accessories:

2.2.2.1 Standard frame sizes, trip ratings, and number of poles.

2.2.2.2 Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.

2.2.2.3 Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.2.2.4 Shall have overcenter, trip free, toggle-type operating mechanisms with quick-make, quick-break action and positive handle indication. All breakers shall be bolt-on type.

2.2.2.5 Circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

2.2.2.6 Provide with shunt trip features where indicated on the Drawings.

3 EXECUTION

3.1 Examination

3.1.1 Examine elements and surfaces to receive circuit breakers for compliance with installation tolerances and other conditions affecting performance.

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

3.2 Installation

3.2.1 Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of circuit breakers.

3.3 Identification

3.3.1 Identify field-installed conductors, interconnecting wiring, and components.

3.4 Adjusting

3.4.1 Set field-adjustable switches and circuit-breaker trip ranges.

3.5 Cleaning

3.5.1 On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

3.5.2 Inspect exposed surfaces and repair damaged finishes.

END OF SECTION

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SECTION 26 27 10 - ENCLOSED CONTROLLERS

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes ac general-purpose controllers rated 600 V and less that are supplied as enclosed units.

1.3 Quality Assurance

1.3.1 Manufacturer Qualifications: Maintain, within 100 miles (160 km) of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

1.3.2 Source Limitations: Obtain enclosed controllers of a single type through one source from a single manufacturer.

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

1.3.4 Comply with NFPA 70.

1.3.5 All products shall be UL listed.

1.3.6 Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed controllers, including clearances between enclosed controllers, and for adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.4 Delivery, Storage, and Handling

1.4.1 Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.4.2 If stored in areas subjected to weather, cover enclosed controllers to protect from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install electric heating of sufficient wattage to prevent condensation.

1.5 Coordination

1.5.1 Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.5.2 Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.

1.5.3 Coordinate features of enclosed controllers and accessory devices with pilot devices and control circuits to which they connect.

1.5.4 Coordinate features, accessories, and functions of each enclosed controller with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and

load.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of enclosed controller. Include dimensions and manufacturer's technical data on features, performance, electrical characteristics, ratings, and finishes.

1.6.2 Shop Drawings:

1.6.2.1 Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

1.6.2.1.1 Enclosure types and details.

1.6.2.1.2 Nameplate legends.

1.6.2.1.3 Short-circuit current rating of integrated unit.

1.6.2.1.4 Features, characteristics, ratings, and factory settings of individual overcurrent protective devices in combination controllers.

1.6.2.1.5 Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

1.7 Test Reports and Verification Submittals:

1.7.1 Perform the following field tests and inspections and prepare test reports:

1.7.1.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including pretesting and adjusting solid-state controllers.

1.7.1.2 Load-Current and List of Settings of Heaters and Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that dip switch settings for motor running overload protection suit actual motor to be protected.

1.8 O&M Data Submittals:

1.8.1 Submit manufacturer's maintenance data including parts lists. Include these data and a copy of approval submittals in O&M manual.

2 PRODUCTS

2.1 Manufacturers

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

2.1.1.1 Enclosed Controllers:

2.1.1.1.1 Square D Co.

2.1.1.1.2 Eaton Corp.; Cutler-Hammer Products.

2.1.1.1.3 General Electrical Distribution & Control.

2.1.1.1.4 Siemens.

2.2 Relays

2.2.1 40A minimum contact rating.

2.2.2 NEMA 1 enclosure.

2.2.3 Single or Double pole as required.

2.2.4 Electrically held.

2.2.5 Coil voltage as required.

2.3 Manual Enclosed Controllers

2.3.1 Manual Starter: Toggle-action with overload and quantity of poles as required.

2.3.2 Manual Controller: Toggle-action hp -rated (size as required) switch, single or three phase as required.

2.4 Magnetic Enclosed Controllers

2.4.1 Full Voltage Non-Reversing (FVNR): (Provide for < 15HP Motors)

2.4.1.1 NEMA ICS 2, Class A, full voltage, nonreversing, across the line.

2.4.1.2 Amp Interrupting Rating (AIR) shall be equal to or greater than the AIC of the upstream panelboard.

2.4.1.3 Coil operating voltage shall be 120VAC, unless otherwise indicated on the drawings.

2.4.1.4 Hand-Off-Auto selector switch on cover unless noted otherwise.

2.4.1.5 Red "run" and green "stop" LED pilot lights on the cover.

2.4.1.6 Control voltage per drawings; obtained from integral fused control power transformer with sufficient capacity to operate coil plus 50VA.

2.4.1.7 1 N.O. and 1 N.C. auxiliary contacts.

2.4.1.8 Overloads for 3 phase units:

2.4.1.8.1 Solid State Overload Relay (Square D Motor Logic “Feature Unit” or equal):

2.4.1.8.2 Selectable Class 10, 20, 30

2.4.1.8.3 Adjustable phase loss/unbalance

2.4.1.8.4 Ambient insensitive.

2.4.1.8.5 Manual Reset.

2.4.1.8.6 Manual Trip with visual indication.

2.4.1.8.7 Self-powered.

2.4.1.9 Overloads for 1 phase units:

2.4.1.9.1 Thermal, melting-alloy.

2.4.1.10 Stop and Lockout Push-Button Station: Magnetic motor controllers shall have momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

2.4.1.11 Multispeed (where specified on the drawings): Match controller to motor type, application, and number of speeds; include the following accessories:

2.4.1.11.1 Compelling relay to ensure motor will start only at low speed.

2.4.1.11.2 Accelerating relay to ensure properly timed acceleration through speeds lower than that selected.

2.4.1.11.3 Decelerating relay to ensure automatically timed deceleration through each speed.

2.4.1.12 Combination (where specified on the drawings): Factory-assembled combination controller and disconnect switch.

2.4.1.12.1 Provide Class 8538 fusible-type starter disconnect switch

2.4.1.12.2 Provide Class RK1 fuses.

2.4.1.12.3 Unit shall be minimum 100 kAIC rated.

2.5 Multipole Contactors

2.5.1 Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.

2.5.1.1 Current Rating: As indicated on drawings.

2.5.1.2 Control-Coil Voltage: Match control power source.

2.5.1.3 Shall have “Hand-Off-Auto” selector switch on cover unless noted otherwise.

2.6 Enclosures

2.6.1 Description: Flush- or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to comply with environmental conditions at installed location.

2.6.1.1 Outdoor Locations: NEMA 250, Type 3R.

2.6.1.2 Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.6.1.3 Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

2.7 Accessories

2.7.1 Devices shall be factory installed in controller enclosure, unless otherwise indicated.

2.8 Factory Finishes

2.8.1 Manufacturer's standard paint applied to factory-assembled and -tested enclosed controllers before shipping.

3 EXECUTION

3.1 Examination

3.1.1 Examine area and surfaces to receive enclosed controllers for compliance with requirements,

installation tolerances, and other conditions affecting performance.

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

3.2 Applications

3.2.1 Select features of each enclosed controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

3.2.2 Select horsepower rating of controllers to suit motor controlled.

3.3 Installation

3.3.1 See Division 26 Section "Basic Electrical Materials and Methods" for general installation requirements.

3.3.2 For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Basic Electrical Materials and Methods."

3.3.3 Install freestanding equipment on concrete bases.

3.4 Identification

3.4.1 Identify enclosed controller components and control wiring according to Division 26 Section "Basic Electrical Materials and Methods."

3.5 Control Wiring Installation

3.5.1 Install wiring between enclosed controllers according to Division 16 Section "Basic Electrical Materials & Methods."

3.5.2 Bundle, train, and support wiring in enclosures.

3.5.3 Connect hand-off-automatic switch and other automatic-control devices where applicable.

3.5.3.1 Connect selector switches to bypass only manual- and automatic-control devices that have no safety functions when switch is in hand position.

3.5.3.2 Connect selector switches with enclosed controller circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.6 Connections

3.6.1 Conduit installation requirements are specified in other Division 26 Sections. Drawings indicate general arrangement of conduit, fittings, and specialties.

3.6.2 Ground equipment.

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

3.7 Adjusting

3.7.1 Set field-adjustable switches and circuit-breaker trip ranges.

3.8 Cleaning

3.8.1 Clean enclosed controllers internally, on completion of installation, according to manufacturer's written instructions. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

3.9 Startup Service

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

3.9.2 Verify that enclosed controllers are installed and connected according to the Contract Documents.

3.9.3 Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 26 Sections.

3.9.4 Complete installation and startup checks according to manufacturer's written instructions.

3.10 Demonstration – for soft start motor starters only

3.10.1 Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers.

3.10.1.1 Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

3.10.1.2 Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."

3.10.1.3 Schedule training with Owner, through Engineer, with at least seven days' advance notice.

3.11 Training: Submit letter verifying that Owner training has been received by factory representative.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.

1.2.1.2 Single and double-pole snap switches and dimmer switches.

1.2.1.3 Device wall plates.

1.2.1.4 Pin and sleeve connectors and receptacles.

1.2.1.5 Floor boxes and poke-through assemblies.

1.3 Definitions

1.3.1 EMI: Electromagnetic interference.

1.3.2 GFCI: Ground-fault circuit interrupter.

1.3.3 PVC: Polyvinyl chloride.

1.3.4 RFI: Radio-frequency interference.

1.3.5 TVSS: Transient voltage surge suppressor.

1.3.6 UTP: Unshielded twisted pair.

1.4 Quality Assurance

1.4.1 Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

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

1.4.3 Comply with NFPA 70.

1.4.4 UL Listed.

1.5 Coordination

1.5.1 Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.5.1.1 Cord and Plug Sets: Match equipment requirements.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each product provided.

2 PRODUCTS

2.1 Manufacturers

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

2.1.1.1 Wiring Devices:

2.1.1.1.1 Eagle Electric Manufacturing Co., Inc.

2.1.1.1.2 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.1.3 Leviton Mfg. Company Inc.

2.1.1.1.4 Pass & Seymour/Legrand; Wiring Devices Div.

2.1.1.2 Wiring Devices for Hazardous (Classified) Locations:

2.1.1.2.1 Crouse-Hinds/Cooper Industries, Inc.; Arrow Hart Wiring Devices.

2.1.1.2.2 EGS/Appleton Electric Company.

2.1.1.2.3 Killark Electric Manufacturing Co./Hubbell Incorporated.

2.1.1.3 Multioutlet Assemblies:

2.1.1.3.1 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.3.2 Wiremold Company (The).

2.1.1.4 Floor boxes and Poke-Throughs:

2.1.1.4.1 Hubbell Incorporated; Wiring Device-Kellems.

2.1.1.4.2 Carlon.

2.1.1.4.3 Wiremold Company (The).

2.2 Receptacles

2.2.1 Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498. Devices shall be specification grade, back and side wired. Hubbell HBL5362, Leviton 5362 or P&S 5362A, no equals. Hubbell “CR” series and Leviton “S” series are not acceptable.

2.2.2 GFCI Receptacles: Straight blade, Devices shall be specification grade, back and side wired, self test design. Integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch- (70-mm-) deep outlet box without an adapter. Hubbell GFRST20, Leviton GFTR2/GFNT2, or P&S 2097, no equals.

2.2.3 Damp and wet locations: All devices in wet or damp locations shall be weather-resistant “WR” type, per NEC 406.8.

2.2.4 USB Receptacles: USB charger, tamper-resistant, UL listed, two USB 2.0 ports, two 120V 20A receptacles. Hubbell USB20x2, Leviton T5832 or P&S 5362USB.

2.2.5 Controlled: All receptacles that are controlled by space occupancy sensors shall have “controlled” and the power symbol imprinted on the face.

2.3 Cord Reels

2.3.1 Heavy duty industrial grade.

2.3.2 Equivalent to KH Industries Heavy Duty Industrial Cord Reels.

2.3.3 Ampacity: As required per drawings.

2.3.4 Wire Size: As required per drawings.

2.3.5 Receptacle: As required per drawings.

2.4 Pendant Cord/Connector Devices

2.4.1 Description: Matching, locking-type plug and receptacle body connector, NEMA WD 6, Heavy-Duty grade.

2.4.1.1 Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.

2.4.1.2 External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.5 Cord and Plug Sets

2.5.1 Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

2.5.1.1 Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.

2.5.1.2 Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 Plugmold

2.6.1 UL listed, multi-outlet raceway assembly.

2.6.2 Size and outlet arrangement per drawings.

2.7 Switches

2.7.1 Single- and Double-Pole 3-way and 4-way Switches: Comply with WS- 896 and UL. Specification grade, quiet type, abuse resistant nylon toggle, color coded base, one piece rivetless copper alloy spring contact arm & terminal plate, one piece integral grounding terminal with #8 brass screw, automatic grounding clip, side and back wiring, one piece rivetless copper alloy spring contact arm and terminal plate. Provide 20 amp switches for circuits less than or equal to 20 amperes. Provide 30 or 40 ampere switches for circuits exceeding 20 amperes. Hubbell “CR” series and Leviton “S” series are not acceptable.

2.7.1.1 Single Pole, 20 amp, 120/277 shall be Hubbell HBL1221, Leviton 1221-2, P&S PS20AC, no equals.

2.7.1.2 Double Pole, 20 amp, 120/277V shall be Hubbell HBL1222, Leviton 1222-2, P&S PS20AC, no equals.

2.7.1.3 Three-Way, 20 amp, 120/277V shall be Hubbell HBL1223, Leviton 1223-2, P&S PS20AC, no equals.

2.7.1.4 Four-Way, 20 amp, 120/277V shall be Hubbell HBL1224, Leviton 1224-2, P&S PS20AC, no equals.

2.7.2 Dimmer Switches: 0-10V style.

2.7.3 30 Amp: 1, 2, or 3 poles, 30A. Equivalent to Leviton MS303-DS.

2.7.4 40 Amp: 1, 2, or 3 poles, 40A. Equivalent to Leviton MS403-DS.

2.8 Wall Plates

2.8.1 Single and combination types to match corresponding wiring devices.

2.8.1.1 Material for Finished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be high-impact smooth nylon. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.

2.8.1.2 Material for Unfinished Spaces: Provide UL listed one-piece device plates for outlets to suit the devices installed. Except as noted below, all wiring device plates shall be high-impact smooth nylon. Sectional type device plates will not be permitted. Screws shall be machine-type with countersunk heads in color to match finish of plate.

2.8.1.3 Material for Wet Locations: Plates installed in wet locations shall be cast, gasketed and UL listed for "wet locations."

2.8.1.4 Outdoor In-use Receptacle Covers: Vertical mount, single-gang, lockable, clear cover. T&B Steel City Perfect-Line WT or Red Dot Code Keeper Extra-Duty, no equals.

2.9 Floor Service Fittings Space(floorboxes & poke-thrus)

2.9.1 Type: See drawings for type, manufacturer, style, etc.

2.9.2 Cover shall be painted cast aluminum unless otherwise indicated on drawings.

2.10 Finishes

2.10.1 Wiring devices and cover plates connected to Normal Power System: White, unless otherwise indicated.

2.10.2 Wiring devices and cover plates connected to Standby Generator System: Red.

2.11 Hazardous (Classified) Location Devices

2.11.1 Shall comply with the Class, Division and Group of the location installed.

3 EXECUTION

3.1 Installation

3.1.1 Install devices and assemblies level, plumb, and square with building lines.

3.1.2 Mounting Heights: Mounting heights for receptacle outlets shall be 18" above finished floor or as indicated on the Drawings. Mounting heights for receptacles over casework shall be 7" above

counter top. Verify all receptacle heights prior to rough-in. Switches are generally mounted 48" above finished floor to top of device. Provide a written description to the Engineer, prior to rough-in, any conflicts. The Contractor shall at his expense, be responsible for the relocation of any device not installed according to these specifications.

3.1.3 Prior to roughing-in wall outlet boxes, the Contractor shall verify from general construction drawings; door swings, type of wall finishes and locations for counters and work benches. Do not scale the plans; location of devices is shown on plans in desired vicinity. The Contractor shall carefully locate devices symmetrically and in coordination with architectural features.

3.1.4 Locate light switches at doors as close as possible to door jam, strike side.

3.1.5 Switches that control remote outlets, fans, etc., shall have engraved plastic name tags indicating the outlets, fans, etc. that are controlled.

3.1.6 Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

3.1.7 Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

3.1.8 Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical. Group adjacent switches under single, multigang wall plates.

3.1.9 Remove wall plates and protect devices and assemblies during painting.

3.1.10 Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.1.11 Receptacles: Mount with ground pin up (exception: where equipment intended for receptacle has a 90-degree plug, in which case ground pin shall be down, coordinate with equipment being supplied).

3.2 Connections

3.2.1 Ground equipment according to Division 26 Section "Grounding and Bonding".

3.2.2 Connect wiring according to Division 26 Section "Basic Electrical Materials and Methods".

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

3.2.4 Connect wire to devices using the back wire screw and clamp.

3.3 Field Quality Control

3.3.1 Perform the following field tests and inspections:

3.3.1.1 After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

3.3.1.2 Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

3.3.1.3 Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

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SECTION 26 41 13 - LIGHTNING PROTECTION SYSTEM - CLASS I MATERIALS

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-26 Basic Electrical Materials and Methods apply to work of this Section.

1.3 Division-26 Grounding and Bonding shall apply to work of this Section.

1.4 Approval Submittals:

1.4.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product to be installed.

1.4.2 Samples: Submit samples of the following:

1.4.2.1 Air terminal.

1.4.2.2 Base plates (each type to be used).

1.4.2.3 Lightning protection conductor (6").

1.4.3 Roof Suitability Letter: Provide statement from manufacturer that system being provided is suitable for surface mounting on the roof material being supplied on this project.

1.4.4 Shop Drawings:

1.4.4.1 Submit complete shop drawings showing the type, size, mounting requirements and locations for all equipment, grounds, and cable routings, etc. Drawings shall be no smaller than 1/16"=1'-0". CAD based roof plans may be obtained from the Architect or Engineer.

1.5 Test Reports and Verification Submittals:

1.5.1 Ground Resistance Testing: Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81. Document results.

1.5.2 System Drawings:

1.5.2.1 Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

1.5.3 UL Letter of Certification:

1.5.3.1 The lightning protection installer shall secure and deliver the UL Letter of Certification to the Architect for the Owner upon completion of the installation. The Contractor shall also submit copies of as-built shop drawings with LPI Form LPI-R88 to finalize the LPI Certified System Application. Provide the original UL certificate to the Owner with a copy in each O&M Manual.

1.6 O&M Data Submittals:

1.6.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.7 Labels: Label A for lightning conductors, Label B for air terminals and Label C for Master Label attached to the building all in compliance with the Underwriter's Laboratories, Inc. Master Label Service, UL 96A.

1.8 Scope: The work covered by this section of the specifications consists of furnishing all labor, materials and items of service required for the completion of a functional and unobtrusive lightning protection system as approved by the Engineer, and in strict accordance with this section of the specifications and the applicable contract drawings. If any departure from the contract drawings or submittal drawings, covered below are deemed necessary by the Contractor, details of such departures and reasons therefore shall be submitted as soon as practical to the Engineer for approval. No such departures shall be made without the prior written approval of the Engineer.

1.9 Standards: The installation shall conform with the latest following codes and standards:

1.9.1 Lightning Protection Institute installation Code LPI 175.

1.9.2 National Fire Protection Code NFPA 780

1.10 Quality Assurance: The lightning protection system shall be conform to the requirements of the Lightning Protection Institute and NFPA Standards for Lightning Protection Systems. The LPI System Certification, including Form LPI-1-R88 shall be furnished and submitted.

1.10.1 The system to be furnished under these specifications shall be the standard product of a manufacturer regularly engaged in the production of lightning protection systems and shall be the manufacturer's latest approved design. The equipment manufacturer shall also be a U.L. listed and approved manufacturer and a fully certified manufacturer member in good standing of the Lightning Protection Institute.

1.10.2 The Contractor shall be a LPI Certified Designer and Installer.

2 PRODUCTS

2.1 Acceptable Producers:

2.1.1 Robbins

2.1.2 Thompson

2.1.3 Harger

2.1.4 Heary

2.1.5 East Coast

2.1.6 Erico

2.1.7 Maxwell

2.2 Standards: All equipment used in this installation shall be factory inspected, approved, and properly labeled in accordance with LPI requirements. All equipment shall be new, the product of a single manufacturer as outlined above, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI and NFPA Codes requirements.

2.3 Air Terminals: Shall be solid, round copper bar of ½" minimum diameter. The air terminals shall have blunt terminal and extend a minimum of 10 inches above object to be protected or as required. Locate and space according to LPI and NFPA requirements. Thompson 52, 662, etc. Air terminals for use on aluminum roof systems shall be aluminum, Thompson A55, A56, A572, A660.

2.4 Conductors: Shall be copper, of 29 strands 17 gauge minimum. Ties to major metal masses shall be same size as main conductor. Miscellaneous ties to sheet metal and flashing shall be minimum size of #6 AWG stranded or equivalent braid. Thompson 29X. Conductors for use on metal roofs shall be aluminum of equal current carrying capacity as the copper conductor. The contractor shall transition to copper after exiting roof with approved connectors.

2.5 Air Terminal Bases:

2.5.1 For Built-up Roofs and Concealed Type: Shall be of cast bronze with bolt pressure cable connections and shall be securely mounted with adhesive type bases and shall have proper adhesive base to support terminal. Crimp type connectors are not acceptable. Thompson Cat. numbers 680, 678, 78, 611, etc., as required. Bases on single ply roofs shall be secured with a proper adhesive and shall have a minimum surface contact area of 18.5 sq. inches, Cat. number 688.

2.5.2 For Metal Roof Systems: Air terminal based for use on metal roofs shall be aluminum adhesive base type, Thompson A688. On sloped metal roofs use angle adapter so that air terminals are vertical, Thompson A27. The cable shall be tied down every 3’ between air terminals and other bonding points with an adhesive tie-down base, Thompson A730. The roof ridge bases shall be Thompson A71A.

2.6 Ground Connections: Provide one (1) for each down conductor preference being given to metal water pipes or other large underground metallic structures. Driven grounds shall be located a minimum of two feet from building foundation. Place conductors connecting to grounds 30" below finished grade. The building electrical system ground shall be bonded to the lightning protection system ground,

2.6.1 Ground Lead Spacing: The spacing for driven ground leads shall not exceed 100’ and shall be equally spaced around the building being protected.

2.6.2 New Construction: The down lead shall be concealed after exiting roof with a through wall connection. Two methods are acceptable for down leads. If building steel is used for down leads, the spacing of the down leads shall not exceed 60’. The driven grounds must still be used and be bonded to the building steel.

2.7 Ground Rods: Shall be coper-clad steel sectional type and minimum 3/4" in diameter and 10' long. Where indicated on the Drawings, provide ¾” by 20’ ground rods.

2.8 Cable Fasteners: Shall be substantial in construction, electrolytically compatible with the conductor and mounting surface and shall be spaced according to LPI and NFPA Code requirements. Thompson 174, 730, 166, etc.

2.9 Bonding Devices: Bonding devices, cable splicers and miscellaneous connectors shall be of cast bronze with bolt pressure connections to cable. Cast or stamped crimp fittings are not acceptable. Splicers similar to 433B, 705, 706, etc., bonding devices similar to 702, 704, 551, 142, 561, 142X, etc. On metal roof systems use bonding devices and cable splicers compatible with the conductors and roof system.

2.10 Miscellaneous Hardware: Bolts, nuts and screws shall be brass, bronze, or stainless steel. On metal roof systems, provide hardware compatible with the roof system.

2.11 Metal Roof System Adhesive: Use adhesives that are approved by the roof system manufacturer. Contractor shall submit the roof manufacturer and system being supplied to the lightning

protection contractor so that the proper adhesive may be used. Thompson 731 or approved alternate.

3 EXECUTION

3.1 Installation: The installation shall be accomplished by an experienced installer who is a Certified Master Installer of the LPI or working under the direct supervision of an LPI manufacturer as listed above or his authorized LPI Certified Master Installer representative.

3.1.1 All equipment shall be installed in a neat workmanlike manner in the most inconspicuous manner possible. The system shall consist of a complete cable network on the roof involving all air terminals, splices, and bonds with cable downleads routed concealed either directly in the building construction (new construction) or in conduit to ground (existing construction).

3.1.2 Copper equipment shall not be connected to aluminum surfaces except by means of an LPI approved bimetal transition fitting. Lead coating is not to be accepted as a bimetal transition.

3.1.3 Bond all metal masses within six feet of the main conductors. Bond all metal equipment and plumbing stacks with proper bonding techniques. Bond water piping system to conductors preferably at or near ground level. Conceal down conductors within the building structure unless indicated otherwise. Install in 1" conduit. Secure conduit on one foot centers.

3.1.4 Joints, Bends and Supports in Conductors: Joints shall be as few in number as possible, mechanically strong and shall provide contact area not less than double the cross sectional area of conductor. Make all joints with corrosion-resistant materials. Joints above grade may be bolted, pressure type, or thermite welding. Bends shall be gradual with minimum angle not less than 90 degrees. Radii of bends at eaves, etc., shall be not less than 8". Place supports a maximum of 4 feet apart. Roof supports shall be a maximum of 3 feet apart.

3.2 Coordination: The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other building ground systems, including both telephone and electrical.

3.3 Ground Rods: Install sufficient length or number of grounds to give maximum resistance of 5 ohms at each down conductor location. Bond different three point grounding systems together if necessary to achieve a lower impedance.

END OF SECTION

SECTION 26 50 15 - DIGITAL LIGHTING CONTROL SYSTEM

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes occupancy sensors and associated relays and controllers for lighting control.

1.3 Definitions

1.3.1 DLM: Digital Lighting Management

1.3.2 DT: Dual Technology

1.3.3 LED: Light-emitting diode.

1.3.4 PIR: Passive infrared.

1.4 Quality Assurance

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

1.4.2 All products shall be UL listed.

1.5 Coordination

1.5.1 Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.6 Approval Submittals:

1.6.1 Product Data: Submit manufacturer's data sheets on each product to be used, including:

1.6.1.1 Catalog sheets and specifications.

1.6.1.2 Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1.6.1.3 Storage and handling requirements and recommendations.

1.6.1.4 Installation instructions.

1.6.2 Shop Drawings: Submit wiring diagrams for the various components of the system specified including:

1.6.2.1 Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.

1.6.2.2 Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.

1.6.2.3 Provide room/area details including products and sequence of operation for each room or area.

Illustrate typical acceptable room/area connection topologies.

1.6.2.4 Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

1.6.3 Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.7 O&M Data Submittals:

1.7.1 Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.7.2 Operation and Maintenance Manual:

1.7.2.1 Include approved Shop Drawings and Product Data.

1.7.2.2 Include Sequence of Operation, identifying operation for each room or space.

1.7.2.3 Include manufacturer's maintenance information.

1.7.2.4 Operation and Maintenance Data: Include detailed information on device programming and setup.

1.7.2.5 Include startup and test reports.

1.8 Training: Submit letter verifying that Owner training has been received by factory representative.

2 PRODUCTS

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

2.1.1.1 Watt Stopper, DLM System

2.1.1.2 Hubbell , NX System

2.1.1.3 Crestron.

2.2 General Description:

2.2.1 Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.

2.2.1.1 DLM local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

2.2.1.2 Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.

2.2.1.3 Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.

2.2.1.4 Digital Fixture Controllers: Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.

2.2.1.5 Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy

sensors with LCD display and two-way active infrared (IR) communications.

2.2.1.6 Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.

2.2.1.7 Handheld remotes for personal control: On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.

2.2.1.8 Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.

2.2.1.9 Configuration Tools: Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.

2.2.1.10 Programming and Configuration Software: Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

2.2.1.11 DLM Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.

2.2.1.12 Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

2.2.2 Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

2.2.2.1 Features of the DLM local network include:

2.2.2.1.1 Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

2.2.2.1.2 Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.

2.2.2.1.3 Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

2.2.2.1.4 Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

2.2.2.2 Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

2.2.2.3 If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 Digital Load Controllers (Room, Plug Load and Fixture Controllers)

2.3.1 Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features

2.3.1.1 Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.

2.3.1.2 Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.

2.3.1.3 Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.

2.3.1.4 Device Status LEDs to indicate:

2.3.1.4.1 Data transmission

2.3.1.4.2 Device has power

2.3.1.4.3 Status for each load

2.3.1.4.4 Configuration status

2.3.1.5 Quick installation features including:

2.3.1.5.1 Standard junction box mounting

2.3.1.5.2 Quick low voltage connections using standard RJ-45 patch cable

2.3.1.6 Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:

2.3.1.6.1 Turn on to 100 percent

2.3.1.6.2 Turn off

2.3.1.6.3 Turn on to last level

2.3.1.7 Each load be configurable to operate in the following sequences based on occupancy:

2.3.1.7.1 Auto-on/Auto-off (Follow on and off)

2.3.1.7.2 Manual-on/Auto-off (Follow off only)

2.3.1.8 Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.

2.3.1.9 BACnet object information shall be available for the following objects:

2.3.1.9.1 Load status

2.3.1.9.2 Schedule state, normal or after-hours

2.3.1.9.3 Demand Response enable and disable

2.3.1.9.4 Room occupancy status

2.3.1.9.5 Total room lighting and plug loads watts

2.3.1.9.6 Electrical current

2.3.1.9.7 Total watts per controller

2.3.1.9.8 Total room watts/sq ft.

2.3.1.9.9 Force on/off all loads

2.3.1.10 UL 2043 plenum rated

2.3.1.11 Manual override and LED indication for each load

2.3.1.12 Zero cross circuitry for each load

2.3.1.13 All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

2.3.1.14 Dimming Room Controllers shall share the following features:

2.3.1.14.1 Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.

2.3.1.14.2 Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.

2.3.1.14.3 The following dimming attributes may be changed or selected using a wireless configuration tool:

2.3.1.14.3.1 Establish preset level for each load from 0-100 percent

2.3.1.14.3.2 Set high and low trim for each load

2.3.1.14.3.3 Initiate lamp burn in for each load of either 0, 12 or 100 hours

2.3.1.14.3.4 Override button for each load provides the following functions:

2.3.1.14.3.4.1 Press and release for on/off control

2.3.1.14.3.4.2 Press and hold for dimming control

2.3.1.14.3.5 Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.

2.3.1.14.3.6 Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.

2.3.1.14.3.7 Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.

2.3.1.14.3.8 All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

2.3.2 Plug Load Controllers shall include:

2.3.2.1 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.

2.3.2.2 One relay configuration with additional connection for unswitched load

2.3.2.3 Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).

2.3.2.4 Factory default operation is Auto-on/Auto-off, based on occupancy

2.3.2.5 Switching power supply

2.3.2.6 RJ-45 DLM local network ports

2.3.3 Fixture Controllers shall include

2.3.3.1 A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.

2.3.3.2 One 3A 120/277V rated mechanically held relay.

2.3.3.3 Programmable behavior on power up following the loss of normal power:

2.3.3.3.1 Turn on to 100 percent

2.3.3.3.2 Turn off

2.3.3.3.3 Turn on to last level

2.3.3.4 Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.

2.3.3.5 Power to drive the LMFC Fixture Controller electronics can come from any Room or Plug Load Controller, Power Booster and/or Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).

2.3.3.6 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.

2.3.3.7 Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor in a 2.2 by 1.32 inch rectangular hole for connection to the DLM local network.

2.3.3.8 Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.

2.3.3.9 A complete set of dimming features described above in the paragraph detailing

On/Off/Dimming Enhanced Room Controllers.

2.4 Digital Wall or Ceiling Mounted Occupancy Sensor:

2.4.1 Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:

2.4.1.1 Digital calibration and pushbutton configuration for the following variables:

2.4.1.1.1 Sensitivity, 0-100 percent in 10 percent increments

2.4.1.1.2 Time delay, 1-30 minutes in 1 minute increments

2.4.1.1.3 Test mode, Five second time delay

2.4.1.1.4 Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.

2.4.1.1.5 Walk-through mode

2.4.1.2 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2.4.1.3 Programmable control functionality including:

2.4.1.3.1 Each sensor may be programmed to control specific loads within a local network.

2.4.1.3.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.

2.4.1.3.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.

2.4.1.3.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

2.4.1.3.4.1 Ultrasonic and Passive Infrared

2.4.1.3.4.2 Ultrasonic or Passive Infrared

2.4.1.3.4.3 Ultrasonic only

2.4.1.3.4.4 Passive Infrared only

2.4.1.3.5 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

2.4.1.3.6 One or two RJ-45 port(s) for connection to DLM local network.

2.4.1.3.7 Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

2.4.1.3.8 Device Status LEDs, which may be disabled for selected applications, including:

2.4.1.3.9 PIR detection

2.4.1.3.10 Ultrasonic detection

2.4.1.3.11 Configuration mode

2.4.1.3.12 Load binding

2.4.1.4 Assignment of occupancy sensor to a specific load within the room without wiring or special tools.

2.4.1.5 Manual override of controlled loads.

2.4.1.6 All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

2.4.2 BACnet object information shall be available for the following objects:

2.4.2.1 Detection state

2.4.2.2 Occupancy sensor time delay

2.4.2.3 Occupancy sensor sensitivity, PIR and Ultrasonic

2.4.3 Units shall not have any dip switches or potentiometers for field settings

2.4.4 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

2.5 Digital Wall Switch Occupancy Sensors:

2.5.1 Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:

2.5.1.1 Digital calibration and pushbutton configuration for the following variables:

2.5.1.1.1 Sensitivity: 0-100 percent in 10 percent increments

2.5.1.1.2 Time delay: 1-30 minutes in 1 minute increments

2.5.1.1.3 Test mode: Five second time delay

2.5.1.1.4 Detection technology: PIR, Dual Technology activation and/or re-activation.

2.5.1.1.5 Walk-through mode

2.5.1.1.6 Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.

2.5.1.2 Programmable control functionality including:

2.5.1.2.1 Each sensor may be programmed to control specific loads within a local network.

2.5.1.2.2 Sensor shall be capable of activating one of 16 user-definable lighting scenes.

2.5.1.2.3 Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.

2.5.1.2.4 On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:

2.5.1.2.4.1 Ultrasonic and Passive Infrared

2.5.1.2.4.2 Ultrasonic or Passive Infrared

2.5.1.2.4.3 Ultrasonic only

2.5.1.2.4.4 Passive Infrared only

2.5.1.3 Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

2.5.1.4 Two RJ-45 ports for connection to DLM local network.

2.5.1.5 Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.

2.5.1.6 Device Status LEDs including

2.5.1.6.1 PIR detection

2.5.1.6.2 Ultrasonic detection

2.5.1.6.3 Configuration mode

2.5.1.6.4 Load binding

2.5.1.7 Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.

2.5.1.8 Assignment of local buttons to specific loads within the room without wiring or special tools

2.5.1.9 Manual override of controlled loads

2.5.1.10 All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

2.5.2 BACnet object information shall be available for the following objects:

2.5.2.1 Detection state

2.5.2.2 Occupancy sensor time delay

2.5.2.3 Occupancy sensor sensitivity, PIR and Ultrasonic

2.5.2.4 Button state

2.5.2.5 Switch lock control

2.5.2.6 Switch lock status

2.5.3 Units shall not have any dip switches or potentiometers for field settings.

2.5.4 Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

2.5.5 Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:

2.5.5.1 Left button

2.5.5.2 Press and release - Turn load on

2.5.5.3 Press and hold - Raise dimming load

2.5.5.4 Right button

2.5.5.4.1 Press and release - Turn load off

2.5.5.4.2 Press and hold - Lower dimming load

2.5.6 Low voltage momentary pushbuttons shall include the following features:

2.5.6.1 Load/Scene Status LED on each switch button with the following characteristics:

2.5.6.1.1 Bi-level LED

2.5.6.1.2 Dim locator level indicates power to switch

2.5.6.1.3 Bright status level indicates that load or scene is active

2.5.6.2 The following button attributes may be changed or selected using a wireless configuration tool:

2.5.6.2.1 Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).

2.5.6.2.2 Individual button function may be configured to Toggle, On only or Off only.

2.5.6.2.3 Individual scenes may be locked to prevent unauthorized change.

2.5.6.2.4 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

2.5.6.2.5 Ramp rate may be adjusted for each dimmer switch.

2.5.6.2.6 Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.6 Digital Wall Switches:

2.6.1 Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:

2.6.1.1 Two-way infrared (IR) transceiver for use with personal and configuration remote controls.

2.6.1.2 Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.

2.6.1.3 Configuration LED on each switch that blinks to indicate data transmission.

2.6.1.4 Load/Scene Status LED on each switch button with the following characteristics:

2.6.1.4.1 Bi-level LED

2.6.1.4.2 Dim locator level indicates power to switch

2.6.1.4.3 Bright status level indicates that load or scene is active

2.6.1.4.4 Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

2.6.1.5 Programmable control functionality including:

2.6.1.5.1 Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority

2.6.1.5.2 Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

2.6.1.5.3 All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

2.6.2 BACnet object information shall be available for the following objects:

2.6.2.1 Button state

2.6.2.2 Switch lock control

2.6.2.3 Switch lock status

2.6.3 Two RJ-45 ports for connection to DLM local network.

2.6.4 Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

2.6.5 Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.

2.6.5.1 Individual button function may be configured to Toggle, On only or Off only.

2.6.5.2 Individual scenes may be locked to prevent unauthorized change.

2.6.5.3 Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

2.6.5.4 Ramp rate may be adjusted for each dimmer switch.

2.6.5.5 Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.7 DLM Handheld User Interface Remotes:

2.7.1 Battery-operated handheld devices in 1, 2 and 5 button configurations for remote switching or dimming control. Remote controls shall include the following features:

2.7.1.1 Two-way infrared (IR) transceiver for line of sight communication with DLM local network within up to 30 feet.

2.7.1.2 LED on each button confirms button press.

2.7.1.3 Load buttons may be bound to any load on a load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.

2.7.1.4 Inactivity timeout to save battery life.

2.7.2 Provide with a wall mount holster and mounting hardware for each remote.

2.8 Digital Daylighting Sensors:

2.8.1 Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.

2.8.1.1 Closed loop sensors measure the ambient light in the space and control a single lighting zone.

2.8.1.2 Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.

2.8.1.3 Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone

2.8.2 Digital daylighting sensors shall include the following features:

2.8.2.1 Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.

2.8.2.2 Sensor light level range shall be from 1-6,553 foot-candles (fc).

2.8.2.3 Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).

2.8.2.4 For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.

2.8.2.5 For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.

2.8.2.6 Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.

2.8.2.7 Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.

2.8.2.8 Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.

2.8.2.9 Configuration LED status light on device that blinks to indicate data transmission.

2.8.2.10 Status LED indicates test mode, override mode and load binding.

2.8.2.11 Recessed switch on device to turn controlled load(s) ON and OFF.

2.8.2.12 BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:

2.8.2.12.1 Light level

2.8.2.12.2 Day and night setpoints

2.8.2.12.3 Off time delay

2.8.2.12.4 On and off setpoints

2.8.2.12.5 Up to three zone setpoints

2.8.2.12.6 Operating mode - on/off, bi-level, tri-level or dimming

2.8.2.13 One RJ-45 port for connection to DLM local network.

2.8.2.14 A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick. Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick. Mounting brackets are compatible with J boxes and wall mounting.

2.8.2.15 Any load or group of loads in the room can be assigned to a daylighting zone

2.8.2.16 Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).

2.8.2.17 All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

2.9 Handheld Configuration Tools:

2.9.1 Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.

2.9.2 Features and functionality of the wireless configuration tool shall include but not be limited to:

2.9.2.1 Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.

2.9.2.2 High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.

2.9.2.3 Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.

2.9.2.4 Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.

2.9.2.5 Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

2.9.2.6 Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.

2.9.2.7 Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.

2.9.2.8 Verify status of building level network devices.

2.10 LMCP Lighting Control Panels and LMZC Zone Controller:

2.10.1 Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated

on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:

2.10.1.1 Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.

2.10.1.2 Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.

2.10.1.3 Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:

2.10.1.3.1 Removable, plug-in terminal blocks with connections for all low voltage terminations.

2.10.1.3.2 Individual terminal block, override pushbutton, and LED status light for each relay.

2.10.1.3.3 Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.

2.10.1.3.4 Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.

2.10.1.3.5 True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.

2.10.1.3.6 Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

2.10.1.3.7 Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

2.10.1.3.8 Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

2.10.1.3.9 Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

2.10.1.3.9.1 Electrical:

2.10.1.3.9.2 30 amp ballast at 277V

2.10.1.3.9.3 20 amp ballast at 347V

2.10.1.3.9.4 20amp tungsten at 120V

2.10.1.3.9.5 30 amp resistive at 347V

2.10.1.3.9.6 1.5 HP motor at 120V

2.10.1.3.9.7 14,000 amp short circuit current rating (SCCR) at 347V

2.10.1.3.9.8 Relays shall be specifically UL 20 listed for control of plug-loads

2.10.1.3.10 Mechanical:

2.10.1.3.10.1 Replaceable, 1/2 inch KO mounting with removable Class 2 wire harness.

2.10.1.3.10.2 Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.

2.10.1.3.10.3 Dual line and load terminals each support two #14 - #12 solid or stranded conductors.

2.10.1.3.10.4 Tested to 300,000 mechanical on/off cycles.

2.10.1.4 Isolated low voltage contacts provide for true relay status feedback and pilot light indication.

2.10.1.5 Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

2.10.1.6 Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.

2.10.1.7 Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.

2.10.1.8 Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 tnetworked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.

2.10.1.8.1 Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.

2.10.1.8.2 Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

2.10.1.8.3 Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:

2.10.1.8.3.1 Scheduled ON / OFF

2.10.1.8.3.2 Manual ON / Scheduled OFF

2.10.1.8.3.3 Astro ON / OFF (or Photo ON / OFF)

2.10.1.8.3.4 Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

2.10.1.8.3.5 User interface shall be a portable IR handheld remote control capable of programming any panel in the system.

2.10.1.8.3.6 Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.

2.10.1.8.3.7 Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

2.10.1.8.3.8 Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

2.10.1.9 Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.

2.10.1.9.1 Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

2.10.1.9.2 Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

2.10.1.9.3 Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

2.10.1.9.4 Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.

2.10.1.9.5 The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

2.10.1.9.6 Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

2.10.1.9.6.1 Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.

2.10.1.9.6.2 Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.

2.10.1.9.6.3 Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.

2.10.1.9.6.4 Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

2.10.1.9.6.5 Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

2.10.1.9.6.6 BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and

after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)

2.10.1.9.6.7 Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

2.10.1.9.6.8 Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

2.10.1.9.6.9 In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:

2.10.1.9.6.10 Use the same intelligence board as the LMCP relay panel.

2.10.1.9.6.11 Shall not include relay driver boards or relays.

2.10.1.9.6.12 Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.

2.10.1.9.6.13 Tub shall have two interior KOs to allow installation of Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.

2.10.1.9.6.14 All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

2.10.1.9.7 To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.

2.10.2 User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:

2.10.2.1 Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.

2.10.2.2 Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.

2.10.2.3 Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.

2.10.2.4 Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.

2.10.2.5 Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.

2.10.2.6 Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.

2.11 Emergency Lighting Control Devices:

2.11.1 Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

2.11.1.1 120/277 volts, 50/60 Hz, 20 amp ballast rating

2.11.1.2 Push to test button

2.11.1.3 Auxiliary contact for remote test or fire alarm system interface.

3 EXECUTION

3.1 Preparation:

3.1.1 Do not begin installation until measurements have been verified and work areas have been properly prepared.

3.1.2 If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 Installation:

3.2.1 Install system in accordance with the approved system shop drawings and manufacturer's instructions.

3.2.2 Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.

3.2.2.1 If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.

3.2.2.2 Install all room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty.

3.2.2.3 Low voltage wiring topology must comply with manufacturer's specifications.

3.2.2.4 Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.

3.2.3 All line voltage connections shall be tagged to indicate circuit and switched legs.

3.2.4 Test all devices to ensure proper communication.

3.2.5 Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.

3.2.6 Provide written or computer-generated documentation on the configuration of the system including room by room description including:

3.2.6.1 Sensor parameters, time delays, sensitivities, and daylighting setpoints.

3.2.6.2 Sequence of operation, (e.g. manual ON, Auto OFF. etc.)

3.2.6.3 Load Parameters (e.g. blink warning, etc.)

3.2.7 Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.

3.2.8 Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.

3.2.9 All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.

3.2.10 Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.

3.2.11 Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.

3.3 Field Quality Control:

3.3.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.

3.3.2 Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

3.3.2.1 Verify Class I and II wiring connections are terminated properly by validating system performance.

3.3.2.2 Set IP addresses and other network settings of system front end hardware per facilities IT instructions.

3.3.2.3 Verify / complete task programming for all switches, dimmers, time clocks, and sensors.

3.3.2.4 Verify that the control of each space complies with the Sequence of Operation.

3.3.2.5 Correct any system issues and retest..

3.3.3 Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:

3.3.3.1 Date of test or inspection.

3.3.3.2 Loads per space, or Fixture Address identification.

3.3.3.3 Quantity and Type of each device installed

3.3.3.4 Reports providing each device's settings.

3.4 Demonstration and Training:

3.4.1 Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:

3.4.1.1 Confirmation of entire system operation and communication to each device.

3.4.1.2 Confirmation of operation of individual relays, switches, and sensors.

3.4.1.3 Confirmation of system Programming, photocell settings, override settings, etc.

3.4.1.4 Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.

3.5 Product Support and Service:

3.5.1 Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes the following:

1.2.1.1 Interior lighting fixtures with lamps and ballasts.

1.2.1.2 Lighting fixtures mounted on exterior building surfaces.

1.2.1.3 Emergency lighting units.

1.2.1.4 Exit signs.

1.3 Quality Assurance

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

1.3.2 Comply with NFPA 70 and NFPA 101.

1.4 Coordination

1.4.1 Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.5 Approval Submittals:

1.5.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of lighting fixture scheduled.

1.5.1.1 Arrange data in the order as they appear in the Lighting Fixture Schedule.

1.5.1.2 Include with each light fixture product data the ballast and lamp product data for that particular fixture. This information must accompany the light fixture product data.

1.6 O&M Data Submittals:

1.6.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

2 PRODUCTS

2.1 Manufacturers

2.1.1 Provide as indicated in the Lighting Fixture Schedule.

2.2 Fixtures and Components, General

2.2.1 Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

2.2.2 LED Fixtures: Comply with LM-80-08.

2.2.3 Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

2.2.3.1 Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.

2.2.3.2 Charger: Fully automatic, solid-state type with sealed transfer relay.

2.2.3.3 Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.2.3.4 Shall have Self Verification and Test capability installed.

2.3 Emergency Lighting Units - Battery Type:

2.3.1 General: Self-contained units complying with UL 924.

2.3.1.1 Battery: Sealed, maintenance-free, lead-acid type with minimum 5-year nominal life and special warranty.

2.3.1.2 Charger: Fully automatic, solid-state type with sealed transfer relay.

2.3.1.3 Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.3.1.4 Output for a minimum of 90 minutes during battery operation.

2.3.1.5 Wire Guard: Where indicated, heavy-chrome-plated wire guard protects lamp heads or fixtures.

2.3.1.6 Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.3.1.7 Shall have Self Verification and Test capability installed.

2.4 Emergency Lighting Fixtures - Battery Type:

2.4.1 Internal Type: Self-contained, modular, battery-inverter unit factory mounted within fixture body. Comply with UL 924.

2.4.1.1 Emergency Connection: Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.

2.4.1.2 Night Light Connection: Operate continuously.

2.4.1.3 Test Switch and Light-Emitting-Diode Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

2.4.1.4 Battery: Sealed, maintenance-free, nickel-cadmium type with minimum seven-year nominal life.

2.4.1.5 Charger: Fully automatic, solid-state, constant-current type.

2.4.1.6 Minimum 50% of fixture's normal lumen output for a minimum of 90 minutes depending upon light source type and quantity.

2.4.1.6.1 Linear fluorescent lamps shall deliver 1400 lumen output for a minimum of 90 minutes depending

upon lamp type and quantity. Compact fluorescent lamps shall deliver 525-750 lumens for a minimum of 90 minutes (PLT-26W/4P shall deliver 525 lumens, PLT-32W/4P shall deliver 700 lumens and PLT -42W/4P shall deliver 750 lumens).

2.4.1.7 Approved manufacturers are Bodine, Beghelli and Emergi-lite.

2.4.1.8 In exterior locations, provide equipment capable of operating at temperatures from 0° F to 130°F.

2.5 LED Fixtures:

2.5.1 Warranty: Minimum 5 years.

2.5.2 Lifetime/Lumen Maintenance: Minimum 50,000 hour lifetime at 70% lumen maintenance.

2.5.3 Interior fixtures shall have a CRI of at least 80.

2.6 Fixture Support Components

2.6.1 Comply with Division 26 Section "Basic Electrical Materials and Methods" for channel- and angle-iron supports and nonmetallic channel and angle supports.

2.6.2 Single-Stem Hangers: ½-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

2.6.3 Twin-Stem Hangers: Two, ½-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

2.6.4 Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated, 12 gage (2.68 mm).

2.6.5 Wires For Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

2.6.6 Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.

2.6.7 Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.6.8 Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

2.6.9 Chain Support: Use chains as recommended by the fixture manufacturer.

2.7 Finishes

2.7.1 Fixtures: Manufacturers' standard, unless otherwise indicated.

2.7.1.1 Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.

2.7.1.2 Metallic Finish: Corrosion resistant.

3 EXECUTION

3.1 Fixture Installation

3.1.1 Set lighting fixtures plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secure in accordance with manufacturers' directions and approved drawings.

3.1.2 Mounting heights specified or indicated shall be to bottom of fixture for ceiling-mounted fixtures and to center of fixture for wall-mounted fixtures. Obtain approval of the exact mounting for lighting

fixtures on the job before installation is commenced and, where applicable, after coordinating with the type, style, and pattern of the ceiling or wall being installed.

3.1.3 2' and larger recessed and semi-recessed fixtures shall be supported by a minimum of two support wires at opposite corners of the fixture connected directly to the structure above. Additionally, for recessed fixtures, provide support clips securely fastened to ceiling grid members, a minimum of one at or near each corner of each fixture.

3.1.4 For downlights and fixtures smaller than 2', provide a minimum of one wire per fixture and connect directly to the structure above.

3.1.5 Do not support fixtures by ceiling acoustical panels. Where fixtures of sizes less than the ceiling grid are indicted to be centered in the acoustical panel, support such fixtures independently or with at least two metal channels spanning, and secured to the ceiling tees. Provide wires for lighting fixture support per above.

3.1.6 There are many types of ceiling systems available on the market and any number of these ceiling systems may be used as part of this work. Verify the types of ceiling construction before ordering fixture fabrication. Determine that suspension methods and flange arrangements for fixtures coordinate with ceiling types and their suspension systems.

3.1.7 Adjust aimable fixtures to provide required light intensities.

3.1.8 GTD: In addition to the switched normal power circuit, provide the unswitched normal power circuit and an unswitched energy circuit to the GTD.

3.1.9 Battery Units: Provide the unswitched normal power circuit to the battery unit.

3.1.10 Dimmable Fixtures: Provide 0-10 volt wires (quantity and size as required) from each dimmer to each dimmed fixture.

3.2 Connections

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

3.3 Field Quality Control

3.3.1 Inspect each installed fixture for damage. Replace damaged fixtures and components.

3.3.2 Verify normal operation of each fixture after installation.

3.3.3 Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

3.3.4 Clean all fixtures. Wipe down and remove finger prints, dust, dirt, grime, etc.

3.3.5 Lamp “Burn-in”: All non-LED lamps, at initial energization, shall be “burned-in” at 100% output for a minimum of 100 hours.

3.3.6 Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery or generator power source and retransfer to normal. Test every emergency fixture.

END OF SECTION

SECTION 27 00 00 - COMMUNICATIONS GENERAL

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 communications work as herein called for and shown on the drawings.

1.2 Related Documents:

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

1.2.2 This is a Basic Communications Requirements Section. Provisions of this section apply to work of all Division 27 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
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1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

1.2.4.4 BICSI: Building Industry Consulting Service International.

1.2.4.5 CO: Communications Outlet.

1.2.4.6 CP: Consolidation Point.

1.2.4.7 EMI: Electromagnetic Interference

1.2.4.8 FUT: Fiber under test.

1.2.4.9 LAN: Local area network.

1.2.4.10 MCE: Main Communications Equipment Room.

1.2.4.11 M/M: Multimode.

1.2.4.12 RCDD: Registered Communications Distribution Designer.

1.2.4.13 SCSC: Structured Cabling System Contractor.

1.2.4.14 S/M: Single mode.

1.2.4.15 TR: Telecommunications Room

1.2.4.16 UTP: Unshielded twisted pair.

1.2.4.17 VOIP: Voice Over Internet Protocol

1.2.4.18 WAO: Work Area Outlet.

1.2.4.19 Horizontal Cabling: The portion of the communications cabling system that extends from the work

area outlet (WAO) to the horizontal cross-connect in the TR.

1.2.4.20 Intrabuilding Backbone: The portion of the communications cabling system within a building that connects each TR to the MCE.

1.2.4.21 Interbuilding Backbone: The portion of the communications cabling system exterior to a building that connects one building's MCE to another's.

1.2.4.22 Active Equipment: The active data network and telephone system equipment will not be included as a part of this contract. The wiring infrastructure to support connectivity will be installed under this contract. The contractor shall assist providers of these systems to integrate and install as required to interface to the cabling systems installed under this contract.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale communications drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on communications drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Special Structured Cabling System Warranty:

1.9.1 See sections 271300 and 27150 for special structured cabling system warranty.

1.10 Approval Submittals:

1.10.1 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 and the following.

1.10.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.10.1.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.10.1.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.10.1.4 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.

1.10.1.5 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 cover sheet.

1.10.1.6 Submittals that include a series of fixtures or devices shall be organized by the fixture number 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.

1.10.1.7 Submittals shall be in searchable PDF format and not a scanned copy.

1.10.1.8 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.10.2 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.

1.10.3 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.

1.10.4 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 ¼" 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.

1.11 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.

1.12 O&M Data Submittals: Submit Operation and Maintenance data as called for in other sections. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 All materials and equipment shall be UL Certified, UL Listed, UL Labeled, UL Recognized, or UL Classified. The UL label shall be attached to the equipment or product.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.4 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.

2.3.5 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.

2.3.6 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:

2.3.6.1 Principal of operation.

2.3.6.2 Materials of construction or finishes.

2.3.6.3 Thickness of gauge of materials.

2.3.6.4 Weight of item.

2.3.6.5 Deleted features or items.

2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 The Contractor shall be responsible for full coordination of the communications systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any supports required for the installation of any communications equipment, fixtures or conduit shall be provided by the Contractor. Where there is no architectural/structural elements available, the Contractor shall construct support structures as required.

3.2.3 It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

3.3 Related Work:

3.3.1 All Division 01 Sections apply to all Division 27 Sections.

3.3.1.1 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

3.3.2 Perform the following as part of Division 27 work, complying with the requirements of Division 03, Concrete.

3.3.2.1 Curbs, foundations and pads for electrical equipment.

3.3.2.2 Encasement of electrical work.

3.3.2.3 Underground structural concrete to accommodate electrical work.

3.3.2.4 Rough grouting in and around electrical work.

3.3.2.5 Patching concrete cut to accommodate electrical work.

3.3.3 Refer to Division 04, Masonry for:

3.3.3.1 Patching openings to accommodate electrical work.

3.3.4 Refer to Division 05, Metals for:

3.3.4.1 Supports for electrical work.

3.3.4.2 Framing openings for electrical equipment.

3.3.5 Refer to Division 06, Wood for:

3.3.5.1 Supports for electrical work.

3.3.5.2 Framing openings for electrical equipment.

3.3.6 Division 07 - Thermal and Moisture Protection for:

3.3.6.1 Installation of all supports for electrical work.

3.3.6.2 Caulking and waterproofing of all wall and roof mounted electrical work.

3.3.6.3 Perform the following as part of Division 27 work, complying with Division 7 requirements.

3.3.6.3.1 Fire barrier penetration seals.

3.3.6.3.2 Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

3.3.7 Refer to Division 08, Doors & Windows for:

3.3.7.1 Installation of all access doors for electrical work.

3.3.8 Refer to Division 09, Finishes for:

3.3.8.1 Painting exposed conduit and equipment.

3.3.8.2 Painting structural metal and concrete for electrical work.

3.3.8.3 Painting access panels.

3.3.8.4 Colors shall be selected by the Architect for all painting of exposed electrical work unless specified herein.

3.3.8.5 Perform the following as part of Division 27 work.

3.3.8.5.1 Touch up painting of factory finishes.

3.3.9 Division 27 - Communications

3.3.9.1 Wiring raceways and cabling as indicated on the communications drawings shall be furnished and installed by the Communications Contractor, complying with the requirements of Division 26 specifications.

3.3.10 Division 28 - Electronic Safety and Security

3.3.10.1 Wiring raceways and cabling as indicated on the electronic safety & security drawings shall be furnished and installed by the Electronic Safety & Security Contractor, complying with the requirements of Division 27 specifications.

3.3.11 Division 33 - Sitework

3.3.11.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 26 05 50.

3.3.11.2 The following is part of Division 27 work.

3.3.11.2.1 Underground communications utilities.

3.4 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.5 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.

3.6 Phasing: Provide all required temporary conduit, wiring, 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.

3.7 Cutting and Patching: Contractor shall provide 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.

3.8 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.9 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 27. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

3.10 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 and leave premises free from debris and in a safe condition.

3.11 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.

3.12 Record (As Built) Drawings:

3.12.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings.

3.12.2 Upon completion of the work, record drawings shall be prepared as described in the General

Conditions, Supplementary Conditions, and Division 1.

3.12.3 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.13 Acceptance:

3.13.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.13.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.13.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.13.3.1 Submit training syllabi prior to training for owner review.

3.13.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.13.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.13.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and organized and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.13.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.13.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.13.4.1.2 Complete wiring and control diagrams.

3.13.4.1.3 Routine maintenance operations.

3.13.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.13.4.1.5 Copies of final approved version of Approval Submittals.

3.13.4.1.6 Copies of all manufacturer's warranties.

3.13.4.1.7 Copies of Test Reports and Verification Submittals.

3.13.4.2 All included information shall comply with the following:

3.13.4.2.1 Remove all non-related information from O&Ms.

3.13.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.13.5 Record Drawings: Submit "Record Drawings".

3.13.6 Control Diagrams: Laminate and mount on equipment room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Communications

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 1/12/18

SECTION: 27 13 00 / Backbone Cabling

Use whatever standard headings you want here

1. Type A
2. Type B
3. Type C
4. Type D
5. Type E

List each item separately

Typical - list mfr name & model number

General Contractor's <u>APPROVAL</u> stamp must be on this sheet.

END OF SECTION

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SECTION 27 00 10 - CODES AND STANDARDS

1 GENERAL

1.1 All work under Division 27 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 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.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

2 CODES

2.1 Florida Building Code - Building - Seventh Edition (2020).

2.2 National Electrical Code (NFPA 70) - 2017

2.3 National Fire Alarm Code (NFPA 72) - 2016

2.4 Florida Fire Prevention Code - Seventh Edition (2020).

2.4.1 Uniform Fire Code (NFPA 1) - 2018 Florida Edition

2.4.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

2.5 National Electrical Safety Code (NESC)

3 STANDARDS

3.1 All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

3.1.1 American National Standard Institutes (ANSI)

3.1.2 Institute of Electrical and Electronics Engineers (IEEE).

3.1.3 National Electrical Manufacturer's Associations (NEMA).

3.1.4 National Fire Protection Association (NFPA).

3.1.5 Occupational Safety and Health Act (OSHA).

3.1.6 Underwriter's Laboratories, Inc. (UL).

3.1.7 TIA/EIA-568-A-5 Additional Transmission Performance Specifications for 4-Pair 100 Ohm Enhanced Category 5 Cabling

3.1.8 ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard

3.1.9 ANSI/EIA/TIA-569-A Commercial Building Standard for Telecommunications Pathways and

Spaces

3.1.10 ANSI/EIA/TIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

3.1.11 ANSI/J-STD-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

3.1.12 BICSI - Telecommunications Distribution Methods Manual (TDMM), current edition.

3.1.13 SCTE - Society of Cable Television Engineers

3.1.14 University of Florida Telecommunications Standards, current edition.

END OF SECTION

SECTION 27 00 20 - CONTRACTOR QUALIFICATIONS

1 GENERAL

1.1 Related Documents:

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

1.2 Summary:

1.2.1 This Section includes Structured Cabling System Contractor qualifications.

1.3 Quality Assurance

1.3.1 Installer Qualifications:

1.3.1.1 The Structured Cabling System Contractor (SCSC) shall be regularly engaged in the layout and installation of structured cabling systems of similar size and complexity as required for this installation. The Structured Cabling System Contractor shall have successfully completed the layout, installation, testing and warranty of not less than five Structured Cabling Systems of the scope of the largest system on this project for a minimum period of three years prior to the bid date, and shall have been regularly engaged in the business of Structured Cabling Systems contracting continuously since. The Contractor shall have an existing permanent office located within 100 miles of the job site from which installation and warranty service operations will be performed.

1.3.1.2 The SCSC shall present the name and certification number of a BICSI certified Registered Communications Distribution Designer (RCDD) who is a permanent employee of the Contractor. The Contractor shall maintain this RCDD, in his permanent employment throughout this project. The RCDD shall have overall responsibility for certifying that the installed structured cabling system conforms to these contract documents.

1.3.1.3 The SCSC shall be on the current University of Florida “Pre-Qualified Low Voltage Contractors” list.

1.3.1.4 The Structured Cabling System Subcontractor’s present on site Project Manager, Fore Person, Lead Techs, and all Technicians shall be Factory Certified to install this building’s Structured Cabling system. The Structured Cabling System Subcontractor shall provide copies of all on site personnel’s Factory Certifications for the Structured Cabling System to installed in this building.

1.3.1.5 The SCSC shall have an Electrical Speciality (ES) or Electrical Contractor (EC) license.

1.4 Proof of Contractor Qualifications:

1.4.1 The SCSC shall provide the following documentation, as evidence that the requirements for SCSC qualifications listed above are satisfied.

1.4.1.1 RCDD name, BICSI certification number, and qualifications.

1.4.1.2 Factory Certifications of all onsite personnel.

2 PRODUCTS

2.1 Not applicable.

3 EXECUTION

3.1 Not applicable.

END OF SECTION

SECTION 27 05 00 - COMMUNICATIONS RELATED WORK

1 DIVISION 01 - GENERAL REQUIREMENTS

1.1 All Division 01 Sections apply to all Division 27 Sections.

1.2 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

2 DIVISION 02 - SITEWORK

2.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 26 05 50.

2.2 The following is part of Division 27 work.

2.2.1 Underground communications utilities.

3 DIVISION 03 - CONCRETE

3.1 Perform the following as part of Division 27 work, complying with the requirements of Division 03, Concrete.

3.1.1 Curbs, foundations and pads for communications equipment.

3.1.2 Encasement of communications work.

3.1.3 Underground structural concrete to accommodate communications work.

3.1.4 Rough grouting in and around communications work.

3.1.5 Patching concrete cut to accommodate communications work.

4 DIVISION 04 - MASONRY

4.1 Refer to Division 04, Masonry for:

4.1.1 Patching openings to accommodate communications work.

5 DIVISION 05 - METALS

5.1 Refer to Division 05, Metals for:

5.1.1 Supports for communications work.

5.1.2 Framing openings for communications equipment.

6 DIVISION 06 - WOOD

6.1 Refer to Division 06, Wood for:

6.1.1 Supports for communications work.

6.1.2 Framing openings for communications equipment.

7 DIVISION 07 - THERMAL & MOISTURE PROTECTION

7.1 Refer to Division 07, Thermal and Moisture Protection for:

7.1.1 Installation of all supports for communications work.

7.1.2 Caulking and waterproofing of all wall and roof mounted communications work.

7.2 Perform the following as part of Division 27 work, complying with Division 07 requirements.

7.2.1 Fire barrier penetration seals.

7.2.2 Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

8 DIVISION 08 - DOORS AND WINDOWS

8.1 Refer to Division 08, Doors & Windows for:

8.1.1 Installation of all access doors for communications work.

9 DIVISION 09 - FINISHES

9.1 Refer to Division 09, Finishes for:

9.1.1 Painting exposed conduit and equipment.

9.1.2 Painting structural metal and concrete for communications work.

9.1.3 Painting access panels.

9.2 Colors shall be selected by the Architect for all painting of exposed communications work unless specified herein.

9.3 Perform the following as part of Division 27 work.

9.3.1 Touch up painting of factory finishes.

10 DIVISION 26 - ELECTRICAL

10.1 All cabling and raceways for communications as indicated on the communications drawings shall be furnished and installed by the communications contractor, complying with the requirements of Division 26 specifications.

END OF SECTION

SECTION 27 15 00 - HORIZONTAL CABLING SYSTEM

1 GENERAL

1.1 Related Documents:

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

1.2 Summary:

1.2.1 See “University of Florida Scope Note” on drawings for actual scope of work by contractor and by UF/USI.

1.3 System Description:

1.3.1 The work consists of all labor, materials, equipment and services necessary to provide, install, test and certify a new horizontal cabling system as described in the contract documents.

1.3.2 The installation shall include all accessories and appurtenances required to provide a complete and operational system. Any materials not specifically mentioned in these specifications or not shown on the drawings, but required for a complete and finished installation shall be furnished and installed at no additional cost to the Owner.

1.3.3 The installed system shall be a complete and warranted category 6 horizontal cabling system solution with all outlet and termination hardware and cable assemblies provided by one single manufacturer. Cabling shall be by the same manufacturer or by a cable manufacturer approved by the connectivity manufacturer for that particular system solution.

1.3.4 Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the TR. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1.3.4.1 Bridged taps and splices shall not be installed in the horizontal cabling.

1.3.5 The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

1.4 System Solution:

1.4.1 Panduit PanGen 6 Enhanced.

1.4.1.1 Ortronics TechChoice.

1.4.1.2 CommScope Uniprise UltraMedia.

1.4.1.3 Leviton eXtreme.

1.4.2 Provide one of the following premium Category 6 solutions:

1.4.2.1 CommScope Systimax GigaSPEED XL.

1.5 Performance Requirements:

1.5.1 The installation shall be in compliance with the requirements of the National Electrical Code,

Standard Building Code and OSHA recommendations, and the rules, regulations and requirements of Federal Communications Commission.

1.5.2 The installation shall comply fully with all county, city, and state laws and ordinances, regulations and codes applicable to the installation.

1.5.3 Local electrical and building codes may differ with national codes. Follow the most stringent code or recommendations. Where there are instances of ambiguity, refer to the Owner/Engineer for interpretation.

1.5.4 All equipment shall be equal to or exceed the minimum requirements of NEMA, IEEE, ASME, ANSI, TIA/EIA and Underwriters' Laboratories.

1.5.5 Should any change in plans or specifications be required to comply with governmental regulations, the Contractor shall notify the Owner at the time of submitting the construction schedule.

1.5.6 All work done under this contract shall be performed in accordance with the most recent issue of the codes, standards and guidelines stated in section 27 05 00. Where there is a perceived conflict between a standard or guideline and the contract documents, the Contractor shall perform the work as directed by the Engineer.

1.5.7 General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.5.8 The entire system shall be operational at least 60 days prior to Substantial Completion to allow for testing of other systems that use this system.

1.6 Special Structured Cabling System Warranty:

1.6.1 The Contractor shall warrant the entire structured cabling system (End-to-End Certification) under the manufacturer's systems warranty for a minimum period of 15 years. The warranty will begin on the first day after final acceptance. The warranty shall include cable and connectivity components and have one point of contact for all cabling system issues. The warranty shall include materials, parts and labor. If any failure or defect occurs within the warranty period, the contractor and/or manufacturers shall remedy it within 48 hours at no cost to the owner, or any owner representative or consultant. Structured cabling systems warranty shall cover cable, connecting hardware and the labor cost for the repair or replacement.

1.7 Approval Submittals:

1.7.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product indicated.

1.8 Test Reports and Verification Submittals:

1.8.1.1 CAT 6 Permanent Link Test: Submit a written report.

1.8.2 O&M Data Submittals:

1.8.2.1 Submit as described in these specifications.

1.9 Training: Submit letter verifying that Owner training has been received as described in these specifications.

1.10 Quality Assurance:

1.10.1 Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1.10.1.1 Layout Responsibility: Preparation and planning by an RCDD.

1.10.1.2 Installation Supervision: Installation shall be under the direct supervision of a Level 2 Installer who shall be present at all times when Work of this Section is performed at Project site.

1.10.1.3 Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10.2 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.

1.10.3 Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

1.10.4 Grounding: Comply with ANSI-J-STD-607-A.

1.11 Project Conditions:

1.11.1 Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.12 Coordination:

1.12.1 Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

2 PRODUCTS

2.1 Pathways:

2.1.1 General Requirements: Comply with TIA/EIA-569-A.

2.1.2 Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

2.1.3 Inside TRs:

2.1.3.1 Support brackets with cable tie slots for fastening cable ties to brackets.

2.1.3.2 D-rings.

2.1.3.3 Straps and other devices.

2.1.3.4 Cable trays.

2.1.3.5 Ladder trays.

2.1.4 Outside TRs:

2.1.4.1 Horizontal cabling shall be routed in 1 inch or larger EMT conduit from outlet boxes to cable trays, then in cable trays to the serving TR. Outlet boxes shall be a minimum of 4 inches by 4 inches by 2 1/8 inches. Conduit materials shall be as specified in section 26 00 00.

2.1.5 Cable Trays:

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

2.1.5.1.1 Cablofil Inc.

2.1.5.1.2 Cooper B-Line, Inc.

2.1.5.1.3 Flextray.

2.1.5.1.4 Wiremold.

2.1.5.1.5 Chatsworth Products, Inc.

2.1.5.2 Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1.

2.1.5.3 Basket Cable Trays: Minimum 12 inches wide and 4 inches deep. Wire mesh spacing shall not exceed 2 inches by 4 inches. Category 6 compliant.

2.1.5.3.1 Provide all necessary transitions at 90-degree angles, tees and change of cable tray size so that the cable tray is continuous. The drawings do not reflect these requirements due to the small scale. Transitions shall also be provided at all change of elevations.

2.1.5.3.2 Supports: Cable tray shall be supported by trapeze style hanging clips on threaded rods on both sides of the tray. Center supports are prohibited. Exception: cable tray in TRs which shall be supported by wall brackets.

2.1.5.3.3 Coordinate installation with other trades to avoid conflicts prior to installation. Install as required to transition around, above or below other trades work.

2.2 UTP Cable:

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

2.2.1.1 Comm Scope

2.2.1.2 General Cable

2.2.1.3 Berk-tek

2.2.2 Category 6 Horizontal Cable:

2.2.2.1 100-ohm, four unshielded twisted pairs of 23 or 24 AWG copper, insulated solid conductors enclosed by an overall jacket.

2.2.2.2 The cable shall exceed the requirements of ANSI/TIA-568-C.2.

2.2.2.3 Riser (CMR) rated.

2.2.2.4 Cable jacket color shall be blue unless noted otherwise.

2.2.2.5 PoE compliant

2.2.2.6 Performance tested to 500 MHZ.

2.2.2.6.1 Gel filled cable to be used for all underground cabling requirements between buildings. Use Mohawk M58772 or equal to all slab on grade floor boxes.

2.3 UTP Cable Hardware:

2.3.1 General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

2.3.2 Work Area Outlets (WAOs):

2.3.2.1 Accommodate up to 6-ports per gang.

2.3.2.2 Have labels for circuit identification with a clear plastic cover and tool-less removal

2.3.2.3 Have surface mount boxes and standoff rings available for both single and double gang faceplates.

2.3.2.4 Have rear protective strain relief caps with side or rear entry, which can be installed onto cable before or after termination.

2.3.2.5 Support both T568A and T568B wiring styles.

2.3.2.6 Allow jack installation from the front or rear of the faceplate, and allow for the jack to pass through the faceplate without re-termination.

2.3.3 Copper Patch Panels:

2.3.3.1 6 port modules.

2.3.3.2 Black aluminum construction.

2.3.3.3 48 (2 RU) port configuration.

2.3.3.4 Allow terminated jacks to pass through panel for easy rearrangement without re-termination.

2.3.3.5 Have a rear wire management bar.

2.3.3.6 Provided with labels and self-adhesive clear label holders.

2.4 Category 6 UTP modular patch cable:

2.4.1 Assembly shall meet TIA/EIA-568-B.2-1 Category 6 standard, factory assembled and tested.

2.4.1.1 24 AWG stranded, 4 pair.

2.4.1.2 Gold plated plug contacts

2.4.1.3 Universal T568A/B compatibility.

2.4.1.4 Modular and snag-less 8 position plug (RJ45) on each end.

2.4.1.5 PVC jacket.

2.5 Other Equipment:

2.5.1 Grounding Products:

2.5.1.1 All grounding products used shall comply with J-STD-607A.

2.5.1.2 Cables shall be insulated (green) with stranded copper conductors.

2.5.1.3 All grounding busbar lugs shall be copper compression, 2-hole (spacing to match busbar hole spacings), long barrel with window lugs. Use stainless steel hex head screws and stainless steel lock nuts to secure lugs to busbars.

2.5.1.4 Connections other than to bushbars shall be copper compression 1-hole lugs.

2.5.2 Fire-stopping Products:

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

2.5.2.2 S.T.I.

2.5.2.3 3M.

2.5.2.4 Wiremold.

2.5.3 Cable Ties:

2.5.3.1 Provide hook and loop cable ties. Provide plenum rated where required.

2.6 Identification Products:

2.6.1 Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

3 EXECUTION

3.1 Wiring Methods:

3.1.1 Wiring Method: Install cables in raceways except within TRs. Conceal raceway and cables except in unfinished spaces.

3.1.2 Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

3.2 Installation of Pathways:

3.2.1 Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

3.2.2 Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

3.2.3 Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.2.4 Pathway Installation in TRs:

3.2.4.1 Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.

3.2.4.2 Install cable trays around perimeter of room.

3.2.4.3 Secure conduits to backboard when entering room from overhead.

3.2.4.4 Extend conduits above finished floor.

3.2.4.5 Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.2.5 Backboards: Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.3 Installation of Cables:

3.3.1 Comply with NECA 1.

3.3.2 General Requirements for Cabling:

3.3.2.1 Comply with TIA/EIA-568-B.1.

3.3.2.2 Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

3.3.2.3 Install 110-style IDC termination hardware unless otherwise indicated.

3.3.2.4 Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

3.3.2.5 Cables may not be spliced. Secure and support cables at intervals not exceeding 12 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

3.3.2.6 Prevent straining connections and prevent bending cables to smaller radii than minimums recommended by manufacturer.

3.3.2.7 Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

3.3.2.8 Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

3.3.2.9 Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.

3.3.2.10 In TRs, install a 10 foot long service loop on end of cable.

3.3.2.11 Support all cable not installed in conduit or cable tray using cable support brackets and D-rings installed on 5' 0” centers maximum spacing.

3.3.2.12 In the TRs, all cables shall be bundled and velcro tie wrapped together. Cables shall be separately bundled with like cables (e.g., multimode fiber, single mode fiber, voice backbone, horizontal cables). Velcro tie wrapping shall occur on 12 inch (6 inch for vertical cable runs) intervals throughout the TRs unless noted otherwise. Tie wraps should not bite into the cable insulation, but should form securely around the cables so as not to depress the cable.

3.3.2.13 All cables shall be neatly bundled and velcro tie wrapped down to the racks and patch panels. Group horizontal cables with not more than 24 cables per bundle.

3.3.2.14 Route cables along cable rack trays in a neat and straight order in 24 cable bundles. Use radius drop out fittings to protect cables as they drop out of cable trays or cable rack trays. Use rear of vertical cable management rails at racks to support and manage cables terminated to rear of patch panels. Maintain a neat and straight order of the cables inside the cable management rails. Adjust length of cables terminating on the rear of patch panels so that cables exit out of vertical cable management rail, fan into the proper port and are punched down in the proper order.

3.3.2.15 Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

3.3.3 UTP Cable Installation:

3.3.3.1 Comply with TIA/EIA-568-B.2.

3.3.3.2 Do not untwist UTP cables more than ½ inch from the point of termination to maintain cable geometry.

3.3.4 Category 6 Cable Length:

3.3.4.1 Prior to pulling cable carefully plan the cable route. In no case shall the cable exceed 295' in length.

Notify Engineer if problems with length are possible.

3.3.5 Separation from EMI Sources:

3.3.5.1 Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

3.3.5.2 Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

3.3.5.2.1 Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

3.3.5.2.2 Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

3.3.5.2.3 Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3.3.5.3 Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

3.3.5.3.1 Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

3.3.5.3.2 Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

3.3.5.3.3 Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

3.3.5.4 Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

3.3.5.4.1 Electrical Equipment Rating Less Than 2 kVA: No requirement.

3.3.5.4.2 Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

3.3.5.4.3 Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

3.3.5.5 Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.

3.3.5.6 Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 Firestopping:

3.4.1 Comply with TIA/EIA-569-A, Annex A, "Firestopping."

3.4.2 Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 Grounding:

3.5.1 Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

3.5.2 Comply with ANSI-J-STD-607-A.

3.5.3 Locate grounding bus bar to minimize the length of bonding conductors.

3.5.4 Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor. Do not loop grounds. Ground all racks, punchdown block towers, etc individually from busbar. Route along rack rear across runway and to busbar.

3.6 Identification:

3.6.1 Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

3.6.1.1 Administration Class: 3.

3.6.1.2 Color-code cross-connect fields and apply colors to voice and data service backboards, connections, covers, and labels.

3.6.2 See Division 27 Section Backbone Cabling System for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration including optional identification requirements of this standard.

3.6.3 Comply with requirements in Division 27 Section Backbone Cabling System.

3.6.4 Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

3.6.5 Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

3.6.6 Labels shall have an adhesive backing for permanent attachment where required.

3.6.7 All labels shall be of sufficient size. All labels shall be easily readable from floor level when viewing a backboard, panel, or communications outlet from the front.

3.6.8 All labels shall be installed straight.

3.6.9 Provide temporary labels on all horizontal cables as they are roughed-in.

3.6.10 Text shall be as large and as bold as possible.

3.6.11 Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

3.6.11.1 Cables use flexible vinyl or polyester that flexes as cables are bent.

3.6.12 The following items shall receive labeling:

3.6.12.1 Cables.

3.6.12.2 Raceways (both ends).

3.6.12.3 Patch panels.

3.6.12.4 Patch panel ports.

3.6.12.5 Firestop locations.

3.6.12.6 All other items as required per UF standards.

3.6.13 Cable and Wire Identification:

3.6.13.1 Label each cable:

3.6.13.2 Within 4 inches of each termination and tap.

3.6.13.3 Where it is accessible in a cabinet or junction or outlet box.

3.6.13.4 Elsewhere as indicated.

3.6.13.5 Label each terminal strip and screw terminal in each cabinet, rack, or panel.

3.6.13.6 Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.

3.6.13.7 Label each unit and field within distribution racks and frames.

3.6.13.8 Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.

3.7 Constructing Names:

3.7.1 Construct names per UF standards.

3.8 Field Quality Control:

3.8.1 Perform the following tests and inspections.

3.8.1.1 Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.

3.8.1.2 Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

3.8.2 UTP Cable Field Tests:

3.8.2.1 Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

3.8.2.1.1 Wire map.

3.8.2.1.2 Length (physical vs. electrical, and length requirements).

3.8.2.1.3 Insertion loss.

3.8.2.1.4 Near-end crosstalk (NEXT) loss.

3.8.2.1.5 Power sum near-end crosstalk (PSNEXT) loss.

3.8.2.1.6 Equal-level far-end crosstalk (ELFEXT).

3.8.2.1.7 Power sum equal-level far-end crosstalk (PSELFEXT).

3.8.2.1.8 Return loss.

3.8.2.1.9 Propagation delay.

3.8.2.1.10 Delay skew.

3.8.3 Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

3.8.4 Remove and replace cabling where test results indicate that they do not comply with specified requirements.

3.8.5 End-to-end cabling will be considered defective if it does not pass tests and inspections.

3.8.6 Prepare test and inspection reports.

3.8.7 Submit all cable test results in electronic format for Fluke Linkware.

3.8.8 Submit all Horizontal Cable Records in Excel format.

3.9 Owner Personnel Training:

3.9.1 After Substantial Completion but before Final Completion, provide on-site training to Owner personnel on the operation and use of the system. Provide one copy of the training material.

3.9.2 The Engineer shall be notified prior to training and may participate in training at their discretion.

3.9.3 The instruction shall be presented in an organized and professional manner by personnel who are thoroughly familiar with the structured cabling system installation and who have demonstrated knowledge in the data equipment specified for installation under the project.

3.9.4 Training shall include a "walk-through" of the systems to identify and locate closets, panels, and important system components, a discussion of overall system concepts and configuration, specific instruction in labeling, a review of the as-built drawings, a review of the system verification and acceptance documentation, and guidelines for basic trouble-shooting and operation of the structured cabling system.

3.9.5 Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

3.9.6 The Contractor shall provide documentation of training (including names of personnel present at each training session) to the Engineer at the Final Completion Inspection. The documentation shall be signed-off by the Owner. The documentation shall be three-hole punched and ready for insertion in the O&M manuals.

END OF SECTION

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SECTION 28 00 00 - ELECTRONIC SAFETY & SECURITY GENERAL

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 & security work as herein called for and shown on the drawings.

1.2 Related Documents:

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

1.2.2 This is a Basic Electronic Safety & Security Requirements Section. Provisions of this section apply to work of all Division 28 Sections.

1.2.3 Review all other contract documents to be aware of conditions affecting work herein.

1.2.4 Definitions:

1.2.4.1 Provide: Furnish, install, and test, complete and ready for intended use.

1.2.4.2 Furnish: Supply and deliver to project site, ready for subsequent requirements.
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1.2.4.3 Install: Operations at project site, including unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, test complete ready for intended use, and similar requirements.

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

1.4 Verification of Owner's Data: Prior to commencing work the Contractor shall satisfy himself as to the accuracy of all data indicated on the Drawings and/or provided by the Owner. Should the Contractor discover any inaccuracies, errors, or omissions in the data, he shall immediately notify the Engineer. Commencement of work by the Contractor 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 Scope: Extent of work is indicated in the Drawings, Schedules, and 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:

1.7.1 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 from full compliance of work indicated on any of the Drawings or in any Section of the Specifications. Report conflicts prior to start of work.

1.7.2 Verify all field dimensions and locations of equipment to insure close, neat fit with other trades' work. Make use of all Contract Documents and approved shop drawings to verify exact dimension and locations. Do not scale electronic safety & security drawings, rely on dimensions shown on architectural or structural drawings.

1.7.3 Coordinate work in this Division in proper sequence to insure that the total work is completed

within Contract time schedule and with minimum cutting and patching.

1.7.4 Locate all equipment, materials, and apparatus symmetrical with architectural elements. Install to exact height and locations when shown on architectural drawings. When locations are shown only on electronic safety & security drawings, be guided by architectural details and conditions existing at job and correlate this work with that of others.

1.7.5 Install work as required to fit structure, avoid obstructions, and retain clearance, headroom, openings and passageways. Cut no structural members without written approval from Engineer or Architect.

1.7.6 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 by the Engineer to resolve discrepancies.

1.7.7 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 material, equipment and accessories with sufficient space for installing and servicing. Contractor is responsible for accuracy of his measurements and shall not order materials or perform work without verification. No extra compensation will be allowed because field measurements vary from the dimensions on the Drawings. If field measurements show that equipment or material will not fit, the 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:

1.8.1 Owner reserves the 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.

1.8.2 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.

1.9 Approval Submittals:

1.9.1 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 and the following.

1.9.1.1 Submittals shall be properly organized in accordance with the approved submittal control log.

1.9.1.2 Submittals for each individual specification section shall contain all of the equipment, materials, etc. required for that particular specification section. Multiple submittals for a single specification section are not allowed (exception: Shop Drawings may be separate from Product Data submittals). Incomplete submittals will be returned as Rejected.

1.9.1.3 Submittals shall not include items from more than one specification section in the same submittal package unless approved in the submittal control log.

1.9.1.4 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.

1.9.1.5 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 cover sheet.

1.9.1.6 Submittals that include a series of fixtures or devices shall be organized by the fixture number 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.

1.9.1.7 Submittals shall be in searchable PDF format and not a scanned copy.

1.9.1.8 Submittals shall ONLY contain relevant product data. Circle, highlight or otherwise identify all items relevant to the project. Remove or strikeout irrelevant product data.

1.9.2 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.

1.9.3 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.

1.9.4 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 ¼" 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. See section 3 of this specification.

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:

2.2.1 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.

2.2.2 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.

2.2.3 All materials and equipment shall be UL Certified, UL Listed, UL Labeled, UL Recognized, or UL Classified. The UL label shall be attached to the equipment or product.

2.2.4 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.

2.2.5 A service organization with personnel and spare parts shall be available within two hours for each type of equipment furnished.

2.2.6 Install in accordance with manufacturer's recommendations. Place in service by a factory trained representative where required.

2.2.7 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 meet detailed specifications and that size and arrangement of equipment are suitable for installation.

2.2.8 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 equipment and materials in accordance with the written description of each item and with the intent of the Drawings and Specifications.

2.3 Requests for Substitution:

2.3.1 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.

2.3.2 Requests by Contractor for substitution will be considered only when reasonable, timely, fully documented, and qualifying under one or more of the following circumstances.

2.3.3 Required product cannot be supplied in time for compliance with Contract time requirements.

2.3.4 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.

2.3.5 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.

2.3.6 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:

2.3.6.1 Principal of operation.

2.3.6.2 Materials of construction or finishes.

2.3.6.3 Thickness of gauge of materials.

2.3.6.4 Weight of item.

2.3.6.5 Deleted features or items.

2.3.6.6 Added features or items.

2.3.6.7 Changes in other work caused by the substitution.

2.3.6.8 Performance curves.

2.3.7 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.

2.4 Prior Approval

2.4.1 Prior Approval shall be required for any manufacturer other than those listed for all specified items in the Drawings and Specifications. Submit all requests for approval of the alternate manufacturer's products two weeks prior to bid opening. Approval will be in the form of an Addendum to the Specifications and Drawings. Clearly indicate all differences between the specified and proposed product following the guidelines for "Request for Substitution" herein. This requirement may be waived if, in the opinion of the engineer, it is in the best interest of the Owner. Submittals received after the award of the bid for equipment that has not been Prior Approved are subject to immediate rejection.

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:

3.2.1 The Contractor shall be responsible for full coordination of the electrical systems with shop drawings of the building construction so the proper openings and sleeves or supports etc., are provided for conduit, devices, or other equipment passing through slabs or walls.

3.2.2 Any supports required for the installation of any electrical equipment, fixtures or conduit shall be provided by the Contractor. Where there is no architectural/structural elements available, the Contractor shall construct support structures as required. For example, an exterior panelboard may require embedded concrete support posts and galvanized unistruts.

3.2.3 It shall be the Contractor's responsibility to see that all equipment that may require maintenance and operation are made easily accessible, regardless of the diagrammatic location shown on the Drawings.

3.2.4 All connections to fixtures and equipment shown on the Drawings shall be considered diagrammatic unless otherwise indicated by a specific detail on the Drawings. The actual connections shall be made to fully suit the requirements of each case and adequately provide for servicing.

3.2.5 The Contractor shall protect equipment and fixtures at all times during storage and construction. He shall replace all equipment and fixtures which are damaged as a result of inadequate protection.

3.2.6 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.

3.2.7 Start of work will be construed as acceptance of suitability of work of others.

EDIT LIST AS REQUIRED

3.3 Related Work:

3.3.1 All Division 01 Sections apply to all Division 28 Sections.

3.3.1.1 Coordinate for all cutting and patching. Contractor shall review all cutting and patching required prior to bidding and shall coordinate installation.

3.3.2 Perform the following as part of Division 28 work, complying with the requirements of Division 03, Concrete.

3.3.2.1 Curbs, foundations and pads for electrical equipment.

3.3.2.2 Encasement of electrical work.

3.3.2.3 Underground structural concrete to accommodate electrical work.

3.3.2.4 Rough grouting in and around electrical work.

3.3.2.5 Patching concrete cut to accommodate electrical work.

3.3.3 Refer to Division 04, Masonry for:

3.3.3.1 Patching openings to accommodate electrical work.

3.3.4 Refer to Division 05, Metals for:

3.3.4.1 Supports for electrical work.

3.3.4.2 Framing openings for electrical equipment.

3.3.5 Refer to Division 06, Wood for:

3.3.5.1 Supports for electrical work.

3.3.5.2 Framing openings for electrical equipment.

3.3.6 Division 07 - Thermal and Moisture Protection for:

3.3.6.1 Installation of all supports for electrical work.

3.3.6.2 Caulking and waterproofing of all wall and roof mounted electrical work.

3.3.6.3 Perform the following as part of Division 28 work, complying with Division 7 requirements.

3.3.6.3.1 Fire barrier penetration seals.

3.3.6.3.2 Caulking and related shielding around ducts and pipes for sound isolation and attenuation.

3.3.7 Refer to Division 08, Doors & Windows for:

3.3.7.1 Installation of all access doors for electrical work.

3.3.8 Refer to Division 09, Finishes for:

3.3.8.1 Painting exposed conduit and equipment.

3.3.8.2 Painting structural metal and concrete for electrical work.

3.3.8.3 Painting access panels.

3.3.8.4 Colors shall be selected by the Architect for all painting of exposed electrical work unless specified herein.

3.3.8.5 Perform the following as part of Division 28 work.

3.3.8.5.1 Touch up painting of factory finishes.

3.3.9 Division 28 - Electronic Safety and Security

3.3.9.1 Wiring raceways and cabling as indicated on the electronic safety & security drawings shall be furnished and installed by the Electronic Safety & Security Contractor, complying with the requirements of Division 26 specifications.

3.3.10 Division 33 - Sitework

3.3.10.1 Specific requirements for excavation and backfill for underground conduit are contained in Section 26 05 50.

3.3.10.2 The following is part of Division 28 work.

3.3.10.2.1 Underground electronic safety and security utilities.

3.4 Service Coordination: Prior to commencing any work, coordinate with utility/service provider to ensure proper services are available to project when needed.

3.5 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.

3.6 Phasing: Provide all required temporary conduit, wiring, 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.

3.7 Cutting and Patching: Contractor shall provide 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.

3.8 Equipment Setting: Bolt equipment directly to concrete pads or foundations, using hot-dipped galvanized anchor bolts, nuts and washers. Level equipment.

3.9 Painting: Touch-up factory finishes on equipment located inside and outside shall be done under Division 28. Obtain matched color coatings from the manufacturer and apply as directed by manufacturer. If corrosion is found during inspection on the surface of any equipment, clean, prime, and paint, as required.

3.10 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 and leave premises free from debris and in a safe condition.

3.11 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.

3.12 Record (As Built) Drawings:

3.12.1 During the progress of the work the Contractor shall record on their field set of Drawings the corrections, variations, and deviations for systems which are not installed exactly as shown on the Contract Drawings. Contractor shall review the record (asbuilt) drawings with the Engineer and the field conditions at every regular job-site meeting. Pay requests will not be processed if record drawings are not accurate and current.

3.12.2 For projects done in Revit, the A/E will update the Revit model for all field orders, change directives, ASIs or other Owner directed revisions. The Contractor shall update the Revit model with all shop drawing data, manufacturer model numbers and field adjustments. True Revit files are required. Imported files such as PDF, linked files, print clouds and IFC files are not acceptable.

3.13 Acceptance:

3.13.1 Acceptance will be on the basis of tests and inspections of the work. A representative of the firm which performed the testing shall be in attendance to assist during inspection. Contractor shall furnish necessary electricians to operate system, make any necessary adjustments and assist with final inspection.

3.13.2 Punch List: Submit written confirmation that all punch lists have been checked and the required work completed.

3.13.3 Instructions & Training: At completion of the work, provide a competent and experienced person who is thoroughly familiar with the project, for a period deemed necessary by the Owner to instruct permanent operating personnel in the operation of equipment and control systems. This is in addition to any specific equipment operation and maintenance training.

3.13.3.1 Submit training syllabi prior to training for owner review.

3.13.3.2 Provide video recording of Owner instruction and provide a copy of the video recording in appropriate format to the Owner with the O&M Manual.

3.13.3.3 All Owner training shall be scheduled and completed prior to substantial completion. The Owner may reserve the right to reschedule any training or divide any training session for a period of 1 year after building occupancy.

3.13.4 Operation and Maintenance Manuals: Prepare O&M Manuals as required by Division 1 (if applicable) and as described herein. Furnish searchable PDF manuals with Table of Contents, organized, and organized and tabbed by specification section. Submit prior to Substantial Completion Inspection.

3.13.4.1 Each individual tabbed specification section of the O&M Manual shall contain all applicable information for that particular section, including, but not limited to:

3.13.4.1.1 Detailed operating instructions and instructions for making minor adjustments.

3.13.4.1.2 Complete wiring and control diagrams.

3.13.4.1.3 Routine maintenance operations.

3.13.4.1.4 Manufacturer's catalog data, service instructions, and parts lists for each piece of operating equipment.

3.13.4.1.5 Copies of final approved version of Approval Submittals.

3.13.4.1.6 Copies of all manufacturer's warranties.

3.13.4.1.7 Copies of Test Reports and Verification Submittals.

3.13.4.2 All included information shall comply with the following:

3.13.4.2.1 Remove all non-related information from O&Ms.

3.13.4.2.2 Manuals shall only include information that is project specific and shall only be relevant to the operation and maintenance of the equipment installed.

3.13.5 Record Drawings: Submit "Record Drawings".

3.13.6 Control Diagrams: Laminate and mount on equipment room wall.

This is a sample cover sheet. Use one for each Approval Submittal.

PROJECT NAME
PROJECT NUMBER

SAMPLE APPROVAL SUBMITTAL

ARCHITECT/ENGINEER: Moses & Associates, Inc.

CONTRACTOR: XYZ Construction

SUBCONTRACTOR: ABC Electric

SUPPLIER: 123 Supply

MANUFACTURER: Various

DATE: 1/12/18

SECTION: 28 13 00 / Access Control System

Use whatever standard headings you want here

1. Type A
2. Type B
3. Type C
4. Type D
5. Type E

List each item separately

Typical - list mfr name & model number

General Contractor's APPROVAL stamp must be on this sheet.

END OF SECTION

SECTION 28 00 10/CODES AND STANDARDS

1 GENERAL

1.1 All work under Division 28 shall be constructed in accordance with the codes and standards listed herein. The design has been based on the requirements of these codes and standards. While it is not the responsibility of the Contractor to verify that all work called for complies with these codes and standards, he shall be responsible for calling to the Engineer's attention any details on the Drawings and/or Specifications that are not in conformance with these or other codes and standards. Current issue of code applies unless specifically noted otherwise.

1.2 Comply with regulations and codes of suppliers of utilities.

1.3 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.

1.4 Where code conflict exists, generally the most stringent requirement applies.

1.5 Codes or standards applying to a specific part of the work may be included in that section.

2 CODES

2.1 Florida Building Code - Building - Seventh Edition (2020).

2.2 National Electrical Code (NFPA 70) - 2017

2.3 National Fire Alarm Code (NFPA 72) - 2016

2.4 Florida Fire Prevention Code - Seventh Edition (2020).

2.4.1 Uniform Fire Code (NFPA 1) - 2018 Florida Edition

2.4.2 Life Safety Code (NFPA 101) - 2018 Florida Edition.

2.5 National Electrical Safety Code (NESC)

3 STANDARDS

3.1 All electrical materials, installation and systems shall meet the requirements of the following standards, including the latest addenda and amendments:

3.1.1 American National Standard Institutes (ANSI)

3.1.2 Illuminating Engineering Society (IES).

3.1.3 Institute of Electrical and Electronics Engineers (IEEE).

3.1.4 National Electrical Manufacturer's Associations (NEMA).

3.1.5 National Fire Protection Association (NFPA).

3.1.6 Occupational Safety and Health Act (OSHA).

3.1.7 Underwriter's Laboratories, Inc. (UL).

END OF SECTION

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SECTION 28 13 00/ACCESS CONTROL SYSTEM

1 GENERAL

1.1 Related Documents:

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

1.1.2 Comply with all requirements of Division 28 Section, Electronic Safety & Security General.

1.1.3 Coordinate with Division 8 (Doors).

1.2 Summary:

1.3 System Description:

1.3.1 The work consists of all labor, materials, software licenses, programming documents, equipment and services necessary to provide, install, test and certify a new Access Control System (ACS) as described in the contract documents.

1.3.2 This specification defines the requirements for the layout, installation, and programing documents for a fully functional ACS specified herein and on the drawings.

1.3.3 The installation shall include all hardware and software licensing required to provide a complete and fully operational system. Any materials not specifically mentioned in these specifications, but required for a finished and functional installation shall be furnished and installed at no additional cost to the Owner.

1.3.4 The University has standardized on the LENEL OnGuard Pro system for their ACS. The ACS contractor shall configure system hardware to communicate to the campus access control system.

1.3.5 All software licensing shall be provided as required for a complete system including, but not limited to any software licensing required for component integration to the campus access system.

1.4 Codes and Standards:

1.4.1 All work done under this contract shall be performed in accordance with the most recent issue of the following codes and standards.

1.4.2 All card access devices shall be compliant with the current Florida Building Code.

1.4.3 University of Florida Design and Construction Standards Division 28 - Electronic Safety and Security

1.4.4 UL 50: Enclosures for Electrical Equipment

1.4.5 UL 1076: Standard for Safety for Proprietary Burglar Alarm Units and Systems

1.4.6 UL 294: Access Control System Units.

1.5 Definitions:

1.5.1 ANSI American National Standards Institute

1.5.2 ASCII American Standard Code for Information Interchange

1.5.3 AWG American Wire Gauge

1.5.4	BPS	Bits Per Second
1.5.5	CCTV	Closed Circuit Television
1.5.6	CPU	Central Processing Unit
1.5.7	DPS	Door Position Switch
1.5.8	FCC	Federal Communications Commission
1.5.9	GUI	Graphical User Interface
1.5.10	ID	Identification
1.5.11	I/O	Input /Output
1.5.12	NEC	National Electrical Code
1.5.13	NEMA	National Electrical Manufacturers Association
1.5.14	ODBC	Open Database Connectivity
1.5.15	PIN	Personal Identification Number
1.5.16	PTZ	Pan/Tilt/Zoom
1.5.17	RAID	Redundant Array of Independent Disks
1.5.18	REX	Request to Exit
1.5.19	SCS	Security Control System
1.5.20	SDRAM	Synchronized Dynamic Random Access Memory
1.5.21	STP	Shielded Twisted Pair
1.5.22	UL	Underwriters Laboratories, Inc.
1.5.23	UPS	Uninterrupted Power Supply
1.5.24	USB	Universal Serial Bus
1.5.25	UTP	Unshielded Twisted Pair

1.6 Glossary:

1.6.1 Access Group: A logical group of card readers (terminals) which may be connected to one or more sub-controllers and which represent a collection of readers for which a particular cardholder may have access privileges.

1.6.2 Access Mode: The mode of operation in which the security control system shall only annunciate tamper and trouble conditions at a monitored point. Alarm conditions shall not be annunciated in this mode. Also referred to as alarm shunting.

1.6.3 Acknowledge: The action taken by a security control system operator to indicate that he/she is aware of a specific alarm or tamper state.

1.6.4 Action Messages: A set of instructions automatically provided to the operator when an alarm condition is generated.

1.6.5 Advisory: A message provided by the security control system to the operator to inform him/her of a condition as reported by the security control system.

1.6.6 Alarm Condition: A change of state, as sensed by the security control system, indicating that the security control system has detected a condition which its sensors were designed to detect.

1.6.7 Cardholder: A person who has been issued a valid access card or key fob.

1.6.8 Card Reader: A device usually located at access points, designed to decode the information contained on or within a card key credential for the purposes of making an access decision or for identity verification.

1.6.9 Clear: The action taken by a security control system operator to respond to an alarm condition or advisory so that other alarms may be serviced or so that other actions may be taken.

1.6.10 Download: To send computer data from the File Server to a controller for the purposes of making access decision without the intervention of the File Server.

1.6.11 Facility Code: A coded number, in addition to the individual card number, stored within each card key that uniquely identifies the facility at which the card is valid. This feature prevents cards from one facility from being used at another facility that has a similar access control system.

1.6.12 File Server: Primary host computer in the networked security system which maintains the access control system database.

1.6.13 Line Supervision: The monitoring of an electrical circuit via electrical and software systems to verify the electrical integrity of the supervised circuit.

1.6.14 Off-line: A condition in which a controller(s) is not in communication with the File Server. In the off-line mode, the controller continues to make access decisions and process alarms according to the information stored at its local database.

1.6.15 Password: A combination of numbers or letters unique to security control system operator which defines commands and data fields he/she may view, edit, or command.

1.6.16 Reset: A command or feedback signal that indicates that a monitored point has returned to its normal state after having transferred to the alarm or trouble state.

1.6.17 Secure Mode: The normal state of an alarm input point from which it will be monitored for change of state to either an alarm or trouble condition.

1.6.18 Secured Area: A physical location within the facility to which access is controlled by one or more card readers.

1.6.19 Secured side: Side of a security door where a higher security level needs to be granted for a user to be authorized to be on that side of the door.

1.6.20 Tamper: A condition within the circuitry of a monitored point which indicates the electrical integrity of that sensing circuit has been compromised.

1.6.21 Time Interval: A time stamp of one start time and one stop time within a time period. Time Period: A user programmable period of time made up of days of the week and hours in the day.

1.6.22 Trouble: A condition within the circuitry of a monitored point which indicates that an equipment malfunction, single break, single fault or a wire-to-wire short exists.

1.6.23 Unsecured side: Side of a security door where a lower security level needs to be granted for a user to be authorized to be on in that side of the door.

1.6.24 User Definable: An attribute of a security control system function that may be easily tailored by the System Administrator.

1.6.25 Workstation: A personal computer connected to the main security control system File Server via a local area network connection for the purpose of programming the system and responding to alarms.

1.7 Quality Assurance

1.7.1 Installer Qualifications: Installer must have at least two Lenel access control trained and certified technicians onsite when system installation work is being performed. Technetium Lenel certification documentation shall be provided to PPD-ITS prior to any onsite work being performed. These technicians must also be trained and experienced to work with Sargent and Von Duprin electrified locking hardware and must be able to understand and configure complex input, output, timer logic and have experience troubleshooting impedance issues as well as door hardware installation issues.

1.7.2 The security contractor shall be an experienced firm regularly engaged in the layout and installation of systems of similar size and complexity as required for this installation. The Contractor shall be an authorized LENEL dealer and provide this documentation. The Contractor shall have successfully completed the layout, installation, programing, testing and warranty of not less than five systems of similar scope of this project for a minimum period of three years prior to the bid date, and shall have been regularly engaged in the business of access control and security contracting. The Contractor shall have an existing permanent office located within 125 miles of the University of Florida Gainesville campus from which installation and warranty service operations will be performed.

1.7.2.1 Along with a project security bid a security contractor shall be required to provide example as-built and wiring diagram documents used on systems of similar size and scope. (100+ reader installations). The contractor will need to provide photos of previous installations depicting wiring methods and installation workmanship.

1.7.2.1.1 Example as-built floorplan layouts with reader, control board and camera layouts.

1.7.2.1.2 Example wiring diagrams developed by the firm depicting the integration of an access system with another building control system. i.e. ADA, Intrusion system, intercom, man-trap. Etc.

1.7.2.1.3 Ten photos of installation enclosures depicting use of wire management and wire labeling.

1.7.2.1.4 Three reference customers of similar size and scope (100+ reader installation) with contact information and willing to correspond with PPD-ITS.

1.7.3 Installers Not Approved:

1.7.3.1 ADT

1.7.3.2 Sound Ideas

1.7.3.3 Convirgent Security Systems

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of product.

1.8.2 Shop Drawings:

1.8.2.1 Submit a "point to point" wiring diagram with the connections to the equipment and terminal cabinets. Indicate the equipment numbers, terminal numbers, wire numbers, and wire colors. The submittal shall be made for approval prior to the installation of the wiring in the raceways.

1.9 Test Reports and Verification Submittals:

1.9.1 Field Test: Provide a written report.

1.9.2 Final Acceptance Test: Provide a written report.

1.10 O&M Data Submittals:

1.10.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.11 All system training shall be provided by PPD-ITS and will be scheduled between the building occupant and PPD-ITS.

1.12 As-Built Documents:

1.12.1 As-built documents shall be provided as part of this contract. As-built drawings shall be a complete set of REVIT floor plans drawings, riser diagrams, and wiring details indicating the layout and interconnection of the system. The original project floor plan disk shall be obtained from the consulting engineer. All cable routings and elevation of each outlet, tie, and riser cable terminations shall be required. All addendum information or project revision resulting in drawing changes that occur during the construction period shall be documented and included in the as-built material. All required as-built documentation is mandatory and shall be required prior to project closeout. A complete set of prints with all changes shall be submitted to the Engineer's for review. Upon completion of the Engineer's review, the Contractor shall electronically provide updated electronic drawing files uploaded to the project SharePoint site or using a file transfer service. This information must include final As-Built conditions and the Engineer's review comments if any.

1.13 Total System Responsibility:

1.13.1 Any additional equipment and accessories required for the installation and operation of a complete and functional system shall be provided and the cost borne by the Contractor.

1.13.2 The Contractor shall have total system responsibility to assure a "turnkey" operational system including any necessary interfaces, power supplies, cabling, control interfaces, etc.

1.13.3 The Contractor shall remain the owner of all equipment provided under this contract and is responsible for all risk of loss or damage to the equipment from any source up to and including the date and time of Substantial Completion by the Owner. After the date of Substantial Completion, the Owner shall assume full ownership of the equipment.

1.14 Warranty:

1.14.1 System Warranty: The contractor shall warranty all parts and labor for a period of one (1) year from the date of acceptance by the University. The contractor shall provide a list of products, product serial numbers, a list of each components manufacture warranty and the starting date of the components warranty. The contractor shall provide both warranty and non-warranty service within four (4) hours of notification of a problem. The contractor shall be able to perform any and all repairs to the system within 2 hours.

2 Products

2.1 Manufacturers: Subject to compliance with requirements, provide products by the following:

2.1.1 Surveillance Cameras: Camera model must be compatible with current version of Lenel LNVR software.

2.1.1.1 Axis

2.1.2 ACS Main Headend Equipment:

2.1.2.1 Lenel

2.1.3 ACS Readers:

2.1.3.1 Lenel

2.1.3.2 HID

2.2 Access Control System Reader Licensing: The Contractor shall provide reader licensing for LENEL OnGuard Enterprise system readers in increments of 32 reader licenses to meet the number of reader hardware installed. The ACS must be designed and licensed to perform on all features and functions. These system functions shall include alarm monitoring, cardholder management and system administration.

2.3 Intelligent System Controller (ISC):

2.3.1 An Intelligent System Controller (ISC) shall link the security software to all other field hardware components (Card Readers and Input Control Modules). The ISC shall provide full distributed processing of access control & alarm monitoring operations. Access levels, hardware configurations, and programmed alarm outputs assigned at the administration client workstation shall be downloaded to the ISC, which shall store this information and function using its high speed, local 32-bit microprocessor. All access granted/denied decisions must be made at the ISC to provide fast responses to card reader transactions. A fully configured ISC with 64 card readers shall require less than one-half (0.5) seconds to grant access to an authorized cardholder or deny access to an unauthorized cardholder. The ISC shall also provide an interface between the software and authentication devices to provide control for two entries. All inputs to the ISC shall be supervised with two 1 kilohms resistors or pre manufactured resistors packs. The supervision shall be installed at the device being monitored. i.e. Door contacts need to be supervised at the contact, door locks need to be supervised at the lock body, duress buttons need to be supervised at the button. Resistor Packs shall be George Risk Industries (GRI) 6644 (2 - 1K @ 1/8 watt).

2.3.2 The Access Control Field Hardware shall provide a network-based ISC. The network ISC shall be an Ethernet-based panel that has the capability to reside on a local area network (LAN) or wide area network (WAN) without connectivity to a PC serial port. The ISC shall utilize an off-the-shelf network connectivity device to deliver this functionality. Network-based Intelligent System Controllers shall be able to communicate back with the database server through industry-standard switches and routers and shall not have to be on the same subnet.

2.3.3 The ISC is required to continue to function normally (stand-alone) in the event that it loses communication with the security system software. While in this off-line state, the ISC is required to make access granted/denied decisions and maintain a log of the events that have occurred. Events shall be stored in local memory, and then uploaded automatically to the database after communication has been restored.

2.3.4 Approved equipment, no substitutions or equivalents:

2.3.4.1 Lenel LNL-2220

2.3.5 If an ISC requires a separate communications module for Ethernet connectivity, the communications module shall be provided with the ISC. Communications modules that use a

separate power supply not backed by batteries are not acceptable.

2.4 Reader Interface Module (RIM):

2.4.1 The Reader Interface Module shall provide an interface between the ISC and authentication devices. The RIM shall operate with any authentication device that produces a standard Wiegand communication output. The RIM shall include six Form-C relays rated at 5A @ 30VDC for door contact supervision, dedicated tamper and power failure circuits, onboard jumpers for 5VDC or 12VDC reader support, and bicolor status LED support. The RIM hardware shall be UL 294 listed and CE approved. All inputs to the RIM shall be supervised with two 1 kilohms resistors or pre manufactured resistors packs. The supervision shall be installed at the device being monitored. i.e. Door contacts need to be supervised at the contact, door locks need to be supervised at the lock body, duress buttons need to be supervised at the button. Resistor Packs shall be George Risk Industries (GRI) 6644 (2 - 1K @ 1/8 watt).

2.4.2 Approved equipment, no substitutions or equivalents:

2.4.2.1 Lenel LNL-1320

2.5 Input Control Module (ICM):

2.5.1 The Input Control Module shall monitor all system alarm inputs.

2.5.2 The ICM shall provide UL 1076 Grade AA alarm input zones to monitor and report line fault conditions, alarm conditions, power faults and tampers. When an alarm input is activated, the associated alarm condition shall be reported to the ISC, database and subsequently to an alarm monitoring client workstation. Status LEDs shall provide information about the sixteen alarm zone inputs, cabinet tamper, and power fault. For each status LED, a slow flash shall imply a "No Alarm" condition, a fast flash shall indicate a "Circuit Fault ", and a steady LED shall indicate an "Alarm Condition" (open, short, ground). All inputs to the ICM shall be supervised with two 1 kilohms resistors or pre manufactured resistors packs. The supervision shall be installed at the device being monitored. i.e. Door contacts need to be supervised at the contact, door locks need to be supervised at the lock body, duress buttons need to be supervised at the button. Resistor Packs shall be George Risk Industries (GRI) 6644 (2 - 1K @ 1/8 watt).

2.5.3 All inputs to ICM shall be wired with end-of-line resistors for supervisory conditions.

2.5.4 Approved equipment, no substitutions or equivalents:

2.5.4.1 Lenel LNL-1100

2.6 Output Control Module (OCM):

2.6.1 The Output Control Module shall incorporate Output Relays that are capable of controlling a corresponding output device upon any input activation or on command from the security system and pulsing for a predetermined duration. The duration shall be programmable for each individual relay.

2.6.2 Each OCM shall provide Form-C relays rated at 5A @ 30VDC. The OCM shall control the relays by digital communication. Upon an input from the ICM or command from the System Operator, the ICM shall transmit an activating signal to a corresponding relay. The OCM shall be UL 294 and CE Certified.

2.6.3 Approved equipment, no substitutions or equivalents:

2.6.3.1 Lenel LNL-1200.

2.7 Security Equipment Enclosures:

2.7.1 All enclosures shall be provided with a key-lockable door and all doors shall be keyed alike. All enclosures shall include a tamper switch for direct supervision of the cabinet door. Cabinet openings shall initiate an alarm condition to the security monitoring system. Hinged NEMA 1 cover enclosures shall be used for indoors application and weatherproof NEMA 4X enclosures shall be used for all outdoor applications. All enclosures shall be UL listed and approved.

2.7.2 For enclosures with a power supply for ISC, RIM, ICM or OCM modules, see paragraph “Power Supply for Access Control Panels”.

2.8 Magnetic Door Position Switch (DPS):

2.8.1 The standard recessed door position switch shall be GE Security 1078C series or approved equivalent. The contact and the magnet shall be hermetically sealed in a one piece, molded, flame retardant ABS plastic housing for maximum strength and durability. The contact and magnet shall snap-lock into a predrilled 3/4" diameter hole. Color of the housing shall be off white, gray, or mahogany, and shall be provided in the appropriate color to match the door and doorframe. The magnet shall be made of Alnico V. For delayed egress doors with card access, and monitored only doors, the recessed door position switch shall be a GE Security 1076D (DPDT). Balanced Magnetic Switches (BMS) or contacts shall be the only surface mount acceptable and shall only be used in high security applications.

2.8.2 The standard roll-up door position switch shall be GE Security 2200 series or approved equivalent. Contact is to be mounted at the top of the door to reduce damage or alignment issues to the contact.

2.8.3 No surface mounted contacts.

2.8.4 On double doors where each leaf has a DPS, the devices shall be wired in series. Both sensors shall report alarms to the system as a single alarm point.

2.9 Tamper Switch:

2.9.1 All security enclosures and power supplies closures shall include a tamper switch for direct supervision of the cabinet door. Any opening of these doors shall initiate an alarm condition to the security monitoring system. All tamper contacts shall be a reed actuated self-adjusting plunger style switch. Tamper contact provided by the manufacturer with the enclosure of the device shall be used.

2.9.2 Tamper switches shall be wired as to report separate alarms to the system for each panel. All cabinet tampers switches need to be wired to independent Lenel inputs, no daisy chaining tampers.

2.9.3 The tamper switch shall be a Amseco PSW-1 or approved equivalent.

2.10 Storefront Mounting Boxes:

2.10.1 Storefront boxes shall be used when the wall adjacent to an access controlled door is not within 36 inches. Storefront mounting boxes shall be mounted on the side of the storefront frame on the strike side of a single door or the right unsecure side of a double door. The storefront reader box shall be a Protocase 37429-2.

2.11 Duress/Panic Buttons:

2.11.1 All Campus system duress/ panic buttons shall be of the two button squeeze type and shall be resettable buy a manufacture supplied key. The reset key shall be supplied to PPD-ITS at the time of its installation. The panic button shall be an Ademco 268.

2.12 Proximity Smart Card Readers:

2.12.1 The proximity smart card reader for use throughout this facility shall be a switch plate style reader in a low profile weatherized polycarbonate housing suitable for mounting in either an indoor or outdoor environment. The reader shall be constructed of a polycarbonate material sealed to a NEMA rating of 4X IP65. The reader shall contain an integral magnet for use with an external magnetic reed switch to provide tamper protection when connected to an external alarm. The reader shall be UL/C 294 listed and shall conform to FCC and ISO standards. The reader shall operate at a frequency of 125 KHz and all RF data transmitted between this device and the smart card shall be encrypted for additional protection using a secure algorithm. The reader shall provide an audiovisual indication to signify access granted or access denied. This operation shall be displayed by a high intensity LED light bar which shall change from red, amber, or green based on the status of the operation. The housing shall mount on an industry standard single gang electrical junction box. It shall have a read range of 9 inches when used with a standard proximity access card. The proximity card reader shall be a HID R40 or approved equivalent.

2.12.2 All ADA access doors shall have a long-range card reader. The long-range card reader shall be a HID Maxiprox or approved equivalent. All long-range card readers shall be provided with a linear power supply.

2.12.3 Prior to ordering any card readers, obtain written verification of the color preference, model and style requirements. This selection shall be coordinated through the architect, UF PPD ITS, and consulting engineers so that the visual impacts can be evaluated.

2.13 Proximity Smart Cards:

2.13.1 Access cards and/or key fobs shall be purchased through the HID Corporate 1000 program with the facility code assigned to University of Florida. The contractor shall coordinate the purchase of access cards and key fobs through UF PPD ITS.

2.14 Electronic Locking Technology - Provided by Division 8:

2.14.1 The door contractor will provide and install all electric locking hardware with associated high inrush power supplies if required by the hardware's manufacturer. The security contractor will provide all necessary wire and cable, low voltage power supplies, terminate all connections, and shall interface this equipment with the access system, integrated ADA entries and if necessary fire alarm contractor provided fire release relays.

2.14.2 All electrified access controlled door hardware will not have the ability to be left in the unlocked state. All electrified hardware specified and installed shall not have the ability to be cylinder or hex key dogged. All hardware will shall be provided with night-latch or storeroom functionality where lock returns can only return to the locked position once the key is removed.

2.15 Power Supply - Door Locking Hardware:

2.15.1 The low voltage power supply shall convert a 115 VAC 60 Hz input to a continuously supplied current of 24 VDC. The power supply shall be UL listed, NFPA compliant, and have multiple class 2 rated outputs. The power supply shall be housed in NEMA 1 hinged cover enclosures where mounted indoors and when approved by PPD-ITS outdoor fully weatherproof NEMA 4 enclosures. All enclosure doors shall be key lockable, keyed alike, and shall include a tamper switch for monitoring by the security system. Any cabinet opening shall initiate an alarm condition to the security monitoring system. The low voltage power supplies for the security system shall be Altronix model Maximal77D or an approved equivalent.

2.15.2 Power supplies for delayed egress panic devices and electric latch retraction type locks shall be provided by the door hardware contractor if required by the door hardware manufacturer. This required device has been specified under Division 8.

2.15.3 Power supplies for regular locking hardware, delayed egress panic devices and electric latch

retraction type locks shall be installed next to access control panels in a dedicated security room or telecom room.

2.15.4 Maintenance free batteries shall be provided with all power supplies for locking hardware. Batteries shall be sized to allow at least 4 hours of power backup. All power supplies shall be monitored for low battery and loss of AC power through the access control system.

2.15.5 All power supplies shall be installed with means of disconnect from line power. The preferable method of disconnect is through a breaker in an electrical panel.

2.15.6 High in-rush power supplies can only be used to power two delayed egress or high in-rush latch retractions devices at a time and with use of a relay control board. The high in-rush power supply for these high in-rush devices shall be a Von Duprin PS914-2RS-BBK-KL or an approved equivalent.

2.15.7 All electrified lock hardware shall use intermediate access power controllers to provide power to each lock. Access power controllers shall have independent Relay and PTC protected outputs to engage electrified door hardware. Access power controllers shall be Altronix or ACM4CB or ACM8CB.

2.16 Power Supply for Access Control Panels:

2.16.1 The low voltage power supply shall convert a 115 VAC 60 Hz input to a continuously supplied current of 24 VDC. The power supply shall be UL listed, NFPA compliant, and have multiple class 2 rated outputs. The power supply shall be housed in NEMA 1 hinged cover enclosures where mounted indoors and when approved by PPD-ITS outdoor fully weatherproof NEMA 4 enclosures. All enclosure doors shall be key lockable, keyed alike, and shall include a tamper switch for monitoring by the security system. Any cabinet opening shall initiate an alarm condition to the security monitoring system. The low voltage power supplies for the security system shall be Altronix model Maximal77D or an approved equivalent.

2.16.2 Power supplies for access control panels shall be installed next to access control panels in a dedicated security room or telecom room.

2.16.3 Maintenance free batteries shall be provided with all power supplies for access control panels. Batteries shall be sized to allow at least 4 hours of power backup. All power supplies shall be monitored for low battery and loss of AC power through the access control system.

2.16.4 All power supplies shall be installed with means of disconnect from line power. The preferable method of disconnect is through a breaker in an electrical panel.

2.16.5 All access controller boards shall be powered through a power distribution module. Each control boards must be powered from a single output separately. Power distribution modules shall have independent PTC protected outputs to power access control boards. Access power controllers shall be Altronix or PD4ULCB, PD8ULCB or PD16WCB.

2.17 Surge Protection:

2.17.1 All security components installed outdoors or exposed to lighting shall be provided with surge and lighting protection. Provide UL listed multi-stage protection on all low voltage and signal transmission lines. All 120 VAC surge suppression devices shall be EDCO HSP121BT-1RU or an approved equivalent. For low voltage connections provide DTK-2MHLPF series with base DTK-MB surge suppressors manufactured by DITEK or an approved equivalent. For RS-485 or RS-422 connections provide DTK-2MHTP series with base DTK-MB manufactured by DITEK or an approved equivalent.

2.18 Cables for Access Control:

2.18.1 Cables for un-powered security sensors shall have the following specification:

2.18.1.1 Minimum cable gauge: AWG 20

2.18.1.2 Number of conductors: 2, stranded conductors

2.18.1.3 Conductor type: Bare copper

2.18.1.4 Cable insulation: Color coded PVC

2.18.1.5 Conductor insulation colors: Black and red.

2.18.1.6 Voltage rating: 300V

2.18.1.7 Cable shield: No cable shields

2.18.2 Cables for powered security sensors shall have the following specifications:

2.18.2.1 Minimum cable gauge: AWG 20

2.18.2.2 Number of conductors: 4, stranded conductors

2.18.2.3 Conductor type: Bare copper

2.18.2.4 Cable insulation: Color coded PVC

2.18.2.5 Conductor insulation colors: Black, red, white and green.

2.18.2.6 Voltage rating: 300V

2.18.2.7 Cable shield: No cable shields

2.18.3 Cables for access control readers shall have the following specifications:

2.18.3.1 Minimum cable gauge: AWG 22

2.18.3.2 Number of conductors: 6, stranded conductors

2.18.3.3 Conductor type: Tinned copper

2.18.3.4 Cable insulation: Color coded PVC

2.18.3.5 Conductor insulation colors: Black, red, white, green, orange (or brown) & blue.

2.18.3.6 Voltage rating: 300V

2.18.3.7 Cable shield: Aluminum/polyester foil (overall) with an AWG 24 tinned copper drain wire

2.18.4 Cables for RS-232, RS-422 or RS-485 control lines shall have the following specifications:

2.18.4.1 Minimum cable gauge: AWG 24

2.18.4.2 Number of conductors: 2-paired, stranded conductors

2.18.4.3 Conductor type: Tinned copper

2.18.4.4 Cable insulation: Polyethylene

2.18.4.5 Conductor insulation colors: White-blue, blue-white, white-orange & orange- white

2.18.4.6 Voltage rating: 300V

2.18.4.7 Cable shield: Aluminum/polyester foil (overall), a tinned copper braid (90% coverage) and a AWG 24 tinned copper drain wire.

2.18.4.8 Nominal characteristic impedance: 120 Ohms

2.18.4.9 Nominal capacitance: 12.8 pF/ft.

2.18.4.10 Nominal delay: 1.6 ns/ft.

2.18.4.11 Nominal attenuation: 0.6 dB/100 ft @ 1 MHz

2.18.5 Cables for door locks and low voltage power supplies shall have the following specifications:

2.18.5.1 Minimum cable gauge: AWG 18

2.18.5.2 Number of conductors: 2, stranded conductors

2.18.5.3 Conductor type: Bare copper

2.18.5.4 Cable insulation: PVC

2.18.5.5 Conductor insulation colors: Black and red.

2.18.5.6 Voltage rating: 300V

2.18.5.7 Cable shield: No cable shields

2.18.6 Cable gauge: All cable gauges shall be estimated as to allow a maximum of 5% voltage drop from the source to the load. Sizes given previously are only minimum gauges accepted. The contractor shall always estimate proper values.

2.18.7 Cable jackets: All cable jackets shall be suitable for the environment on which the cables will be installed. Use plenum rated cables when cables are installed in plenum spaces. Use riser rated cables when cables are installed through floor sleeves. Use cable jackets with water-blocking material when installed in underground conduits

2.18.8 Acceptable manufacturers: Belden, Alpha Wire Company, General Cable, Honeywell and West Penn Wire.

2.18.9 UTP Category cables and fiber optic cables: for specifications on all UTP paired category cables and fiber optic cables the contractor shall follow all requirement on UF Telecommunications Standards (http://net-services.ufl.edu/infrastructure/)

2.18.10 Access Control Cable Installation

2.18.10.1 All access control cabling shall be installed in conduit or cable tray. Free wiring or j-hooks are not acceptable. All conduit must be installed following the same restrictions as electrical conduit such as no more than 360 degrees between pull boxes or devices. All conduit must allow for cabling to be reinstalled through regular cable pulling methods. Wire fill of conduit must not exceed 80% of internal dimension of the conduit.

2.18.10.2 Storefront Cable Installation. All access control cable shall be installed to allow for the reinstalled of the cable without any disassembly of the storefront. Conduits within the storefront shall terminate within three inches from an access control device if an electrical box cannot be installed. (Door contact or card reader). Cables must have the ability to be reinstalled by use of an electrical fish tape without splicing any cable. Cable cannot be installed as the storefront is being constructed. Cabling may only use immediate door jamb portion of the storefront as a

wire way and can only include a single bend such as a corner between an electric power transfer and the same door's position switch (door contact). If storefront is used as a wire way in this scenario, the conduit bend must be completely open and free of burs or sharp edges at the bend or joint.

2.18.10.3 Cable Labeling: All access control inputs and outputs must be labeled at three inches from the point where they are connected to access controller, power supply equipment and any other control type device such as power distribution, multi-relay control boards, relays and timers,. The labeling must be printed on a 1 inch industrial label maker and instead by wrapping around the cable. Wrapping around a cable and leaving a flag is not acceptable.

2.18.10.4 Cable Label Text: All cable labels shall include the following information

2.18.10.4.1 Door room number as indicated on floor plan or cabinet or enclosure number.

2.18.10.4.2 Type of input or output (RTE-Request to Exit, DPS-Door position switch, Lock, Sounder, Card Reader, ADA panic strip, 24VDC Constant, Battery Fail, Cabinet Tamper, etc.

2.18.10.5 Enclosure Label, Access Controller: All access controller related enclosures shall include the following information, affixed to the exterior top right corner of the enclosure door.

2.18.10.5.1 Enclosures Major Purpose: Access Control, Elevator control, ADA control, etc.

2.18.10.5.2 Enclosures Minor Purpose: Address range of control boards contained.

2.18.10.6 Enclosure Label, Power Supply: All access control power supplies shall include the following information, affixed to the top right corner of the enclosure door.

2.18.10.6.1 Enclosures Major Purpose: Panel Power supply, Lock power supply or dedicated door power supply.

2.18.10.6.2 Enclosures Minor Purpose: Address range of control boards powered, Address range of door locks powered or address of dedicated door powered.

2.18.10.7 Power Supply Electrical Feed Circuit Label: All access control power supplies shall include the following information, affixed to the interior top right corner of the enclosure.

2.18.10.7.1 Electrical Panel: The electrical panel that feeds the power supply.

2.18.10.7.2 Electrical Breaker: The electrical circuit breaker that feeds the power supply.

2.18.10.8 Enclosure Label Other: All access control related enclosures shall include the following information.

2.18.10.8.1 Enclosures Major Purpose: ADA integration, Interlock control and Elevator Control.

2.18.10.8.2 Enclosures Minor Purpose: address of dedicated device/s controlled.

2.18.10.9 Board Labeling: All access control boards shall be labeled on their CPU chip and if equipped Output relay. The label shall have the following information, CPU label: Address: UF segment Number and board address i.e SSS-BB.

2.18.10.9.1 Relay label related door: Door Number as indicated on floor plan.

2.18.10.9.2 Relay purpose: Lock, Sounder, Strobe, Elevator Floor, Device trigger, Device reset, LED trigger, Intrusion panel trigger.

2.18.10.10 Backup Battery Labeling: All access control power supply backup batteries shall be labeled with the following information.

2.18.10.10.1 Date put into service: Month/Year or MM/YYYY.

2.19 Fire Alarm Interface: A fire alarm interface shall be required at door locking power supplies for doors that require this unlock by code. The interface shall be configured to unlock fail-safe type locks during a fire alarm condition as required by code. Configure to break power feeds to associated door locks. Non-fail safe locks shall continue to function normally during a fire alarm condition. ACS contractor shall coordinate interface with fire alarm system provider and local authority having jurisdiction (AHJ).

2.20 Door Types:

2.20.1 Door Type E-1 (Single, emergency-only exit with delayed egress, non-ADA):

2.20.1.1 Door type: Single leaf, non-ADA

2.20.1.2 Door mode: Emergency only.

2.20.1.3 Devices on secured side:

2.20.1.3.1 By door hardware contractor: One (1) Power transfer, one (1) UL listed delayed egress panic device, (1) High inrush power supply and fire interface board (if high inrush device used).

2.20.1.3.2 By security contractor: One (1) Door position switch, two (2) available auxiliary reader board inputs for door status and delayed egress alarm indication, (1) auxiliary output relay connection from Access Control System to reset the delayed egress panic device remotely.

2.20.1.3.3 By fire alarm contractor: A Form-C relay for fire alarm release located in security room or telecom room and interfaced with the panic devices power supply.

2.20.1.4 Devices on unsecured side:

2.20.1.4.1 By door hardware contractor: None.

2.20.1.4.2 By security contractor: None.

2.20.1.5 Door operation:

2.20.1.5.1 From the secured side, after pressing the panic device for more than 3 seconds the panic device shall go into an irreversible process that unlocks the door after 30 seconds. The door shall be opened by mechanical means by pressing the panic bar after the 30 seconds.

2.20.1.5.2 From the unsecured side, the door cannot be opened.

2.20.1.6 Key override: Key override will be provided in the built-in key switch in the panic devices.

2.20.1.7 Fire alarm release: The door shall be unlocked immediately upon activation of the sprinkler system, a heat detector or no more than 2 smoke detectors in the building.

2.20.1.8 Alarm reset and door relock: Panic device shall be reset and re-armed after momentary activation of the key switch. This same action shall be possible from a single click command from any access control workstation with access to this door.

2.20.1.9 Reported Alarms:

2.20.1.9.1 Door forced open.

2.20.1.9.2 Irreversible process started at the exit device.

2.20.2 Door Type E-2 (Double, emergency-only exit with delayed egress, non-ADA) :

2.20.2.1 Door type: Double leaf, non-ADA

2.20.2.2 Door mode: Emergency only

2.20.2.3 Devices on secured side:

2.20.2.3.1 By door hardware contractor: One (2) Power transfer, one (2) UL listed delayed egress panic device, (1) High inrush power supply and fire interface board (if high inrush device used).

2.20.2.3.2 By security contractor: One (2) Door position switch, (2) available auxiliary reader board input for door status and delayed egress alarm indication (door status and egress alarm for both doors are wired as a pair of inputs), (1) auxiliary output relay connection from Access Control System to reset the delayed egress panic device remotely.

2.20.2.3.3 By fire alarm contractor: A Form-C relay for fire alarm release located in security room or telecom room and interfaced with the panic devices power supply.

2.20.2.4 Devices on unsecured side:

2.20.2.4.1 By door hardware contractor: None.

2.20.2.4.2 By security contractor: None.

2.20.2.5 Door operation:

2.20.2.5.1 From the secured side, after pressing any of the panic devices for more than 3 seconds both panic devices shall go into an irreversible process that unlocks both leaves after 30 seconds. Door shall be opened by mechanical means by pressing the panic bar after the 30 seconds.

2.20.2.5.2 From the unsecured side, the door cannot be opened.

2.20.2.6 Key override: Key override will be provided in the built-in key switch in the panic devices.

2.20.2.7 Fire alarm release: Both leaves shall be unlocked immediately upon activation of the sprinkler system, a heat detector or no more than 2 smoke detectors in the building.

2.20.2.8 Alarm reset and door relock: Panic devices shall be reset and re-armed after momentary activation of the key switch. This same action shall be possible from a single click command from any access control workstation with access to this door.

2.20.2.9 Reported Alarms:

2.20.2.9.1 Door forced open, either leaf as one alarm.

2.20.2.9.2 Irreversible process started at the exit device, either leaf as one alarm.

2.20.3 Door Type EO-1 (Single, controlled entry with electric trim, free exit, emergency and operational, non-ADA):

2.20.3.1 Door type: Single leaf, non-ADA

2.20.3.2 Door mode: Emergency and Operational door.

2.20.3.3 Devices on secured side:

2.20.3.3.1 By door hardware contractor: One (1) Power transfer, one (1) panic device with REX switch and electric trim and no mechanical dogging and one (1) door closer.

2.20.3.3.2 By security contractor: One (1) Door position switch and no mechanical dogging and one (1) door closer.

2.20.3.3.3 Devices on unsecured side: By door hardware contractor: None.

2.20.3.3.4 By security contractor: One (1) reader, as indicated in floor plans.

2.20.3.4 Door operation:

2.20.3.4.1 From the secured side, the door shall be opened by mechanical means by pressing the panic bar. Activation of the built-in request to exit switch in the panic bar shall bypass all door alarms for a fixed period of time.

2.20.3.4.2 From the unsecured side, the door shall be unlocked by releasing the lock in the trim after a valid transaction at the reader. Door alarms shall be bypassed for a fixed period of time.

2.20.3.5 Key override: The use of a valid key in the lock's cylinder shall retract the lock's latch/rods and allow the door to be opened, but if used without a valid reader transaction, a door forced open alarm shall be initiated. Key shall not unlock the lock (night latch).

2.20.3.6 Fail mechanism: The door lock shall be fail-secure.

2.20.3.7 Reported Alarms:

2.20.3.7.1 Door forced open.

2.20.3.7.2 Invalid, lost or stolen card presented at the reader.

2.20.3.7.3 Door held open. Contractor to coordinate with the UF PPD ITS held open time on a per door basis.

2.20.4 Door Type EO-2 (Double, controlled entry with electric trim, free exit, emergency and operational, non-ADA):

2.20.4.1 Door type: Double leaf, one leaf active for entry, both leaves active for exit. Non-ADA

2.20.4.2 Door mode: Emergency and Operational door.

2.20.4.3 Devices on secured side:

2.20.4.3.1 By door hardware contractor: Two (2) Power transfers, two (2) panic device with REX switch and one of the panic devices with electric trim, no trim on second leaf or mechanical dogging on either panic, two (2) door closers

2.20.4.3.2 By security contractor: Two (2) Door position switch, one (1) one reader port.

2.20.4.3.3 Devices on unsecured side: By door hardware contractor: None.

2.20.4.3.4 By security contractor: One (1) reader, as indicated in floor plans.

2.20.4.4 Door operation:

2.20.4.4.1 From the secured side, the door shall be opened by mechanical means by pressing the panic bar (either leaf). Activation of the built-in request to exit switch in either panic bar shall bypass all door alarms for a fixed period of time.

2.20.4.4.2 From the unsecured side, the door shall be unlocked by releasing the lock in the trim after a valid transaction at the reader. Door alarms shall be bypassed for a fixed period of time.

2.20.4.5 Key override: The use of a valid key in the lock's cylinder shall retract the lock's latch/rods and allow the door to be opened, but if used without a valid reader transaction, a door forced open alarm shall be initiated. Key shall not unlock the lock (night latch).

2.20.4.6 Fail mechanism: Door lock shall be fail-secure.

2.20.4.7 Reported Alarms:

2.20.4.7.1 Door forced open, either leaf as one alarm.

2.20.4.7.2 Invalid, lost or stolen card presented at the reader.

2.20.4.7.3 Door held open, either leaf as one alarm. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.5 Door Type EO-5 (Single controlled entry/exit with delayed egress, non-ADA):

2.20.5.1 Door type: Single leaf, non-ADA

2.20.5.2 Door mode: Emergency and operational door.

2.20.5.3 Devices on secured side:

2.20.5.3.1 By door hardware contractor: One (1) Power transfer, one (1) UL listed delayed egress panic device with electric trim, one (1) door closer, one (1) high inrush power supply and fire interface board (if high inrush device used).

2.20.5.3.2 By security contractor: One (1) Door position switch (DPDT) and one (1) reader with keypad as indicated in floor plans, one (1) reader interface port, one (1) auxiliary reader board input delayed egress alarm indication, (1) auxiliary output relay connection from Access Control System to reset the delayed egress panic device remotely.

2.20.5.3.3 By fire alarm contractor: A Form-C relay for fire alarm release located in security room or telecom room and interfaced with the panic devices power supply.

2.20.5.4 Devices on unsecured side:

2.20.5.4.1 By door hardware contractor: None.

2.20.5.4.2 By security contractor: One reader as indicated in floor plans.

2.20.5.5 Door operation:

2.20.5.5.1 From the secured side, after pressing the panic device for more than 3 seconds the panic device shall go into an irreversible process that unlocks the door after 30 seconds. Door shall be opened by mechanical means by pressing the panic bar after the 30 seconds. Door shall also be opened by mechanical means after a valid transaction at the reader without delay and without setting off any alarms. Door alarms shall be bypassed for a fixed period of time.

2.20.5.5.2 From the unsecured side, the door shall be opened by mechanical means after a valid transaction at the reader causing the electrified trim to be released. Door alarms shall be bypassed for a fixed period of time.

2.20.5.6 Key override: Key override will be provided in the built-in key switch in the panic devices.

2.20.5.7 Fire alarm release: The door shall be unlocked immediately upon activation of the sprinkler system, a heat detector or no more than 2 smoke detectors in the building.

2.20.5.8 Alarm reset and door relock: Panic device shall be reset after a valid transaction at the reader and it shall be re-armed after the door or the door is closed. This same action shall be possible from a single click command from any access control workstation with access to this door.

2.20.5.9 Reported Alarms:

2.20.5.9.1 Door forced open.

2.20.5.9.2 Irreversible process started at the exit device.

2.20.5.9.3 Invalid, lost or stolen card presented at the reader.

2.20.5.9.4 Door held open. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.6 Door Type EO-6 (Double controlled entry/exit with delayed egress, non-ADA) :

2.20.6.1 Door type: Double leaf, non-ADA

2.20.6.2 Door mode: Emergency and operational door.

2.20.6.3 Devices on secured side:

2.20.6.3.1 By door hardware contractor: Two (2) Power transfers, , two (2) UL listed delayed egress panic device with electric trim, two (2) door closers, (1) High inrush power supply and fire interface board (if high inrush device used).

2.20.6.3.2 By security contractor: Two (2) Door position switches (DPDT) and one (1) reader with keypad as indicated in floor plans, two (2) reader interface ports, (1) auxiliary reader board input for delayed egress alarm indication (both leaves), (1) auxiliary output relay connection from Access Control System to reset the delayed egress panic device remotely.

2.20.6.3.3 By fire alarm contractor: A form C relay for fire alarm release located in security room or telecom room and interfaced with the panic devices power supply.

2.20.6.4 Devices on unsecured side:

2.20.6.4.1 By door hardware contractor: None.

2.20.6.4.2 By security contractor: One reader as indicated in floor plans.

2.20.6.5 Door operation:

2.20.6.5.1 From the secured side, after pressing either panic device for more than 3 seconds both panic devices shall go into an irreversible process that unlocks the door after 30 seconds. Doors shall be opened by mechanical means by pressing the panic bar after the 30 seconds. Doors shall also be opened by mechanical means after a valid transaction at the reader without delay and without setting off any alarms. Door alarms shall be bypassed for a fixed period of time.

2.20.6.5.2 From the unsecured side, the door shall be opened by mechanical means after a valid transaction at the reader causing the electrified trims to be released. Door alarms shall be bypassed for a fixed period of time.

2.20.6.6 Key override: Key override for delayed egress panic alarm and bar will be provided in the built-in key switch in the panic devices. Key override for trim will retract latch/rods but will not let the door be unlocked (night latch).

2.20.6.7 Fire alarm release: The door shall be unlocked immediately upon activation of the sprinkler system, a heat detector or no more than 2 smoke detectors in the building.

2.20.6.8 Alarm reset and door relock: Panic devices shall be reset after a valid transaction at the reader and it shall be re-armed after door is closed. This same action shall be possible from a single click command from any access control workstation with access to this door.

2.20.6.9 Reported Alarms:

2.20.6.10 Door forced open, either leaf as one alarm.

2.20.6.10.1 Irreversible process started at the exit device, either leaf as one alarm.

2.20.6.10.2 Invalid, lost or stolen card presented at the reader.

2.20.6.10.3 Door held open, either leaf as one alarm. Contractor to coordinate with the UF PPD ITS held open time in a per door basis.

2.20.7 Door Type EO-10 (Double mode, double reader, emergency and operational, ADA):

2.20.7.1 Door type: Double leaf, automatic door. ADA compliant

2.20.7.2 Door mode: Emergency and Operational door. Door has two operating modes, free mode and controlled mode. Modes shall be activated by a schedule.

2.20.7.3 Devices on secured side:

2.20.7.3.1 By door hardware contractor: Two (2) Power transfers, two (2) panic device with REX switch and electric latch retraction and no mechanical dogging, one (1) hardwired ADA push strip, one (1) automatic door opener (opens both leaves), one (1) High inrush power supply (if high inrush device used).

2.20.7.3.2 By security contractor: Two (2) Door position switches, one (1) proximity card reader, three (3) reader ports, two (2) isolation relays and two (2) delay timers or one (1) auxiliary output relay connection from Access Control System to trigger ADA operator, and one (1) power supply relay ports (ACMxCB output) if high inrush device is not used.

2.20.7.4 Devices on unsecured side:

2.20.7.4.1 By door hardware contractor: One (1) hardwired ADA push strip. ~~None.~~

2.20.7.4.2 By security contractor: One proximity reader and one magnetic stripe reader and one (1) ADA push button.

2.20.7.5 Door operation (Free Mode/Public Access Mode): Door hardware latches in the retracted state.

2.20.7.5.1 From the secured side, the door shall be opened by mechanical means by pressing the panic bar (either leaf). A valid transaction at the proximity reader or activation of the ADA push strip ~~button~~ shall open both leaves automatically for a fixed period of time.

2.20.7.5.2 From the unsecured side, the door shall be opened mechanically by pulling the outside trims. A valid transaction at the proximity reader or activation of the ADA push strip shall open both leaves automatically for a fixed period of time. The electric latches shall be retracted at all times during this mode.

2.20.7.6 Door operation (Controlled Mode/Secured Afterhours): Door hardware latches in the locked state.

2.20.7.6.1 From the secured side, the door shall be opened by mechanical means by pressing the panic bar (either leaf) or automatically by pressing the ADA push strip. Either action shall issue a request to exit to the system and shall bypass all door alarms for a fixed period of time. A valid transaction at the proximity reader or activation of the ADA push strip shall open both leaves automatically and bypass all door alarms for a fixed period of time.

2.20.7.6.2 From the unsecured side, the door shall be unlocked by electrically retracting the latches/rods in the panic devices after a valid transaction at the magnetic swipe reader. A valid transaction at the magnetic card reader shall also enable the ADA push strip momentary for a fixed period of time, but does not need to open the door automatically unless the ADA push strip is pressed while enabled. The door shall be unlocked by electrically retracting the latches/rods in the panic devices and then opened automatically after a valid transaction at the proximity reader. A valid transaction in any of the readers shall bypass all door alarms for a fixed period of time.

2.20.7.7 Either Mode:

2.20.7.7.1 Key override: Key cylinder on the right leaf's trim will retract latch/rods but will not let the door be unlocked (night latch).

2.20.7.8 Reported Alarms (Controlled Mode):

2.20.7.8.1 Door forced open, either leaf as one alarm.

2.20.7.8.2 Invalid, lost or stolen card presented at the reader.

2.20.7.8.3 Door held open, either leaf as one alarm. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.7.8.4 Reported Alarms (either mode):

2.20.7.8.4.1 Power supply tamper.

2.20.7.8.5 AC failure.

2.20.7.8.6 Battery low.

2.20.8 Door Type O-1 (Single controlled entry with mortise lock, free exit, non- emergency)

2.20.8.1 Door type: Single leaf

2.20.8.2 Door mode: Operational door.

2.20.8.3 Devices on secured side:

2.20.8.3.1 By door hardware contractor: One (1) Power transfer, one (1) electric mortise lock with request to exit switch built in and one (1) door closers.

2.20.8.3.2 By security contractor: One (1) Door position switch, one (1) reader interface port and one power supply relay output (ACMxCB output).

2.20.8.4 Devices on unsecured side:

2.20.8.4.1 By door hardware contractor: None.

2.20.8.4.2 By security contractor: One (1) reader, as indicated in floor plans.

2.20.8.5 Door operation:

2.20.8.5.1 From the secured side, the door shall be opened by mechanical means using the electric mortise lock. Activation of the built-in request to exit switch in the lock shall bypass all door alarms for a fixed period of time.

2.20.8.5.2 From the unsecured side, the door shall be unlocked by releasing the lock after a valid transaction at the reader. Door alarms shall by bypassed for a fixed period of time.

2.20.8.6 Key override: The use of a valid key in the lock's cylinder shall retract the lock's latch and allow the door to be opened, but if used without a valid reader transaction, a door forced open alarm shall be initiated. Key shall not unlock the lock (storeroom function).

2.20.8.7 Fail mechanism: Door lock shall be fail-secure.

2.20.8.8 Reported Alarms:

2.20.8.8.1 Door forced open.

2.20.8.8.2 Invalid, lost or stolen card presented at the reader.

2.20.8.8.3 Door held open. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.9 Door Type O-2 (Double controlled entry with mortise lock, free exit, non- emergency):

2.20.9.1 Door type: Double leaf, one active, one inactive

2.20.9.2 Door mode: Operational door.

2.20.9.3 Devices on secured side:

2.20.9.3.1 By door hardware contractor: One (1) Power transfer, one (1) electric mortise lock with request to exit switch built in, two (2) door closers, one (1) top and bottom set of automatic locking pins for inactive leaf and one (1) door coordinator.

2.20.9.3.2 By security contractor: Two (2) Door position switches, one (1) reader interface port and one power supply relay output (ACMxCB output).

2.20.9.4 Devices on unsecured side:

2.20.9.4.1 By door hardware contractor: None.

2.20.9.4.2 By security contractor: One (1) reader, as indicated in floor plans.

2.20.9.5 Door operation:

2.20.9.5.1 From the secured side, one leaf shall be opened by mechanical means using the electric mortise lock. Activation of the built-in request to exit switch in the lock shall bypass all door alarms for a fixed period of time. Second leaf shall only be opened by mechanical means after other leaf is opened.

2.20.9.5.2 From the unsecured side. one leaf shall be unlocked by releasing the lock after a valid transaction at the reader. Door alarms shall by bypassed for a fixed period of time.

2.20.9.6 Key override: The use of a valid key in the lock's cylinder shall retract the lock's latch and allow the door to be opened, but if used without a valid reader transaction, a door forced

open alarm shall be initiated. Key shall not unlock the lock (storeroom function).

2.20.9.7 Fail mechanism: Door lock shall be fail-secure.

2.20.9.8 Reported Alarms:

2.20.9.8.1 Door forced open.

2.20.9.8.2 Invalid, lost or stolen card presented at the reader.

2.20.9.8.3 Door held open, either leaf as one alarm. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.10 Door Type O-3 (Single monitored door with request to exit):

2.20.10.1 Door type: Single leaf

2.20.10.2 Door mode: Operational door.

2.20.10.3 Devices on secured side:

2.20.10.3.1 By door hardware contractor: One (1) Power transfer, one (1) mortise lock with request to exit switch built in and two (2) door closers.

2.20.10.3.2 By security contractor: One (1) Door position switch and one (1) reader interface port.

2.20.10.4 Devices on unsecured side:

2.20.10.4.1 By door hardware contractor: None.

2.20.10.4.2 By security contractor: None.

2.20.10.5 Door operation:

2.20.10.5.1 From the secured side, the door shall be opened by mechanical means using the mortise lock. Activation of the built-in request to exit switch in the lock shall bypass all door alarms for a fixed period of time.

2.20.10.5.2 From the unsecured side, the door shall be opened by mechanical means using the door lock. The use of a valid key in the lock's cylinder shall retract the lock's latch and create a door forced open alarm shall be initiated. Key shall not unlock the lock (storeroom function).

2.20.10.6 Reported Alarms:

2.20.10.6.1 Door forced open from unsecure side.

2.20.10.6.2 Door held open. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.11 Door Type O-9 (Single monitored door):

2.20.11.1 Shall only be used on interior door or external closed space that does not allow access to the occupied portion of the building. i.e. fire pump rooms, external storage rooms, external maintenance rooms.

2.20.11.2 Door type: Single leaf

2.20.11.3 Door mode: Operational door.

2.20.11.4 Devices on secured side:

2.20.11.4.1 By door hardware contractor: None.

2.20.11.4.2 By security contractor: One (1) Door position switch.

2.20.11.5 Devices on unsecured side:

2.20.11.5.1 By door hardware contractor: None.

2.20.11.5.2 By security contractor: None.

2.20.11.6 Door operation:

2.20.11.6.1 From the secured side or the unsecured side, the door shall be opened by mechanical means using the door lock.

2.20.11.7 Reported Alarms:

2.20.11.7.1 Door opened if alarm point is armed. No alarms if alarm point is disarmed.

2.20.12 Door Type O-10 (Dual monitored door with request to exit):

2.20.12.1 Door type: Double leaf

2.20.12.2 Door mode: Operational door.

2.20.12.3 Devices on secured side:

2.20.12.3.1 By door hardware contractor: Two (2) Power transfer, one (2) mortise lock with request to exit switch built in and two (2) door closers.

2.20.12.3.2 By security contractor: Two (2) Door position switches and one (1) reader interface port.

2.20.12.4 Devices on unsecured side:

2.20.12.4.1 By door hardware contractor: None.

2.20.12.4.2 By security contractor: None.

2.20.12.5 Door operation:

2.20.12.5.1 From the secured side, the door shall be opened by mechanical means using the mortise lock. Activation of the built-in request to exit switch in the lock shall bypass all door alarms for a fixed period of time.

2.20.12.5.2 From the unsecured side, the door shall be opened by mechanical means using the door lock. The use of a valid key in the lock's cylinder shall retract the lock's latch and create a door forced open alarm shall be initiated. Key shall not unlock the lock (storeroom function).

2.20.12.6 Reported Alarms:

2.20.12.6.1 Door forced open from unsecure side (both leaves reporting as one alarm).

2.20.12.6.2 Door held open, either leaf as one alarm. Held open time to be determined by PPD-ITS at time of substantial completion inspection.

2.20.13 Door Type O-11 (Double monitored door):

2.20.13.1 Shall only be used on interior door or external closed space that does not allow access to the occupied portion of the building. i.e. fire pump rooms, external storage rooms, external maintenance rooms.

2.20.13.2 Door type: Double leaf

2.20.13.3 Door mode: Operational door.

2.20.13.4 Devices on secured side:

2.20.13.4.1 By door hardware contractor: None.

2.20.13.4.2 By security contractor: Two (2) Door position switches.

2.20.13.5 Devices on unsecured side:

2.20.13.5.1 By door hardware contractor: None.

2.20.13.5.2 By security contractor: None.

2.20.13.6 Door operation:

2.20.13.6.1 From the secured side or the unsecured side, the door shall be opened by mechanical means using the door lock.

2.20.13.7 Reported Alarms:

2.20.13.7.1 Door opened if alarm point (both leaves reporting as one alarm) is armed. No alarms if alarm point is disarmed.

3 Execution

3.1 Wiring Installation:

3.1.1 Wiring Method: Install wiring in raceways. Comply with Division 26 Section " Basic Electrical Materials and Methods." Minimum conduit size shall be ½ inch (13 mm).

3.1.2 Wiring within Enclosures: Bundle, lace, train and label conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions. Size conductors according to equipment manufacturer's written instructions, unless otherwise indicated

3.1.3 Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

3.1.4 All junction boxes that contain splices or connections shall be equipped with a tamper switch. All junction boxes shall be clearly identified.

3.1.5 All cable runs shall be continuous from the device to the head-end equipment. Cable splices shall only be permitted when required by supervision resistors.

3.2 120 VAC Power: The Contractor shall provide power supplies for all devices included as part of their system and for the system to operate. Power supplies shall be provided for all field panels, door hardware, and other devices as required, INCLUDING door operators, etc. The contractor shall coordinate with the electrical contractor to provide 120VAC circuits (on Emergency Generator circuits) as required. Power supplies shall be specifically designed for ACS equipment service, shall have factory enclosure, and shall be UL listed.

All electrical work shall be in accordance with the National Electrical Code and the Standard Building Code.

3.2.1 All AC power shall be fed from the building's power source supported by an emergency backup generator where applicable. If no generator is available a UPS device shall be included with the system that will provide continuous power for a minimum of 30 minutes. The source of the AC power feed shall be identified at termination point of equipment.

3.2.2 All power supplies shall be monitored for AC failure. When power supply provides a Form-C relay with low battery signaling, this contact shall also be monitored. All AC fail and battery low alarms shall be monitored through individual alarm inputs. Series connections of multiple alarm points shall not be allowed.

3.3 Identification

3.3.1 Identify components and power and control wiring according to Division 26 Section “Basic Electrical Materials and Methods.”

3.3.2 All cables, wires, wiring forms, terminal blocks, and device terminals shall be clearly identified by pre-printed labels or tags. The permanent markings shall clearly indicate the function, source, and destination of all cabling, wire, and terminals. Labeling at each device is can be referenced in section 2.23.10 Access Control Cable Installation. Schematic legends shall be placed inside all terminal cabinets to assist with identification of any integrated components (i.e. ADA operators, relays, timers or intercom) and connections contained therein.

3.3.3 All access control panels shall include a worksheet attached to the interior of the panel in plastic envelops. This worksheet shall include the location, type of device and part number of all devices connected to the boards inside the panel. All names used to identify devices in these worksheets shall conform to the UF Standardized Hardware Naming Convention. This document can be found on the PPD website (http://www.ppd.ufl.edu/PPDITS/pdf/uflenelnamingconventions.pdf). A second digital copy of this worksheet shall be delivered to the UF PPD ITS (serrato@ufl.edu) along with the as-built information.

3.4 Additional Contractor Responsibilities:

3.4.1 Upon project commencement, the Contractor shall provide qualified technical personnel on-site. Personnel shall be present on each consecutive working day until the system is fully functional and ready to begin the testing phase.

3.4.2 During the installation process the contractor shall maintain an up-to-date set of as- built shop drawings, which shall always be available for review by the client and/or consultants. This set of documents should be clearly annotated with as-built data as the work is performed.

3.5 Programming and System Configuration:

3.5.1 The contractor shall assist UF PPD ITS with programming and configuration of the security management system. Programming shall include defining descriptions for access control hardware, doors, alarm monitor points, operating sequences, camera call-ups, and the like. An example of a programming sheet can be found on the PPD website (http://www.ppd.ufl.edu/PPDITS/pdf/uflenelprogrammingsheet.pdf).

3.5.2 Contractor shall maintain hard copy worksheets which fully document the system installation, programming, and configuration. Worksheets shall be kept up to date on a daily basis by contractor until final acceptance.

3.6 Warranty:

3.6.1 During the first year of service the contractor shall ensure that manufacturer-certified repair and maintenance personnel are available for Emergency Service calls twenty- four (24) hours a day, three hundred sixty five (365) days a year. The maximum on- site response time for emergency services shall not exceed four (4) hours for warranty or non-warranty issues. The contractor shall be able to perform any and all repairs to the system within 24 hours.

3.7 Field Testing:

3.7.1 The contractor shall activate all alarms and other output devices that are in the system to test for proper operation, including supervisory and trouble circuit tests.

3.7.2 After installation and prior to termination, all wiring and cabling shall be checked and tested to ensure there are no grounds, opens, or shorts on any conductors or shields. A volt ohms meter shall be utilized for this test. Signal strength greater that 20 megohms shall be required to successfully complete the test.

3.7.3 All testing of UTP Category cable shall be provided in conformance with the requirements established under the UF Telecommunications Standards (http://net-services.ufl.edu/infrastructure/).

3.7.4 The contractor shall develop a report that indicates a complete listing of all equipment and alarm monitoring points in this facility. This list shall be used as a guide during testing to ensure that all components are inspected. The personnel conducting these tests shall indicate the following information on this form:

3.7.4.1 Name of person conducting test

3.7.4.2 Date of test

3.7.4.3 Time of test

3.7.4.4 Results of test

3.7.5 Upon successful completion of tests, the log file(s) generated by this activity shall be printed and submitted along with the testing documents, to the client and consulting engineer for review.

3.8 Preparation for Final Acceptance Testing:

3.8.1 All components shall be inspected to ensure they have been properly installed, securely attached, and remain clean and unmarred.

3.8.2 All equipment shall be properly adjusted, clearly labeled, and fully operational.

3.8.3 All broken, damaged or modified items such as walls, doorframes, ceiling tiles, etc., shall be replaced or properly repaired to the satisfaction of the client.

3.8.4 All extra or spare materials shall be delivered to PPD-ITS.

3.8.5 Test report of all system components shall be completed and available for inspection as indicated herein.

3.8.6 Individual factory issued Equipment Manuals containing all technical information on each piece of equipment. Advertising brochures or information instructions shall not be used in lieu of technical manuals and information. Documents to be provided in digital format CD or DVD.

3.8.7 Individual factory issued Operation Manuals containing all technical information on the system. Advertising brochures or information instructions shall not be used in lieu of technical manuals and information. Documents to be provided in digital format CD or DVD.

3.8.8 As-Built drawings. Documents to be provided in digital format CD or DVD. One set of As-Built drawings are to be placed in the ground floor access panel for service purposes.

3.8.9 Statement of Guarantee including date of termination, and the name/telephone number of person to be called in the event of equipment failure.

3.9 Final Acceptance Testing:

3.9.1 After testing reports, as-built drawings, and required manuals have been submitted for review, the Contractor shall coordinate a date for Final Acceptance Testing.

3.9.2 Testing and acceptance of this system will take place in the presence of the Designer or Consultant and UF PPD ITS.

3.9.3 Acceptance of the system shall require a demonstration of all system components to evaluate their performance and reliability. Prior to this test the system must have been online for a period of sixty (60) days, with an uptime of no less than 99%. Should a major equipment failure occur, the Contractor shall replace the defective component and continue the testing period. Any items discovered during final inspection which require the contractors attention, shall be promptly addressed. These items will then be re-inspected by the Designer or consultant for approval.

3.9.4 Upon the completion of acceptable Final Acceptance Testing the Contractor shall submit all finalized project documentation and associated electronic media. Upon approval from UF PPD ITS and the Designer or Consultant, UF PPD ITS will issue a Letter of Completion to the Contractor indicating the date of such completion. This notice will serve as Client acceptance of this system.

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SECTION 28 31 00 - FIRE DETECTION AND ALARM SYSTEM - ADDRESSABLE

1 GENERAL

1.1 Related Documents

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

1.2 Summary

1.2.1 This Section includes fire alarm systems.

1.3 Definitions

1.3.1 FACP: Fire alarm control panel.

1.3.2 LED: Light-emitting diode.

1.3.3 MNS: Mass Notification System.

1.3.4 NAC: Notification Appliance Circuit.

1.3.5 NICET: National Institute for Certification in Engineering Technologies.

1.3.6 SLC: Signaling Line Circuit.

1.3.7 Definitions in NFPA 72 apply to fire alarm terms used in this Section.

1.4 System Description

1.4.1 Noncoded, analog-addressable system; automatic sensitivity control of certain smoke detectors; and multiplexed signal transmission dedicated to fire alarm service only.

1.5 Performance Requirements: See Matrix on drawings.

1.6 Quality Assurance

1.6.1 Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project. The fire alarm system shall be installed by a state certified fire alarm system installation contractor. The fire alarm system installation contractor shall have an unlimited electrical license (Type EC) or a fire alarm specialty license (Type EF).

1.6.1.1 The fire alarm contractor shall be an experienced firm regularly engaged in the layout and installation of automatic fire alarm systems. The contractor shall have successfully completed the installation, testing, and warranty of systems of the scope of the largest system on this project at least one year prior to bid, and have regularly engaged in the business of fire alarm systems contracting continuously since.

1.6.1.2 The fire alarm contractor shall have been NICET Level III certified, and certified by an approved equipment manufacturer to perform installation, testing, adjustment, maintenance, and repair on the approved manufacturer's equipment prior to the date of bid. The proposed fire alarm contractor shall commence no work on the project until he furnishes evidence, satisfactory to the aforementioned certifications and receives notice to proceed with the installation from the Engineer.

1.6.1.3 Firms shall have a factory authorized service organization and stock spare parts. Parts and repair shall be available within 24 hours.

1.6.2 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. All equipment shall be UL listed.

1.6.3 Sequencing and Scheduling

1.6.3.1 Existing Fire Alarm Equipment: Maintain fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire alarm equipment "NOT IN SERVICE" until removed from the building.

1.6.3.2 Equipment Removal: After acceptance of the new fire alarm system, remove existing disconnected fire alarm equipment.

1.7 Extra Materials

1.7.1 Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7.1.1 Smoke and Heat Detectors, Addressable Modules, Relays, Pull Stations: Quantity equal to 10 percent of amount of each type installed, but not less than 1 unit of each type.

1.7.1.2 Detector Bases: Quantity equal to 2 percent of amount of each type installed, but not less than 1 unit of each type.

1.7.1.3 Keys and Tools: One extra set for access to locked and tamper proofed components.

1.7.1.4 Audible and Visual Notification Appliances: One of each type installed.

1.7.1.5 Fuses: Two of each type installed in the system.

1.8 Approval Submittals:

1.8.1 Product Data: Submit manufacturer's technical product data, specifications and installation instructions for each type of device provided.

1.8.2 Calculations:

1.8.2.1 Battery size calculations

1.8.2.2 NAC circuit cable voltage drop calculations.

1.8.3 Qualification Data: For Installer.

1.8.4 Submittals to Authorities Having Jurisdiction: In addition to distribution requirements for submittals specified in Division 1 Section "Submittals," make an identical submittal (of the Engineer approved set) to authorities having jurisdiction. To facilitate review, include copies of annotated Contract Drawings as needed to depict component locations. Resubmit if required to make clarifications or revisions to obtain approval. On receipt of comments from authorities having jurisdiction, submit them to Engineer for review.

1.8.5 Shop Drawings:

1.8.5.1 Shop Drawings shall be prepared by persons with the following qualifications:

1.8.5.1.1 Trained and certified by manufacturer in fire alarm system design.

1.8.5.1.2 Fire alarm certified by NICET, minimum Level III.

1.8.5.2 System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.

1.8.5.3 Floor Plans: Submit a "point-to-point" wiring diagram showing the connections to the equipment and terminal cabinets. Indicate the equipment numbers, terminal numbers, wire numbers, address numbers and wire colors. Include the connections for the Mechanical Systems. The submittal shall be made for approval prior to the installation of the wiring in the raceways. Indicate final outlet locations showing address of each addressable device. Show size and routing of cable and conduits.

1.8.5.4 System riser diagram with device addresses, conduit sizes, and cable and wire types and sizes.

1.9 Test Reports and Verification Submittals:

1.9.1 NFPA 72 Test: Submit written test report.

1.9.2 NFPA Record of Completion: Submit written record.

1.10 O&M Data Submittals:

1.10.1 Submit manufacturer's maintenance data including parts lists. Include these data, a copy of approval submittals (product data & shop drawings) in O&M manual.

1.10.2 Comply with NFPA 72, Chapter 10, recommendations for Owner's manual. Include abbreviated operating instructions for mounting at the FACP.

1.11 Training: Submit letter verifying that Owner training has been received by factory representative.

2 PRODUCTS

2.1 Manufacturers

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

2.1.1.1 FACP and Equipment:

2.1.1.1.1 SimplexGrinnell LP; a Tyco International Company.

2.2 FACP

2.2.1 General Description:

2.2.1.1 Modular, power-limited design with electronic modules, UL 864 listed.

2.2.1.2 Addressable initiation devices that communicate device identity and status.

2.2.1.3 Smoke sensors shall additionally communicate sensitivity setting.

2.2.1.4 Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

2.2.1.5 Addressable control circuits for operation of mechanical equipment.

2.2.2 Alphanumeric Display and System Controls: Arranged for interface between human operator at the FACP and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

2.2.2.1 Annunciator and Display: Liquid-crystal type, two lines of 40 characters each, minimum.

2.2.2.2 Keypad: Arranged to permit entry and execution of programming, display, and control commands.

2.2.3 Electronic Loop Controller: Electronic Loop Controller shall be provided in each Fire Alarm Control Panel, to interface between the main panel, expansion modules, and the Analytical Microprocessor-based Detectors and modules. No electronic loop controller shall be loaded to more than 75% of the maximum allowable number of devices which can be connected to the electronic loop.

2.2.4 Circuits:

2.2.4.1 Signaling Line Circuits: NFPA 72, Class B Style 4.

2.2.4.2 Notification-Appliance Circuits: NFPA 72, Class B, Style Y.

2.2.4.3 Actuation of alarm notification appliances, emergency voice communications where provided, annunciation, elevator recall shall occur within 10 seconds after the activation of an initiating device.

2.2.4.4 Electrical monitoring for the integrity of wiring external to the FACP for mechanical equipment shutdown and magnetic door-holding circuits is not required, provided a break in the circuit will cause doors to close and mechanical equipment to shut down.

2.2.5 Smoke-Alarm Verification:

2.2.5.1 Initiate audible and visible indication of an "alarm verification" signal at the FACP.

2.2.5.2 Activate a listed and approved "alarm verification" sequence at the FACP and the detector.

2.2.5.3 Sound general alarm if the alarm is verified.

2.2.5.4 Cancel FACP indication and system reset if the alarm is not verified.

2.2.6 Notification-Appliance Circuit:

2.2.6.1 Horns: Operation shall sound in a 3-pulse temporal pattern, complying with ANSI S3.41.

2.2.6.2 Strobes: All visual appliances shall be synchronized.

2.2.6.3 Loading: Do not load any individual circuit more than 75% of its rated capacity to allow for future adds and changes to any NAC circuit.

2.2.7 Elevator Controls(when elevator and fire protection system is present): Heat detector operation shuts down elevator power by operating a shunt trip in a circuit breaker feeding the elevator.

2.2.8 Power Supply for Supervision Equipment: Supply for audible and visual equipment for supervision of the ac power shall be from a dedicated dc power supply, and power for the dc component shall be from the ac supply.

2.2.9 Alarm Silencing, Trouble, and Supervisory Alarm Reset: Manual reset at the FACP and remote annunciators, after initiating devices are restored to normal.

2.2.9.1 Silencing-switch operation halts alarm operation of audible notification appliances and activates an "alarm silence" light. Display of identity of the alarm zone or device is retained.

2.2.9.2 Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.

2.2.9.3 When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.

2.2.10 Walk Test: A test mode to allow one person to test alarm and supervisory features of initiating devices. Enabling of this mode shall require the entry of a password. The FACP and annunciators shall display a test indication while the test is underway. If testing ceases while in walk-test mode, after a preset delay, the system shall automatically return to normal.

2.2.11 Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and control of changes in those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and make a print-out of the final adjusted values on the system printer.

2.2.12 Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, trouble, and supervisory signals to a remote alarm station through a digital alarm communicator transmitter and telephone lines.

2.2.13 Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines and trouble signal shall be powered by the 24-V dc source.

2.2.13.1 The alarm current draw of the entire fire alarm system shall not exceed 80 percent of the power-supply module rating.

2.2.13.2 Power supply shall have a dedicated lockable circuit breaker for this connection. Paint the circuit breaker red and identify it with "FIRE ALARM SYSTEM POWER."

2.2.14 Secondary Power: 24-V dc supply system with batteries and automatic battery charger and an automatic transfer switch.

2.2.14.1 Batteries: Shall be capable of providing power to the system for a minimum of 24 hours.

2.2.14.2 Battery and Charger Capacity: Comply with NFPA 72.

2.2.15 Surge Protection:

2.2.15.1 Install surge protection on normal ac power for the FACP and its accessories.

2.2.15.2 Install surge protectors recommended by FACP manufacturer. Install on all system wiring external to the building housing the FACP.

2.2.16 Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a plastic frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 Manual Fire Alarm Boxes

2.3.1 Description: UL 38 listed; finished in red with molded, raised-letter operating instructions in contrasting color. Station shall show visible indication of operation. Mounted on recessed outlet box; if indicated as surface mounted, provide manufacturer's surface back box.

2.3.1.1 Single-action mechanism requiring one actions to initiate an alarm, pull lever type. With integral addressable module, arranged to communicate manual-station status (normal, alarm, or trouble) to the FACP.

2.3.1.2 Station Reset: Key- or wrench-operated switch.

2.3.1.3 Indoor Protective Shield: Factory-fabricated clear plastic enclosure, hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation. Provide on all manual fire alarm stations near exterior exit doors and in all exterior locations. Equivalent to STI Stopper II.

2.4 System Smoke Detectors

2.4.1 General Description:

2.4.1.1 Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.4.1.2 Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. Provide terminals in the fixed base for connection of building wiring. Removal of the respective detector shall not affect electronic loop communications with other detectors on that loop.

2.4.1.3 Integral Visual-Indicating Light: LED type.6

2.4.1.4 Shall be capable of transmitting pre-alarm and alarm signals to the Fire Alarm Control Panel via the Electronic Loop Controller. It shall be possible to program Fire Alarm Control Panel activity and response to each of the following signal levels: Normal, Pre-Alarm, Alarm, Trouble, Detector need cleaning.

2.4.1.5 Shall contain an environmental compensation algorithm, which identifies and sets ambient “Environmental Thresholds” continually and periodically. In this manner, the environmental impact of temperature, humidity, environmental contaminates as well as detector aging shall be automatically monitored. This process shall employ digital compensation techniques to adapt the detector to both long term and short-term changes in the environment in which they are installed. The microprocessor shall monitor this environmental compensation value and alert the system operator when the detector 80% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the derived base line sensitivity that the detector has sensed in its environment. The base line sensitivity information shall be automatically and periodically updated and permanently stored in the detector.

2.4.1.6 Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

2.4.2 Photoelectric Smoke Detectors:

2.4.2.1 Sensor: LED or infrared light source with matching silicon-cell receiver.

2.4.2.2 Detector Sensitivity: Between 0.2 and 3.7 percent/foot smoke obscuration when tested according to UL 268A.

2.4.2.3 Provide a minimum of 5 levels of detection sensitivity for each sensor.

2.4.3 Duct Smoke Detectors:

2.4.3.1 Shall utilize addressable photoelectric smoke detectors.

2.4.3.2 Plug-in Arrangement: Detector and associated electronic components shall be mounted in a plug-in module that connects to a fixed base. The fixed base shall be designed for mounting directly to the air duct. Provide terminals in the fixed base for connection to building wiring.

2.4.3.3 Duct Housing Enclosure: UL listed for use with the supplied detector.

2.4.3.4 Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation. TROUBLE at control panel shall require manual reset.

2.4.3.5 Integral Visual-Indicating Light: LED type. Provide remote status and alarm indicator where detector is not visible from normal standing position.

2.4.3.6 Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.

2.4.3.7 Each sensor shall have multiple levels of detection sensitivity.

2.4.3.8 Sampling Tubes: Design and dimensions as recommended by manufacturer for the specific duct size, air velocity, and installation conditions where applied.

2.4.3.9 Relay Fan Shutdown: Rated to interrupt fan motor-control circuit. Shall be addressable.

2.5 Heat Detectors

2.5.1 General: UL 521 listed.

2.5.2 Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or rate-of-rise of temperature that exceeds 15 deg F (8 deg C) per minute, unless otherwise indicated.

2.5.3 Rate-of-rise temperature characteristic shall be selectable at the FACP for 15 or 20 deg F (8 or 11 deg C) per minute.

2.5.4 Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at the FACP to operate at 135 or 155 deg F (57 or 68 deg C).

2.5.5 Provide higher temperature devices where ambient conditions require.

2.5.6 Mounting: Plug-in base, interchangeable with smoke-detector bases.

2.5.7 Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.

2.6 Notification Appliances

2.6.1 Description: Equipped for mounting as indicated and with screw terminals for system connections.

2.6.2 Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly.

2.6.3 Audible Alarm Devices

2.6.3.1 Selectable (Steady or Coded) output type, Selectable output level, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.

2.6.4 Visible Alarm Devices

2.6.4.1 Xenon strobe lights listed under UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

2.6.4.2 Rated Light Output: Selectable 15, 30, 75, 110 candela.

2.6.4.3 All strobes shall be synchronized.

2.7 Sprinkler System Remote Indicators

2.7.1 Remote status and alarm indicator and test stations, with LED indicating lights. Light is connected to flash when the associated device is in an alarm or trouble mode. Lamp is flush mounted in a single-gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, device initiating the signal and room where the smoke detector or valve is located. For water-flow switches, the identification plate also designates protected spaces downstream from the water-flow switch.

2.8 Magnetic Door Holders

2.8.1 Description: Units are equipped for wall mounting as indicated and are complete with matching door plate.

2.8.2 Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.

2.8.3 Wall-Mounted Units: Flush mounted, unless otherwise indicated.

2.8.4 Rating: 24-V dc.

2.8.5 Material and Finish: Match door hardware.

2.9 Remote Annunciator

2.9.1 Description: Duplicate annunciator functions of the FACP for ALARM, SUPERVISORY, and TROUBLE indications. Also duplicate manual switching functions of the FACP, including acknowledging, silencing, resetting, and testing.

2.9.2 Mounting: Flush cabinet, NEMA 250, Class 1.

2.9.3 Display Type and Functional Performance: Alphanumeric display same as the FACP. Controls with associated LEDs permit acknowledging, silencing, resetting, and testing functions for alarm, supervisory, and trouble signals identical to those in the FACP.

2.9.4 For voice evacuation systems, provide with a remote microphone.

2.10 Addressable Interface Device

2.10.1 Description: Microelectronic monitor module listed for use in providing a system address for listed alarm-initiating devices for wired applications with normally open contacts.

2.10.2 Integral Relay: Capable of providing a direct signal to the elevator controller to initiate elevator recall and to a circuit-breaker shunt trip for power shutdown.

2.11 IP Alarm Communicator

2.11.1 Provide a digital IP alarm communication module with the following features:

2.11.2 Compatible with most control panels that use the Contact ID format.

2.11.3 2-way, always-on IP communication.

2.11.4 Works over local LAN/WAN network or the Internet.

2.11.5 128-bit AES encryption (NIST approved).

2.11.6 Supports DHCP (dynamic IP addresses).

2.11.7 Reports events to 2 different receiver IP addresses.

2.11.8 Polling and hardware substitution protection.

2.11.9 Low network bandwidth requirements..

2.11.10 Compatible with 10/100BaseT networks.

2.11.11 Compatible with Sur-Gard System I/II/III/IV monitoring station receivers.

2.11.12 4 on-board programmable zone inputs (expandable to 12 using PC5108 zone expander).

2.11.13 2 programmable voltage outputs.

2.11.14 Programmable through the panel keypad or T-Link Console software.

2.11.15 24-hour battery backup.

2.11.16 Transformer (120VAC) and Power Supply (PS4085).

2.11.17 Ships with the PC4050CR Red Cabinet for Fire Applications.

2.11.18 300s Supervisory Window and programmable heartbeat intervals.

2.11.19 UL/ULC Commercial Fire listed, CSFM listed and NFPA72 compliant, FM approved

2.12 Digital Alarm Communicator Transmitter

2.12.1 Listed and labeled according to UL 632.

2.12.2 Functional Performance: Unit receives an alarm, supervisory, or trouble signal from the FACP, and automatically captures one or two telephone lines and dials a preset number for a remote central station. When contact is made with the central station(s), the signal is transmitted. The unit supervises up to two telephone lines. Where supervising 2 lines, if service on either line is interrupted for longer than 45 seconds, the unit initiates a local trouble signal and transmits a signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. When telephone service is restored, unit automatically reports that event to the central station. If service is lost on both telephone lines, the local trouble signal is initiated.

2.12.3 Protocol: Contact I.D.

2.12.4 Secondary Power: Integral rechargeable battery and automatic charger. Battery capacity is adequate to comply with NFPA 72 requirements.

2.12.5 Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 Guards for Physical Protection

2.13.1 Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

2.13.2 Factory fabricated and furnished by manufacturer of the device.

2.13.3 Finish: Paint of color to match the protected device.

2.14 Wire and Cable

2.14.1 Wire and cable for fire alarm systems shall be UL listed and labeled as complying with NFPA 70, Article 760.

2.14.2 Signaling Line Circuits: Twisted, unshielded or shielded (as recommended by manufacturer) pair, not less than No. 18 AWG. Color shall be red.

2.14.3 Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

2.14.3.1 Low-Voltage Circuits: No. 14 AWG, minimum.

2.14.3.2 Line-Voltage Circuits: No. 12 AWG, minimum.

3 EXECUTION

3.1 Equipment Installation

3.1.1 Connecting to Existing Equipment

3.1.1.1 Verify that existing fire alarm system is operational before making changes or connections.

3.1.1.2 Connect new equipment to the existing control panel in the existing part of the building.

3.1.1.3 Connect new equipment to the existing monitoring equipment at the Supervising Station.

3.1.1.4 Expand, modify, and supplement the existing control equipment as necessary to extend the existing control functions to the new points. New components shall be capable of merging with the existing configuration without degrading the performance of either system.

3.1.1.5 Modify existing system programming, graphics, annunciators, etc. as required.

3.1.2 Detector Mounting

3.1.2.1 Smooth ceiling spacing shall not exceed 30 feet.

3.1.2.2 Spacing of heat detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas, shall be determined according to Appendix A in NFPA 72.

3.1.2.3 Spacing of heat detectors shall be determined based on guidelines and recommendations in NFPA 72.

3.1.2.4 Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of the duct. Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening. Mount in accessible location.

3.1.2.5 Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

3.1.2.6 Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

3.1.3 Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position (i.e. detector above a dropped ceiling).

3.1.4 NAC Devices: Install 80” AFF to bottom of strobe lens if wall mounted. Ceiling mounted devices shall be coordinated with all other trades work. In exposed ceiling spaces, suspend/pendent mount devices to the plane of the light fixtures so they are visible.

3.1.4.1 Audible Devices: Contractor to select and set devices as required to meet NFPA 72 audible levels.

3.1.4.2 Strobe Devices: Contractor to set as required to meet spacing and room size.

3.1.5 FACP: Surface mount with tops of cabinets not more than 72 inches above the finished floor.

3.1.6 Manual Pull Stations: Mount top at 48" AFF per ADA.

3.1.7 Annunciator: Install with top of panel not more than 60 inches above the finished floor.

3.2 Wiring Installation

3.2.1 Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable. Minimum raceway size for all fire alarm circuits is ¾".

3.2.2 Wiring Method

3.2.2.1 Wire nuts shall not be used. All connections shall be terminal block type.

3.2.2.2 Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.

3.2.2.3 Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

3.2.3 Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved pressure-type terminal blocks

3.2.4 Cable Taps: Not allowed.

3.2.5 Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.2.5.1 Color coding shall comply with UF PPD Standards.

3.2.5.1.1 Audible Devices = Red +/ Black -

3.2.5.1.2 Strobes (if separate) = White +/ Purple -

3.2.5.1.3 Alarms = Blue +/ Yellow -

3.2.5.1.4 A/C Ventilation = Shut Down Brown +/ Orange -

3.2.5.1.5 Magnetic Doors = Pink +/ Grey -

3.2.5.1.6 Misc. Circuits = Violet +/ Tan -

3.3 Identification

3.3.1 Identify system components, wiring, cabling, and terminals according to Division 26 Section "Basic Electrical Materials and Methods" & "Cable Identification."

3.3.2 Install instructions frame in a location visible from the FACP.

3.3.3 Label power-supply circuit breaker "FIRE ALARM."

3.3.4 Label each device with a unique identifier acceptable to the Owner.

3.4 Grounding

3.4.1 Ground the FACP and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to the FACP.

3.5 Testing:

3.5.1 Manufacturer's Field Service: Engage a factory-authorized service representative to inspect test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

3.5.2 Perform the following field tests and inspections and prepare test reports:

3.5.2.1 Before requesting final approval of the installation, submit a written statement using the form for Record of Completion shown in NFPA 72.

3.5.2.2 Perform each electrical test and visual and mechanical inspection listed in NFPA 72. Certify compliance with test parameters. All tests shall be conducted under the direct supervision of a NICET technician certified under the Fire Alarm Systems program at Level III.

3.5.2.3 Visual Inspection: Conduct a visual inspection before any testing. Use as-built drawings and system documentation for the inspection. Identify improperly located, damaged, or nonfunctional equipment, and correct before beginning tests.

3.5.2.4 Testing: Follow procedure and record results complying with requirements in NFPA 72.

3.5.2.5 Detectors that are outside their marked sensitivity range shall be replaced.

3.5.2.6 Test and Inspection Records: Prepare according to NFPA 72, including demonstration of sequences of operation by using the matrix-style form in Chapter 10 in NFPA 72.

3.6 Adjusting

3.6.1 Occupancy Adjustments: Within 12 months of date of Substantial Completion and in coordination with post occupancy Commissioning, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

3.7 Warranty

3.7.1 Warranty shall cover all parts and labor.

3.7.2 Warranty period shall be 12 months after Substantial Completion.

3.7.2.1 During the warranty period the Contractor shall ensure that manufacturer-certified repair an maintenance personnel are available for emergency service calls twenty four (24) hours a day, three hundred sixty five (365) days a year. The maximum on-site response time for emergency services shall not exceed four (4) hours for warranty or non-warranty issues. The Contractor shall be able to perform any and all repairs to the system within twenty four (24) hours.

3.8 Training

3.8.1 Provide one 4 hour training session.

END OF SECTION

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SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Stripping and stockpiling rock.
   6. Removing above- and below-grade site improvements.
   7. Disconnecting, capping or sealing, and removing site utilities.
   8. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 01 50 00 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

C. Related Requirements:
   1. Section 01500 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other nonsoil materials.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

B. Rock Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

D. Utility Locator Service: Notify One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

F. Tree- and Plant-Protection Zones: Protect according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Architect not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 02 41 16 "Structure Demolition" and Section 02 41 19 "Selective Demolition."

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and dispose of off-site

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones.
   3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 STOCKPILING ROCK

A. Remove from construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.
   1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.
   1. Limit height of rock stockpiles to 48inches
   2. Do not stockpile rock within protection zones.
   3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
   4. Stockpile surplus rock to allow later use by the Owner.

3.8 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

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SECTION 31 20 00 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Excavating and filling for rough grading the Site.
   2. Preparing subgrades for slabs-on-grade, walks, pavements, turf and grasses.
   3. Excavating and backfilling for buildings and structures.
   4. Drainage course for concrete slabs-on-grade.
   5. Subbase course for concrete walks and pavements.
   6. Subbase course and base course for asphalt paving.
   7. Subsurface drainage backfill for walls and trenches.
   8. Excavating and backfilling trenches for utilities and pits for buried utility structures.
   9. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Requirements:
   1. Section 01 32 33 "Photographic Documentation" for recording preexcavation and earth-moving progress.
   2. Section 31 10 00 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
   3. Section 31 50 00 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
   4. Section 31 63 29 "Drilled Concrete Piers and Shafts" for excavation of shafts and disposal of surplus excavated material.
   5. Section 32 92 00 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.
   6. Section 32 93 00 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
   2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by a geotechnical testing agency, according to ASTM D1586.

J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

K. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

L. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

M. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct preexcavation conference at Project site
   1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
      a. Personnel and equipment needed to make progress and avoid delays.
      b. Coordination of Work with utility locator service.
      c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
      d. Extent of trenching by hand or with air spade.
      e. Field quality control.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Geofoam.
   4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches.
   2. Warning Tape: 12 inches long; of each color.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D2487.
   2. Laboratory compaction curve according to ASTM D698

C. Blasting plan approved by authorities having jurisdiction.

D. Seismic survey report from seismic survey agency.

E. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.7 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
   1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.8 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing earth moving indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
   1. Do not proceed with work on adjoining property until directed by Architect.

C. Utility Locator Service: Notify One Call for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 01 50 00 "Temporary Facilities and Controls" and Section 31 10 00 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 01 56 39 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups A-1, A-2-4, A-2-5, and A-3 according to AASHTO M 145 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940/D2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and zero to 5 percent passing a No. 4 sieve.

J. Sand: ASTM C33/C33M; fine aggregate.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

C. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

D. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

B. Explosives: Obtain written permission from authorities having jurisdiction before bringing explosives to Project site or using explosives on Project site.
   1. Perform blasting without damaging adjacent structures, property, or site improvements.
   2. Perform blasting without weakening the bearing capacity of rock subgrade and with the least-practicable disturbance to rock to remain.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs-on-grade.
      f. 6 inchesbeneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
   1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; and soil, boulders, and other materials not classified as rock or unauthorized excavation.
      a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
   2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inchesoutside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.

d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
e. 6 inches beneath bottom of concrete slabs-on-grade.
f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
   2. Cut and protect roots according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
   1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
   1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
   2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
   3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe and conduit elevations to allow for bedding course. Hand-excavate deeper for bells of pipe.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

E. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 01 56 39 "Temporary Tree and Plant Protection."

3.8 EXCAVATION FOR ELEVATOR CYLINDER

A. Drill well hole plumb in elevator pit to accommodate installation of elevator-cylinder assembly. Coordinate with applicable requirements for diameter and tolerances in Section 14 24 00 "Hydraulic Elevators."

B. Provide well casing as necessary to retain walls of well hole.

3.9 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 03 30 00 "Cast-in-Place Concrete."

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:

1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:

1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under grass and planted areas, use satisfactory soil material.
   2. Under walks and pavements, use satisfactory soil material.
   3. Under steps and ramps, use engineered fill.
   4. Under building slabs, use engineered fill.
   5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.15 Deleted

3.16 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.17 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 98 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.18 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.19 SUBSURFACE DRAINAGE

A. per Stormtech Specifications or approved equal

3.20 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
   1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place base course material over subbase course under hot-mix asphalt pavement.
   3. Shape subbase course and base course to required crown elevations and cross-slope grades.
   4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
   5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D698

3.21 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
   1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
   2. Place drainage course 6 inches or less in compacted thickness in a single layer.
   3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
   4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D698.

3.22 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material classification and maximum lift thickness comply with requirements.

3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 75feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 20 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cold milling of existing asphalt pavement.
   2. Hot-mix asphalt patching.
   3. Hot-mix asphalt paving.
   4. Hot-mix asphalt overlay.
   5. Asphalt curbs.
   6. Asphalt traffic-calming devices.
   7. Asphalt surface treatments.

B. Related Requirements:
   1. Section 02 41 16 "Structure Demolition" and Section 02 41 19 "Selective Demolition" for demolition and removal of existing asphalt pavement.
   2. Section 31 20 00 "Earth Moving" for subgrade preparation, fill material, separation geotextiles, unbound-aggregate subbase and base courses, and aggregate pavement shoulders.
   3. Section 32 13 13 "Concrete Paving" for concrete pavement and for separate concrete curbs, gutters, and driveway aprons.
   4. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants and fillers at pavement terminations.
   5. Section 32 14 00 "Unit Paving" for bituminous setting bed for pavers and for stone and precast concrete curbs.

1.3 Deleted

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
      a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      b. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include technical data and tested physical and performance properties.
   2. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
   3. Job-Mix Designs: For each job mix proposed for the Work.

B. Sustainable Design Submittals:
   1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Samples for Verification: For the following product, in manufacturer's standard sizes unless otherwise indicated:
   1. Paving Fabric: 12 by 12 inches minimum.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data

B. Material Certificates: For each paving material.

C. Material Test Reports: For each paving material, by a qualified testing agency.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by FDOT

B. Testing Agency Qualifications: Qualified according to ASTM D3666 for testing indicated.

C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of FDOT for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Slurry Coat: Comply with weather limitations in ASTM D3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D692/D692M, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D1073 or AASHTO M 29, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D242/D242M or AASHTO M 17, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: ASTM D6373 or AASHTO M 320 binder designation PG 76-22.

B. Asphalt Cement: ASTM D3381/D3381M for viscosity-graded material and ASTM D946/D946M for penetration-graded material.

C. Cutback Prime Coat: ASTM D2027/D2027M, medium-curing cutback asphalt, MC-250

D. Emulsified Asphalt Prime Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

E. Tack Coat: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D977 or AASHTO M 140 emulsified asphalt, or ASTM D2397/D2397M or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

H. Undersealing Asphalt: ASTM D3141/D3141M; pumping consistency.

2.3 AUXILIARY MATERIALS

A. Recycled Materials for Hot-Mix Asphalt Mixes: Reclaimed asphalt pavement; reclaimed, unbound-aggregate base material; and recycled from sources and gradations that have performed satisfactorily in previous installations, equal to performance of required hot-mix asphalt paving produced from all new materials.

B. Herbicide: Commercial chemical for weed control, registered by the EPA, and not classified as "restricted use" for locations and conditions of application. Provide in granular, liquid, or wettable powder form.

C. Sand: ASTM D1073 or AASHTO M 29, Grade No. 2 or No. 3.

D. Paving Geotextile: AASHTO M 288 paving fabric; nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

E. Joint Sealant: ASTM D6690, hot-applied, single-component, polymer-modified bituminous sealant.

2.4 MIXES

A. Recycled Content of Hot-Mix Asphalt: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 40 percent or more than 50 percent by weight.

1. Surface Course Limit: Recycled content no more than 10 percent by weight.

B. Hot-Mix Asphalt: Dense-graded, hot-laid, hot-mix asphalt plant mixes approved by FDOT and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Base Course: per plans.
3. Surface Course: per plans.

C. Emulsified-Asphalt Slurry: ASTM D3910.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

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

3.2 PREPARATION

A. Protection: Provide protective materials, procedures, and worker training to prevent asphalt materials from spilling, coating, or building up on curbs, driveway aprons, manholes, and other surfaces adjacent to the Work.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 1-1/2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace curbs, driveway aprons, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Patch surface depressions deeper than 1 inch after milling, before wearing course is laid.
7. Handle milled asphalt material according to approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."
8. Keep milled pavement surface free of loose material and dust.
9. Do not allow milled materials to accumulate on-site.

3.4 PATCHING

A. Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Undersealing: Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into perimeter of adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Before placing patch material, apply tack coat uniformly to vertical asphalt surfaces abutting the patch. Apply at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Placing Patch Material: Fill excavated pavement areas with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Placing Patch Material: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.6 SURFACE PREPARATION

A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Cutback Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

D. Emulsified Asphalt Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.10 to 0.30 gal./sq. yd. per inch depth. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure.
   1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
   2. Protect primed substrate from damage until ready to receive paving.

E. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.7 PAVING GEOTEXTILE INSTALLATION

A. Apply tack coat uniformly to existing pavement surfaces at a rate of 0.20 to 0.30 gal./sq. yd.

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches and transverse joints 6 inches.

C. Protect paving geotextile from traffic and other damage, and place hot-mix asphalt overlay the same day.

3.8 PLACING HOT-MIX ASPHALT

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand in areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at a minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Overlap mix placement about 1 to 1-1/2 inches from strip to strip to ensure proper compaction of mix along longitudinal joints.
2. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.9 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.10 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D6927 or AASHTO T 245, but not less than 94 percent or greater than 100 percent.
2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D2041/D2041M, but not less than 90 percent or greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.11 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.
2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch.
2. Surface Course: 1/8 inch.
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Asphalt Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.12 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D3910 and allow to cure.

1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. Asphalt Traffic-Calming Devices: Finished height of traffic-calming devices above pavement will be measured for compliance with tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979/D979M or AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041/D2041M, and compacted according to job-mix specifications.
2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726/D2726M.
    a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than three cores taken.
    b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950 and correlated with ASTM D1188 or ASTM D2726/D2726M.

F. Replace and compact hot-mix asphalt where core tests were taken.

G. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.14 WASTE HANDLING

A. General: Handle asphalt-paving waste according to approved waste management plan required in Section 01 74 19 "Construction Waste Management and Disposal."

END OF SECTION 32 12 16

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes Concrete Paving including the following:
   1. Driveways.
   2. Roadways.
   3. Parking lots.
   4. Curbs and gutters.
   5. Walks.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" and Section 03 30 53 "Miscellaneous Cast-in-Place Concrete" for general building applications of concrete.
   2. Section 32 13 16 "Decorative Concrete Paving" for stamped concrete other than stamped detectable warnings.
   3. Section 32 13 73 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.
   4. Section 32 17 13 "Parking Bumpers."
   5. Section 32 17 23 "Pavement Markings."
   6. Section 32 17 26 "Tactile Warning Surfacing" for detectable warning tiles, mats, and pavers.
   7. Section 32 17 29 "Manufactured Traffic-Calming Devices."

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Contractor's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving Subcontractor.
      e. Manufacturer's representative of stamped concrete paving system used for stamped detectable warnings.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
2. Environmental Product Declaration: For each product.
3. Health Product Declaration: For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Laboratory Test Reports: For concrete paving mixtures, documentation indicating that cured concrete complies with Solar Reflectance Index requirements.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:

1. Exposed Aggregate: 10-lb Sample of each mix.

E. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates: Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

D. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Stamped Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.9 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from galvanized-steel wire into flat sheets.

C. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

D. Epoxy-Coated Welded-Wire Reinforcement: ASTM A884/A884M, Class A, plain steel.

E. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

F. Galvanized Reinforcing Bars: ASTM A767/A767M, Class II zinc coated, hot-dip galvanized after fabrication and bending; with ASTM A615/A615M, Grade 60 deformed bars.

G. Epoxy-Coated Reinforcing Bars: ASTM A775/A775M or ASTM A934/A934M; with ASTM A615/A615M, Grade 60 deformed bars.

H. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.

I. Plain-Steel Wire: ASTM A1064/A1064M, galvanized

J. Deformed-Steel Wire: ASTM A1064/A1064M.

K. Epoxy-Coated-Steel Wire: ASTM A884/A884M, Class A; coated, plain.

L. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars; zinc coated (galvanized) after fabrication according to ASTM A767/A767M, Class I coating. Cut bars true to length with ends square and free of burrs.

M. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.

N. Tie Bars: ASTM A615/A615M, Grade 60; deformed.

O. Hook Bolts: ASTM A307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

P. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

Q. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating, compatible with epoxy coating on reinforcement.

R. Zinc Repair Material: ASTM A780/A780M.

2.4 CONCRETE MATERIALS

A. Regional Materials: Concrete shall be manufactured within 100 milesof Project site from aggregates and cementitious materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, white portland cement Type I, Type II, and Type III.
2. Fly Ash: ASTM C618, Class C or Class F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag or Type IP, portland-pozzolan or Type IL, Portland-limestone or Type IT, ternary blended cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S or Class 4M, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:

1. Aggregate Sizes: 3/8 to 5/8 inch nominal.

E. Air-Entraining Admixture: ASTM C260/C260M.

F. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

G. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Alabama Pigments Company, LLC.
   b. BASF Corporation.
   c. Bon Tool Co.
   d. Brickform; a division of Solomon Colors.
   e. Butterfield Color, Inc.
   f. Dynamic Color Solutions, Inc.
   g. Euclid Chemical Company (The); an RPM company.
   h. Hoover Color Corporation.
   i. Lambert Corporation.
   j. LANXESS Corporation.

k. Matcrete Inc.
l. NewLook International, Inc.
m. Proline Concrete Tools, Inc.
n. QC Construction Products.
o. Scofield, a Business Unit of Sika Corporation.
p. Solomon Colors, Inc.
q. Stampcrete International, Ltd.
r. SureCrete Design Products.
s. Venator Materials PLC.

2. Color: Match Architect's sample.

H. Water: Potable and complying with ASTM C94/C94M.

2.5 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABC Polymer Industries, LLC.
   b. Euclid Chemical Company (The); an RPM company.
   c. FORTA Corporation.
   d. GCP Applied Technologies Inc.
   e. Nycon, Inc.
   f. Propex Operating Company, LLC.
   g. Sika Corporation.

B. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in decorative concrete paving, complying with ASTM C1116/C1116M, Type III.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ABC Polymer Industries, LLC.
   b. Euclid Chemical Company (The); an RPM company.
   c. FORTA Corporation.
   d. GCP Applied Technologies Inc.
   e. Nycon, Inc.
   f. Propex Operating Company, LLC.
   g. Sika Corporation.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Corporation.
   b. Bon Tool Co.
   c. Brickform; a division of Solomon Colors.

d. ChemMasters, Inc.
e. Dayton Superior.
f. Euclid Chemical Company (The); an RPM company.
g. Kaufman Products, Inc.
h. Lambert Corporation.
i. Laticrete International, Inc.
j. Metalcrete Industries.
k. Nox-Crete Products Group.
l. Sika Corporation.
m. SpecChem, LLC.
n. TK Products.
o. Vexcon Chemicals Inc.
p. W.R. Meadows, Inc.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete International, Inc.
h. Nox-Crete Products Group.
i. Right Pointe.
j. SpecChem, LLC.
k. TK Products.
l. Unitex by Dayton Superior.
m. Vexcon Chemicals Inc.
n. W.R. Meadows, Inc.

F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 2, Class B, dissipating.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.
b. ChemMasters, Inc.
c. Dayton Superior.
d. Euclid Chemical Company (The); an RPM company.
e. Kaufman Products, Inc.
f. Lambert Corporation.
g. Laticrete International, Inc.
h. SpecChem, LLC.
i. Vexcon Chemicals Inc.
j. W.R. Meadows, Inc.

2.7 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D1752, cork or self-expanding cork in preformed strips.

B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Chemical Surface Retarder: Water-soluble, liquid, set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ChemMasters, Inc.
   b. Dayton Superior.
   c. Euclid Chemical Company (The); an RPM company.
   d. Kaufman Products, Inc.
   e. Nox-Crete Products Group.
   f. QC Construction Products.
   g. Scofield, a Business Unit of Sika Corporation.
   h. Sika Corporation.
   i. SpecChem, LLC.
   j. TK Products.
   k. Vexcon Chemicals Inc.
   l. W.R. Meadows, Inc.

F. Pigmented Mineral Dry-Shake Hardener: Factory-packaged, dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anti-Hydro International, Inc.
   b. BASF Corporation.
   c. Bon Tool Co.
   d. Brickform; a division of Solomon Colors.
   e. Butterfield Color, Inc.
   f. Dayton Superior.
   g. Decosup Inc.
   h. Dynamic Color Solutions, Inc.
   i. Euclid Chemical Company (The); an RPM company.
   j. H&C® Decorative Concrete Products; a brand of Sherwin-Williams Co.
   k. Kaufman Products, Inc.
   l. Lambert Corporation.
   m. Laticrete International, Inc.

n. Metalcrete Industries.
o. Proline Concrete Tools, Inc.
p. QC Construction Products.
q. Scofield, a Business Unit of Sika Corporation.
r. Specialty Concrete Products, Inc.
s. Stampcrete International, Ltd.
t. SuperStone, Inc.
u. SureCrete Design Products.

2. Color: Match Architect's sample.

G. Rock Salt: Sodium chloride crystals, kiln dried, coarse gradation with 100 percent passing 3/8-inch sieve and 85 percent retained on a No. 8 sieve.

2.8 STAMPED DETECTABLE WARNING MATERIALS

A. Detectable Warning Stamp: Semirigid polyurethane mats with formed underside capable of imprinting detectable warning pattern on plastic concrete; perforated with a vent hole at each dome.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. ADA Solutions, Inc.
   b. Advanced Surfaces Inc.
   c. Butterfield Color, Inc.
   d. Stampcrete International, Ltd.
   e. Transpo Industries, Inc.
2. Size of Stamp: One piece, matching detectable warning area shown on Drawings.

B. Liquid Release Agent: Manufacturer's standard, clear, evaporating formulation designed to facilitate release of stamp mats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Surfaces Inc.
   b. Artcrete, Inc.
   c. Bon Tool Co.
   d. Brickform; a division of Solomon Colors.
   e. Butterfield Color, Inc.
   f. Decosup Inc.
   g. Matcrete Inc.
   h. Proline Concrete Tools, Inc.
   i. QC Construction Products.
   j. Scofield, a Business Unit of Sika Corporation.
   k. Specialty Concrete Products, Inc.
   l. Stampcrete International, Ltd.
   m. SuperStone, Inc.
   n. Venator Materials PLC.

2.9 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
1. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-1/2-inch nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1-1/2 percent for 1-inch nominal maximum aggregate size.
3. Air Content: 5 percent plus or minus 1-1/2 percent for 3/4-inch nominal maximum aggregate size.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.
1. Compressive Strength (28 Days): 3000 – 4000 psi per plans.
2. Maximum W/C Ratio at Point of Placement: 0.45.
3. Slump Limit: 5 inches plus or minus 1 inch.
4. Solar Reflectance (SR): Three-year-aged SR value of at least 0.28 or initial SR of at least 0.33.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.

3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/4 inch according to requirements in Section 31 20 00 "Earth Moving."

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

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Zinc-Coated Reinforcement: Use galvanized-steel wire ties to fasten zinc-coated reinforcement. Repair cut and damaged zinc coatings with zinc repair material.

F. Epoxy-Coated Reinforcement: Use epoxy-coated steel wire ties to fasten epoxy-coated reinforcement. Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D3963/D3963M.

G. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap of adjacent mats.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.

1. When joining existing paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use epoxy-bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 30 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows, to match jointing of existing adjacent concrete paving:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
    a. Tolerance: Ensure that grooved joints are within 2inches either way from centers of dowels.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
    a. Tolerance: Ensure that sawed joints are within 2inches either way from centers of dowels.
3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

D. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

F. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

G. Screed paving surface with a straightedge and strike off.

H. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

I. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

J. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.7 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.

2. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.

3. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.8 SPECIAL FINISHES

A. Monolithic Exposed-Aggregate Finish: Expose coarse aggregate in paving surface as follows:
   1. Immediately after float finishing, spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
   4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

B. Seeded Exposed-Aggregate Finish: Immediately after initial floating, spread a single layer of aggregate uniformly on paving surface. Tamp aggregate into plastic concrete and float finish to entirely embed aggregate with mortar cover of 1/16 inch.
   1. Spray-apply chemical surface retarder to paving according to manufacturer's written instructions.
   2. Cover paving surface with plastic sheeting, sealing laps with tape, and remove sheeting when ready to continue finishing operations.
   3. Without dislodging aggregate, remove mortar concealing the aggregate by lightly brushing surface with a stiff, nylon-bristle broom. Do not expose more than one-third of the average diameter of the aggregate and not more than one-half of the diameter of the smallest aggregate.
   4. Fine-spray surface with water and brush. Repeat cycle of water flushing and brushing until cement film is removed from aggregate surfaces to depth required.

C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread dampened, slip-resistive aggregate over paving surface in two applications. Tamp aggregate flush with surface using a steel trowel, but do not force below surface.
   2. Uniformly distribute approximately two-thirds of slip-resistive aggregate over paving surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second slip-resistive aggregate application, uniformly distributing remainder of material at right angles to first application to ensure uniform coverage, and embed by power floating.
   3. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
   4. After curing, lightly work surface with a steel-wire brush or abrasive stone and water to expose nonslip aggregate.

D. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to paving surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread dry-shake hardener at a rate per manufacturer.
   2. Uniformly distribute approximately two-thirds of dry-shake hardener over the concrete surface with mechanical spreader; allow hardener to absorb moisture and embed it by power floating. Follow power floating with a second application of pigmented mineral dry-shake hardener, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed hardener by final power floating.
   3. After final power floating, apply a hand-troweled finish followed by a broom finish.
   4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.9 DETECTABLE WARNING INSTALLATION

A. Blockouts: Form blockouts in concrete for installation of detectable paving units specified in Section 32 17 26 "Tactile Warning Surfacing."

1. Tolerance for Opening Size: Plus 1/4 inch, no minus.

B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles specified in Section 32 17 26 "Tactile Warning Surfacing." Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with Section 32 17 26 "Tactile Warning Surfacing" immediately after screeding concrete surface.

C. Stamped Detectable Warnings: Install stamped detectable warnings as part of a continuous concrete paving placement and according to stamp-mat manufacturer's written instructions.

1. Before using stamp mats, verify that the vent holes are unobstructed.
2. Apply liquid release agent to the concrete surface and the stamp mat.
3. Stamping: While initially finished concrete is plastic accurately align and place stamp mats in sequence. Uniformly load, gently vibrate, and press mats into concrete to produce imprint pattern on concrete surface. Load and tamp mats directly perpendicular to the stamp-mat surface to prevent distortion in shape of domes. Press and tamp until mortar begins to come through all of the vent holes. Gently remove stamp mats.
4. Trimming: After 24 hours, cut off the tips of mortar formed by the vent holes.
5. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture-retaining-cover curing as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.11 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch.
   2. Thickness: Plus 3/8 inch, minus 1/4 inch.
   3. Surface: Gap below 10-feet-long; unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Lateral Alignment and Spacing of Dowels: 1 inch.
   6. Vertical Alignment of Dowels: 1/4 inch.
   7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Paving Edge: 1/4 inch per 12 inches of dowel.
   8. Joint Spacing: 3 inches.
   9. Contraction Joint Depth: Plus 1/4 inch, no minus.
   10. Joint Width: Plus 1/8 inch, no minus.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or 3000 sq. ft. or fraction thereof of each concrete mixture placed each day.
      a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
   4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
   5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
   6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.
      a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIR AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

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SECTION 32 17 23 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes painted markings applied to asphalt and concrete pavement.

B. Related Requirements:

1. Section 07 18 00 "Traffic Coatings" for painting whole areas of building floors and pavements with coatings having an integral wearing surface.
2. Section 09 91 13 "Exterior Painting" for painting exterior concrete surfaces other than pavement.
3. Section 09 91 23 "Interior Painting" for painting interior concrete surfaces other than pavement.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking pavement including, but not limited to, the following:
   a. Pavement aging period before application of pavement markings.
   b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

B. Shop Drawings: For pavement markings.

1. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
2. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each exposed product and for each color and texture specified; on rigid backing, 8 inches square.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of FDOT for pavement-marking work.

1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. Aexcel Inc.
2. Colorado Paint Company; a subsidiary of Swarco Industries Inc.
3. Columbia Paint & Coatings, Inc.; a subsidiary of Sherwin-Williams Company (The).
4. Conco Paints.
5. Diamond Vogel Paints.
6. Dow Chemical Company (The).
7. Dunn-Edwards Corporation.
8. Ennis-Flint.
9. General Paint.
10. Insl-X Products; Benjamin Moore & Co.
11. McCormick Paints.
12. PPG Paints.
13. Rodda Paint Co.
14. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
15. Scott Paint.
16. Sherwin-Williams Company (The).
17. Transpo Industries, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and the University of Florida Environmental Health and Safety Standards.

2.3 PAVEMENT-MARKING PAINT

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type S; colors complying with FS TT-P-1952.

1. Color: As indicated

B. Pavement-Marking Paint: MPI #32, solvent-borne traffic-marking paint.

1. Color: As indicated

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.

1. Color: As indicated

D. Pavement-Marking Paint: MPI #97, latex traffic-marking paint.

1. Color: As indicated.

E. Glass Beads: AASHTO M 247, Type 1.

1. Roundness: Minimum 70 percent true spheres by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

B. Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for a minimum of 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.
2. Broadcast glass beads uniformly into wet markings at a rate of 6 lb/gal.

3.3 PROTECTING AND CLEANING

A. Protect pavement markings from damage and wear during remainder of construction period.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 32 17 23

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SECTION 33-42-00 - STORMWATER CONVEYANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Ductile-iron culvert pipe and fittings.
2. Ductile-iron, pressure pipe and fittings.
3. Corrugated-steel pipe and fittings.
4. Corrugated-aluminum pipe and fittings.
5. ABS pipe and fittings.
6. PE pipe and fittings.
7. PVC pipe and fittings.
8. Fiberglass sewer pipe and fittings.
9. Concrete pipe and fittings.
10. Non-pressure transition couplings.
11. Pressure pipe couplings.
12. Expansion joints and deflection fittings.
13. Backwater valves.
14. Cleanouts.
15. Drains.
16. Encasement for piping.
17. Manholes.
18. Polymer-concrete, channel drainage systems.
19. Plastic, channel drainage systems.
20. Catch basins.
21. Stormwater inlets.
22. Stormwater detention structures.
23. Pipe outlets.
24. Dry wells.
25. Stormwater disposal systems.
26. Stormtech Chambers

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings:
   1. Manholes: Include plans, elevations, sections, details, frames, and covers.
   2. Catch basins, stormwater inlets: Include plans, elevations, sections, details, frames, covers, and grates.
   3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames, covers, design calculations, and concrete design-mix reports.
   4. Stormtech Chambers and appurtenances

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.

B. Profile Drawings: Show system piping in elevation. Draw profiles at horizontal scale of not less than 1 inch equals 50 feet and vertical scale of not less than 1 inch equals 5 feet. Indicate manholes and piping. Show types, sizes, materials, and elevations of other utilities crossing system piping.

C. Product Certificates: For each type of cast-iron soil pipe and fitting, from manufacturer.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes in accordance with manufacturer's written rigging instructions.

D. Handle catch basins, stormwater inlets, and stormtech chambers in accordance with manufacturer's written rigging instructions.

1.8 Deleted

PART 2 - PRODUCTS

2.1 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AB & I Foundry; a part of the McWane family of companies.
   2. Charlotte Pipe and Foundry Company.
   3. NewAge Casting.
   4. Tyler Pipe; a part of McWane family of companies.

B. Source Limitations: Obtain hub-and-spigot, cast-iron soil pipe and fittings from single manufacturer.

C. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Class: ASTM A74, Service and Extra Heavy class(es).

D. Gaskets: ASTM C564, rubber.

E. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.2 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. AB & I Foundry; a part of the McWane family of companies.
   2. Charlotte Pipe and Foundry Company.
   3. NewAge Casting.
   4. Tyler Pipe; a part of McWane family of companies.

B. Source Limitations: Obtain hubless cast-iron soil pipe and fittings from single manufacturer.

C. Pipe and Fittings:
   1. Marked with CISPI collective trademark and NSF certification mark.
   2. Standard: ASTM A888 or CISPI 301.

D. CISPI, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ANACO-Husky.
      b. Charlotte Pipe and Foundry Company.
      c. Dallas Specialty & Mfg. Co.
      d. Fernco Inc.
      e. Ideal Clamp Products, Inc.
      f. Matco-Norca.
      g. MIFAB, Inc.
      h. Mission Rubber Company, LLC; a division of MCP Industries.
      i. NewAge Casting.
      j. Tyler Pipe; a subsidiary of McWane Inc.
   2. Source Limitations: Obtain CISPI, hubless-piping couplings from single manufacturer.
   3. Description: Stainless-steel corrugated shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stop.
   4. Standards:
      a. ASTM C1277 and CIPSI 310 for couplings.
      b. ASTM C564 for gaskets.

E. Heavy-Duty, Hubless-Piping Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ANACO-Husky.
      b. Charlotte Pipe and Foundry Company.
      c. Clamp-All Corp.
      d. Dallas Specialty & Mfg. Co.
      e. Ideal Clamp Products, Inc.
      f. MIFAB, Inc.
      g. Mission Rubber Company, LLC; a division of MCP Industries.
      h. NewAge Casting.
      i. Tyler Pipe; a subsidiary of McWane Inc.
   2. Source Limitations: Obtain heavy-duty, hubless-piping couplings from single manufacturer.

3. Description: Stainless-steel shield; stainless-steel bands and tightening devices; and rubber sleeve with integral, center pipe stop.
4. Standards:
   a. ASTM C1277 and ASTM C1540 for couplings.
   b. ASTM C564 for rubber gaskets.

F. Cast-Iron, Hubless-Piping Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Charlotte Pipe and Foundry Company.
   b. MG Piping Products Company.
2. Source Limitations: Obtain cast-iron, hubless-piping couplings from single manufacturer.
3. Description: Two-piece, cast-iron housing; stainless-steel bolts and nuts; and rubber sleeve with integral, center pipe stop.
4. Standards:
   a. ASTM C1277 for couplings.
   b. ASTM A48/A48M for cast-iron castings.
   c. ASTM C564 for gaskets.

2.3 DUCTILE-IRON, CULVERT PIPE AND FITTINGS

A. Pipe: ASTM A716, for push-on joints.

B. Standard Fittings: AWWA C110/A21.10, ductile or gray iron, for push-on joints.

C. Compact Fittings: AWWA C153/A21.53, for push-on joints.

D. Gaskets: AWWA C111/A21.11, rubber.

2.4 DUCTILE-IRON, PRESSURE PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Ductile Iron Pipe.
2. McWane Ductile.
3. U.S. Pipe and Foundry Company.

B. Source Limitations: Obtain ductile-iron, pressure pipe and fittings from single manufacturer.

C. Ductile-Iron, Push-on-Joint Piping:
1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

D. Ductile-Iron, Mechanical-Joint Piping:
1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.5 CORRUGATED-STEEL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. American Piping Products.
   2. Specialty Pipe & Tube.
   3. Steel Mart, Inc.

B. Source Limitations: Obtain corrugated-steel pipe and fittings from single manufacturer.

C. Corrugated-Steel Pipe and Fittings: ASTM A760/A760M, Type I with fittings of similar form and construction as pipe.
   1. Special-Joint Bands: Corrugated steel with O-ring seals.
   2. Standard-Joint Bands: Corrugated steel.
   3. Coating: Aluminum or Zinc

2.6 CORRUGATED-ALUMINUM PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Brunner Enterprises, Inc.
   2. Continental Steel & Tube.
   3. Sapa North America.

B. Source Limitations: Obtain corrugated-aluminum pipe and fittings from single manufacturer.

C. Corrugated-Aluminum Pipe and Fittings: ASTM B745/B745M, Type I with fittings of similar form and construction as pipe.
   1. Special-Joint Bands: Corrugated aluminum with O-ring seals.
   2. Standard-Joint Bands: Corrugated aluminum.

2.7 ABS PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Charlotte Pipe and Foundry Company.
   2. JM Eagle.
   3. Mueller Industries, Inc.
   4. Rocky Mountain Colby Pipe Company.
   5. Royal Building Products.

B. Source Limitations: Obtain ABS pipe and fittings from single manufacturer.

C. NSF Marking: Comply with NSF 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

D. Solid-Wall ABS Pipe: ASTM D2661, Schedule 40.

E. Cellular-Core ABS Pipe: ASTM F628, Schedule 40.

F. ABS Socket Fittings: ASTM D2661, made to ASTM D3311, drain, waste, and vent patterns.

G. Gaskets: ASTM F477, elastomeric seals.

H. Solvent Cement: ASTM D2235.
   1. Solvent cement shall have a VOC content of 325 g/L or less.

2. Solvent cement shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.8 CORRUGATED-PE PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Emco Industrial Plastics.
   2. Industrial Specialties Mfg, Inc.

B. Source Limitations: Obtain corrugated-PE pipe and fittings from single manufacturer.

C. Corrugated-PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

D. Corrugated-PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 294, Type S, with smooth waterway for coupling joints.

E. Corrugated-PE Silttight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.

F. Corrugated-PE Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings.

2.9 PVC PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Charlotte Pipe and Foundry Company.
   2. GF Piping Systems.
   3. JM Eagle.
   4. Mueller Industries, Inc.
   5. National Pipe and Plastic, Inc.
   6. North America Pipe Corporation.
   7. Rocky Mountain Colby Pipe Company.
   8. Silver-line Plastics.

B. Source Limitations: Obtain PVC pipe and fittings from single manufacturer.

C. NSF Marking: Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic storm drain and "NSF-sewer" for plastic storm sewer piping.

D. PVC Cellular-Core Piping:
   1. PVC Cellular-Core Pipe and Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
   2. Fittings: ASTM D3034, SDR 35 PVC socket-type fittings.

E. PVC Corrugated Sewer Piping:
   1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
   3. Gaskets: ASTM F477, elastomeric seals.

F. PVC Profile Sewer Piping:
   1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM D3034, PVC with bell ends.

3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Type PSM Sewer Piping:
1. Pipe: ASTM D3034, SDR 35 PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D3034, PVC with bell ends.
3. Gaskets: ASTM F477, elastomeric seals.

H. PVC Gravity Sewer Piping:
1. Pipe and Fittings: ASTM F679, PS 75 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends and with integral ASTM F477, elastomeric seals for gasketed joints.

I. PVC Pressure Piping:
1. Pipe: AWWA C900, Class 200 PVC pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: AWWA C900, Class 200 PVC pipe with bell ends
3. Gaskets: ASTM F477, elastomeric seals.

J. PVC Water-Service Piping:
1. Pipe: ASTM D1785, Schedule 80 PVC, with plain ends for solvent-cemented joints.
2. Fittings: ASTM D2467, Schedule 80 PVC, socket type.

K. Adhesive Primer: ASTM F656.
1. Adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.10 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:
1. For Concrete Pipes: ASTM C443, rubber.
2. For Cast-Iron Soil Pipes: ASTM C564, rubber.
3. For Fiberglass Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
4. For Plastic Pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
5. For Dissimilar Pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Dallas Specialty & Mfg. Co.
b. Fernco Inc.
c. Logan Clay Pipe.
d. Mission Rubber Company, LLC; a division of MCP Industries.
e. NDS Inc.
f. Plastic Oddities.
2. Source Limitations: Obtain unshielded, flexible couplings from single manufacturer.
3. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Mfg. Co.
      b. Dallas Specialty & Mfg. Co.
      c. Mission Rubber Company, LLC; a division of MCP Industries.
   2. Source Limitations: Obtain shielded, flexible couplings from single manufacturer.
   3. Description: ASTM C1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fernco Inc.
      b. Logan Clay Pipe.
      c. Mission Rubber Company, LLC; a division of MCP Industries.
   2. Source Limitations: Obtain ring-type, flexible couplings from single manufacturer.
   3. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.11 PRESSURE PIPE COUPLINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cascade Waterworks Mfg. Co.
   2. Dresser, Inc.
   3. Ford Meter Box Company, Inc. (The).
   4. Jay R. Smith Mfg. Co.
   5. JCM Industries, Inc.
   6. Romac Industries, Inc.
   7. Victaulic Company.
   8. Viking Johnson.

B. Source Limitations: Obtain pressure pipe couplings from single manufacturer.

C. Description: AWWA C219, tubular-sleeve coupling, with center sleeve, gaskets, end rings, and bolt fasteners.

D. Metal, bolted, sleeve-type, reducing or transition coupling, for joining underground pressure piping. Include 200 psig minimum pressure rating and ends sized to fit adjoining pipes.

E. Gasket Material: Natural or synthetic rubber.

F. Metal Component Finish: Corrosion-resistant coating or material.

2.12 EXPANSION JOINTS AND DEFLECTION FITTINGS

A. Ductile-Iron, Flexible Expansion Joints:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. EBAA Iron, Inc.
      b. Romac Industries, Inc.
      c. Star Pipe Products.

2. Source Limitations: Obtain ductile-iron, flexible expansion joints from single manufacturer.
3. Description: Compound fitting with combination of flanged and mechanical-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include two gasketed ball-joint sections and one or more gasketed sleeve sections, rated for 250-psig minimum working pressure and for offset and expansion indicated.

B. Ductile-Iron Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Dresser, Inc.
b. EBAA Iron, Inc.
c. Jay R. Smith Mfg. Co.
d. JCM Industries, Inc.
2. Source Limitations: Obtain ductile-iron expansion joints from single manufacturer.
3. Description: Three-piece assembly of telescoping sleeve with gaskets and restrained-type, ductile iron or steel with protective coating; bell-and-spigot end sections complying with AWWA C110/A21.10 or AWWA C153/A21.53.
4. Pressure Rating: 250-psig minimum working pressure and for expansion indicated.

C. Ductile-Iron Deflection Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. EBAA Iron, Inc.
2. Source Limitations: Obtain ductile-iron deflection fittings from single manufacturer.
3. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110/A21.10 or AWWA C153/A21.53. Include AWWA C111/A21.11, ductile-iron glands, rubber gaskets, and steel bolts. Include AWWA C111/A21.11 ductile-iron glands, rubber gaskets, and steel bolts.
4. Pressure Rating: 250 psig minimum.

2.13 BACKWATER VALVES

A. Cast-Iron Backwater Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Jay R. Smith Mfg. Co.
b. Josam Company.
c. Tyler Pipe; a subsidiary of McWane Inc.
d. WATTS.
e. Zurn Industries, LLC.
2. Source Limitations: Obtain cast-iron backwater valves from single manufacturer.
3. Description: ASME A112.14.1, gray-iron body and bolted cover, with bronze seat.
4. Horizontal type; with swing check valve and hub-and-spigot ends.
5. Combination horizontal and manual gate-valve type; with swing check valve, integral gate valve, and hub-and-spigot ends.
6. Terminal type; with bronze seat, swing check valve, and hub inlet.

B. PVC Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Industries, LLC.
2. Source Limitations: Obtain PVC backwater valves from single manufacturer.
3. Description: Horizontal type; with PVC body, PVC removable cover, and PVC swing check valve.

2.14 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Tyler Pipe; a subsidiary of McWane Inc.
   e. WATTS.
   f. Zurn Industries, LLC.
   g. Nyloplast
2. Source Limitations: Obtain cast-iron cleanouts from single manufacturer.
3. Description: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside caulk or spigot connection and countersunk, tapered-thread, brass closure plug.
4. Top-Loading Classification(s): Heavy Duty and Extra-Heavy Duty
5. Sewer Pipe Fitting and Riser to Cleanout: ASTM A74, Service class, cast-iron soil pipe and fittings.

B. PVC Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Canplas LLC.
   b. IPS Corporation.
   c. NDS Inc.
   d. Plastic Oddities.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Zurn Industries, LLC.
   g. Nyloplast
2. Source Limitations: Obtain PVC cleanouts from single manufacturer.
3. Description: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

2.15 DRAINS

A. Cast-Iron Area Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Neenah Foundry Company.
   e. Tyler Pipe; a subsidiary of McWane Inc.
   f. WATTS.
   g. Zurn Industries, LLC.
   h. Nyloplast
2. Source Limitations: Obtain cast-iron area drains from single manufacturer.
3. Description: ASME A112.6.3 gray-iron round body with anchor flange and round or square grate. Include bottom outlet with inside caulk or spigot connection, of sizes indicated.
4. Top-Loading Classification(s): Medium and Heavy Duty.

B. Grate Openings: 3/8 inch circular or 3/8-by-3-inch slots.

2.16 STORMWATER DISPOSAL SYSTEMS

A. Chamber Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Drainage Systems, Inc.
   b. CULTEC, Inc.
   c. Hancor Inc.
   d. Infiltrator Systems Inc.
   e. Interface H2O.
   f. StormTech LLC.
   g. Suntree Technologies, Inc.
2. Source Limitations: Obtain chamber systems from single manufacturer.
3. Storage and Leaching Chambers: Molded PE with perforated sides and open bottom. Include number of chambers, distribution piping, end plates, and other standard components as required for system total capacity.
4. Filtering Material: ASTM D448, Size No. 24, 3/4- to 2-1/2-inch washed, crushed stone or gravel.
5. Filter Mat: Geotextile woven or spun filter fabric, in one or more layers, for minimum total unit weight of 4 oz./sq. yd..

B. Pipe Systems: Perforated manifold, header, and lateral piping complying with AASHTO M 252 for NPS 10 and smaller, AASHTO M 294 for NPS 12 to NPS 60. Include proprietary fittings, couplings, seals, and filter fabric.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advanced Drainage Systems, Inc.
   b. Hancor Inc.
2. Source Limitations: Obtain pipe systems from single manufacturer.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

F. Install gravity-flow, nonpressure drainage piping in accordance with the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
3. Install piping with 36 inch-minimum cover.
4. Install hub-and-spigot, cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
5. Install hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
6. Install ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
7. Install corrugated-steel piping in accordance with ASTM A798/A798M.
8. Install corrugated-aluminum piping in accordance with ASTM B788/B788M.
9. Install ABS sewer piping in accordance with ASTM D2321 and ASTM F1668.
10. Install PE corrugated sewer piping in accordance with ASTM D2321.
11. Install PVC cellular-core piping in accordance with ASTM D2321 and ASTM F1668.
12. Install PVC sewer piping in accordance with ASTM D2321 and ASTM F1668.
13. Install PVC profile gravity sewer piping in accordance with ASTM D2321 and ASTM F1668.
14. Install PVC water-service piping in accordance with ASTM D2321 and ASTM F1668.
15. Install fiberglass sewer piping in accordance with ASTM D3839 and ASTM F1668.
16. Install nonreinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."
17. Install reinforced-concrete sewer piping in accordance with ASTM C1479 and ACPA's "Concrete Pipe Installation Manual."

G. Install force-main pressure piping in accordance with the following:
   1. Install piping with restrained joints at tee fittings and at horizontal and vertical changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
   2. Install piping with 36 inch-minimum cover.
   3. Install ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41.
   4. Install ductile-iron special fittings in accordance with AWWA C600.
   5. Install PVC pressure piping in accordance with AWWA M23, or ASTM D2774 and ASTM F1668.
   6. Install PVC water-service piping in accordance with ASTM D2774 and ASTM F1668.

H. Install corrosion-protection piping encasement over the following underground metal piping in accordance with ASTM A674 or AWWA C105/A21.5:
   1. Hub-and-spigot, cast-iron soil pipe and fittings.
   2. Hubless cast-iron soil pipe and fittings.
   3. Ductile-iron pipe and fittings.
   4. Expansion joints and deflection fittings.

3.3 PIPE JOINT CONSTRUCTION

A. Join gravity-flow, nonpressure drainage piping in accordance with the following:
   1. Join hub-and-spigot, cast-iron soil piping with gasketed joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
   2. Join hub-and-spigot, cast-iron soil piping with caulked joints in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum caulked joints.
   3. Join hubless cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
   4. Join ductile-iron culvert piping in accordance with AWWA C600 for push-on joints.
   5. Join ductile-iron piping and special fittings in accordance with AWWA C600 or AWWA M41.
   6. Join corrugated-steel sewer piping in accordance with ASTM A798/A798M.
   7. Join corrugated-aluminum sewer piping in accordance with ASTM B788/B788M.
   8. Join ABS sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
   9. Join corrugated-PE piping in accordance with ASTM D3212 for push-on joints.
   10. Join PVC cellular-core piping in accordance with ASTM D2321 and ASTM F891 for solvent-cemented joints.
   11. Join PVC corrugated sewer piping in accordance with ASTM D2321 for elastomeric-seal joints.
   12. Join PVC sewer piping in accordance with ASTM D2321 and ASTM D3034 for elastomeric-seal joints or ASTM D3034 for elastomeric-gasketed joints.
   13. Join PVC profile gravity sewer piping in accordance with ASTM D2321 for elastomeric-seal joints or ASTM F794 for gasketed joints.
   14. Join fiberglass sewer piping in accordance with ASTM D3839 for elastomeric-seal joints.
   15. Join nonreinforced-concrete sewer piping in accordance with ASTM C14 and ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   16. Join reinforced-concrete sewer piping in accordance with ACPA's "Concrete Pipe Installation Manual" for rubber-gasketed joints.
   17. Join dissimilar pipe materials with nonpressure-type flexible couplings.

B. Join force-main pressure piping in accordance with the following:
   1. Join ductile-iron pressure piping in accordance with AWWA C600 or AWWA M41 for push-on joints.
   2. Join ductile-iron special fittings in accordance with AWWA C600 or AWWA M41 for push-on joints.
   3. Join PVC pressure piping in accordance with AWWA M23 for gasketed joints.
   4. Join PVC water-service piping in accordance with ASTM D2855 for solvent-cemented joints.
   5. Join dissimilar pipe materials with pressure-type couplings.

3.4 BACKWATER VALVE INSTALLATION

A. Install horizontal-type backwater valves in piping where indicated.

B. Install combination horizontal and manual gate-valve type in piping and in manholes where indicated.

C. Install terminal-type backwater valves on end of piping and in manholes where indicated.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
   1. Use Light-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification cleanouts in roads.

B. Set cleanout frames and covers in earth in cast-in-place concrete block, 18 by 18 by 8 inches deep. Set with tops 1 inch(es above surrounding earth grade.

C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Light-Duty, top-loading classification drains in earth or unpaved foot-traffic areas.
   2. Use Medium-Duty, top-loading classification drains in paved foot-traffic areas.
   3. Use Heavy-Duty, top-loading classification drains in vehicle-traffic service areas.
   4. Use Extra-Heavy-Duty, top-loading classification drains in roads.

B. Embed drains in 4-inch-minimum concrete around bottom and sides.

C. Fasten grates to drains if indicated.

D. Set drain frames and covers with tops flush with pavement surface.

E. Assemble trench sections with flanged joints.

F. Embed trench sections in 4 inch-minimum concrete around bottom and sides.

3.7 STORMWATER DISPOSAL SYSTEM INSTALLATION

A. Chamber Systems: Excavate trenches of width and depth, and install system and backfill in accordance with chamber manufacturer's written instructions. Include storage and leaching chambers, filtering material, and filter mat.

B. Piping Systems: Excavate trenches of width and depth, and install piping system, filter fabric, and backfill, in accordance with piping manufacturer's written instructions.

3.8 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Section 22 14 13 "Facility Storm Drainage Piping."

B. Connect force-main piping to building's storm drainage force mains specified in Section 22 14 13 "Facility Storm Drainage Piping." Terminate piping where indicated.

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping; and encase entire wye fitting, plus 6-inch overlap, with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
3. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
    a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
    b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Connect to sediment interceptors specified in Section 22 13 23 "Sanitary Waste Interceptors."

E. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
    a. Shielded flexible couplings for same or minor difference OD pipes.
    b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
    c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.

3.9 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:

1. Close open ends of piping with at least 8 inch-thick, brick masonry bulkheads.
2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
   1. Remove manhole or structure and close open ends of remaining piping.
   2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, gravel, or compacted dirt. Fill to top with concrete.

C. Backfill to grade in accordance with Section 31 20 00 "Earth Moving."

3.10 IDENTIFICATION

A. Materials and their installation are specified in Section 31 20 00 "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
   1. Use detectable warning tape over ferrous piping.
   2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.11 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems in accordance with requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
   4. Submit separate report for each test.
   5. Gravity-Flow Storm Drainage Piping: Test in accordance with requirements of authorities having jurisdiction, UNI-B-6, and the following:
      a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
      b. Option: Test plastic piping in accordance with ASTM F1417.
   6. Force-Main Storm Drainage Piping: Perform hydrostatic test after thrust blocks, supports, and anchors have hardened. Test at pressure not less than 1-1/2 times the maximum system operating pressure, but not less than 150 psig (kPa).
      a. Ductile-Iron Piping: Test in accordance with AWWA C600, "Hydraulic Testing" Section.
      b. PVC Piping: Test in accordance with AWWA M23, "Testing and Maintenance" Chapter.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.12 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

END OF SECTION 33 42 00

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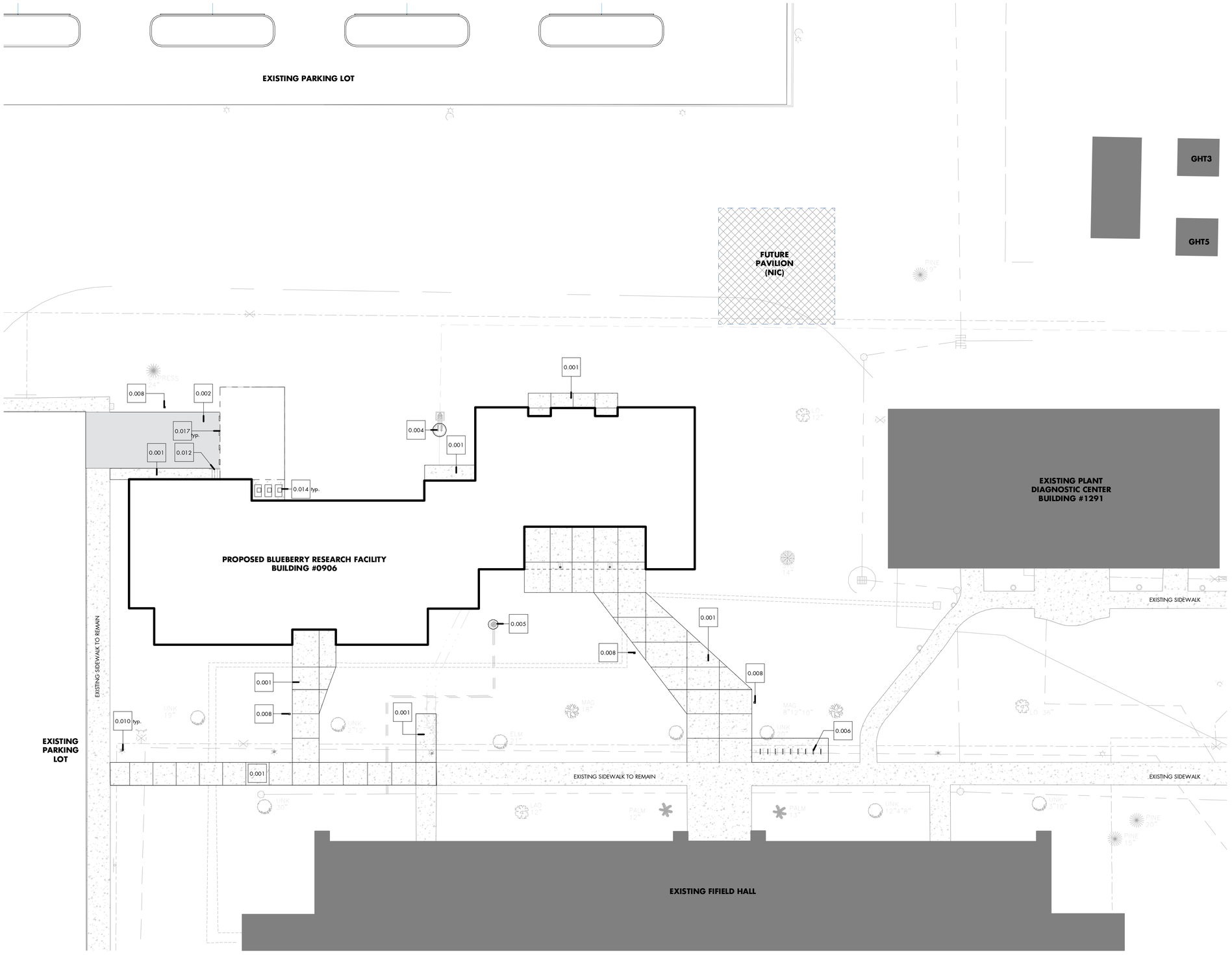

1 ARCHITECTURAL SITE PLAN
scale : 1/16" = 1'-0"

KEYED NOTES

0.001	CONCRETE SIDEWALK.
0.002	ASPHALT DRIVE AISLE.
0.004	LIFT STATION.
0.005	AREA DRAIN.
0.006	BICYCLE RACKS.
0.008	LED SITE LIGHTING.
0.010	EXISTING SITE LIGHTING TO REMAIN.
0.012	HANDRAIL.
0.014	CONDENSING UNIT TIED TO WALK-IN-COOLERS.
0.017	LOADING DOCK BUMPER, 10" TALL BY 24" WIDE SEGMENTS.

SITE PLAN LEGEND

- EXISTING BUILDING / AREA NOT IN SCOPE OF WORK
- NEW BUILDING
- NEW CANOPY
- NEW SIDEWALK
- NEW ASPHALT
- FUTURE PAVILION
- EXISTING

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AR0013510 2020.11.17

Project Information

UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
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32611

Project Number 1918

Distribution

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02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

Revisions

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Sheet Information

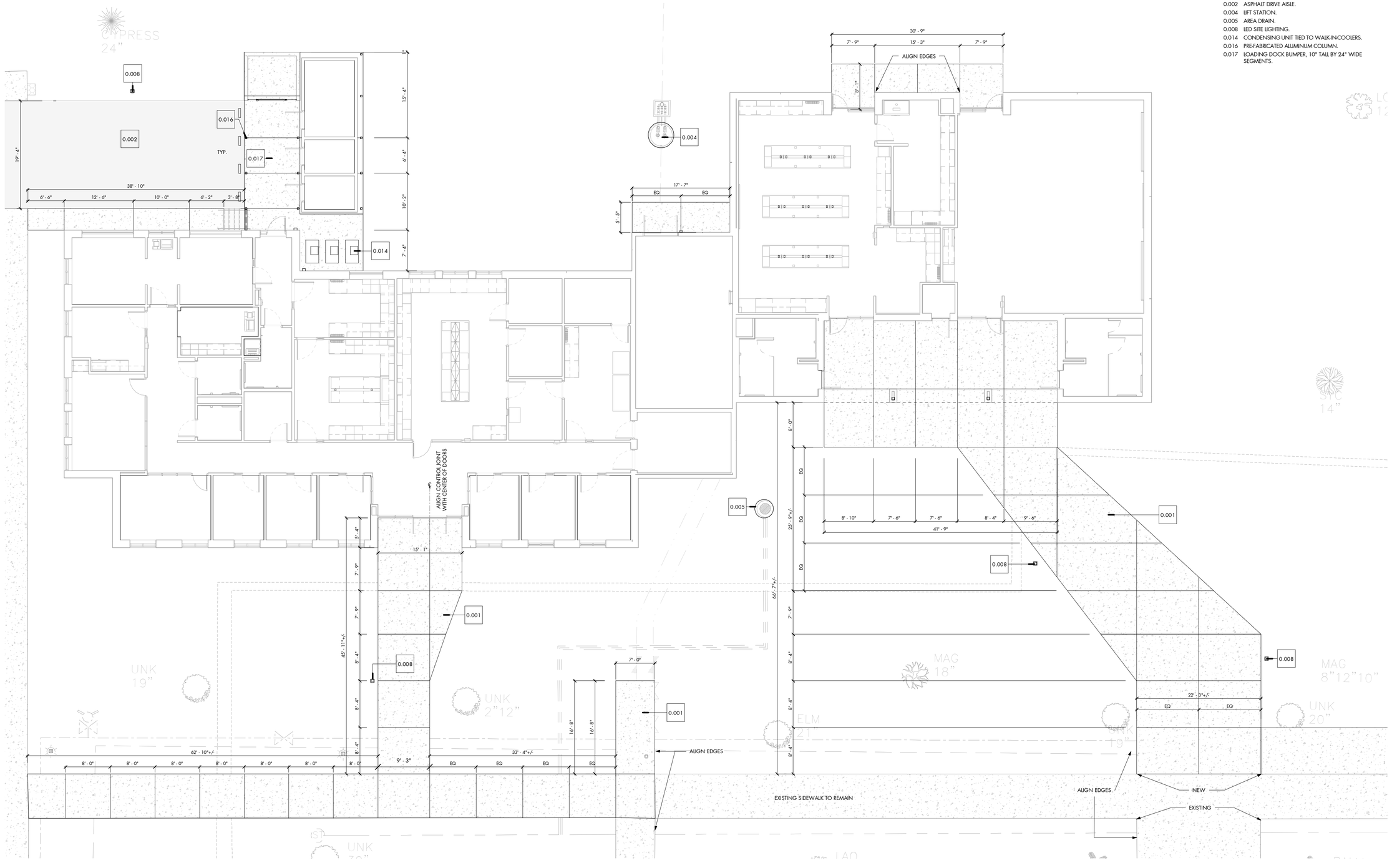
ARCHITECTURAL SITE PLAN

0' 2' 4' 8' 16' 32'
1/16" = 1'-0"

A001

KEYED NOTES

0.001	CONCRETE SIDEWALK.
0.002	ASPHALT DRIVE AISLE.
0.004	LIFT STATION.
0.005	AREA DRAIN.
0.008	LED SITE LIGHTING.
0.014	CONDENSING UNIT TIED TO WALK-IN COOLERS.
0.016	PRE-FABRICATED ALUMINUM COLUMN.
0.017	LOADING DOCK BUMPER, 10" TALL BY 24" WIDE SEGMENTS.



1 FLOOR PLAN - DIMENSIONED - HARDSCAPE
scale : 1/8" = 1'-0"

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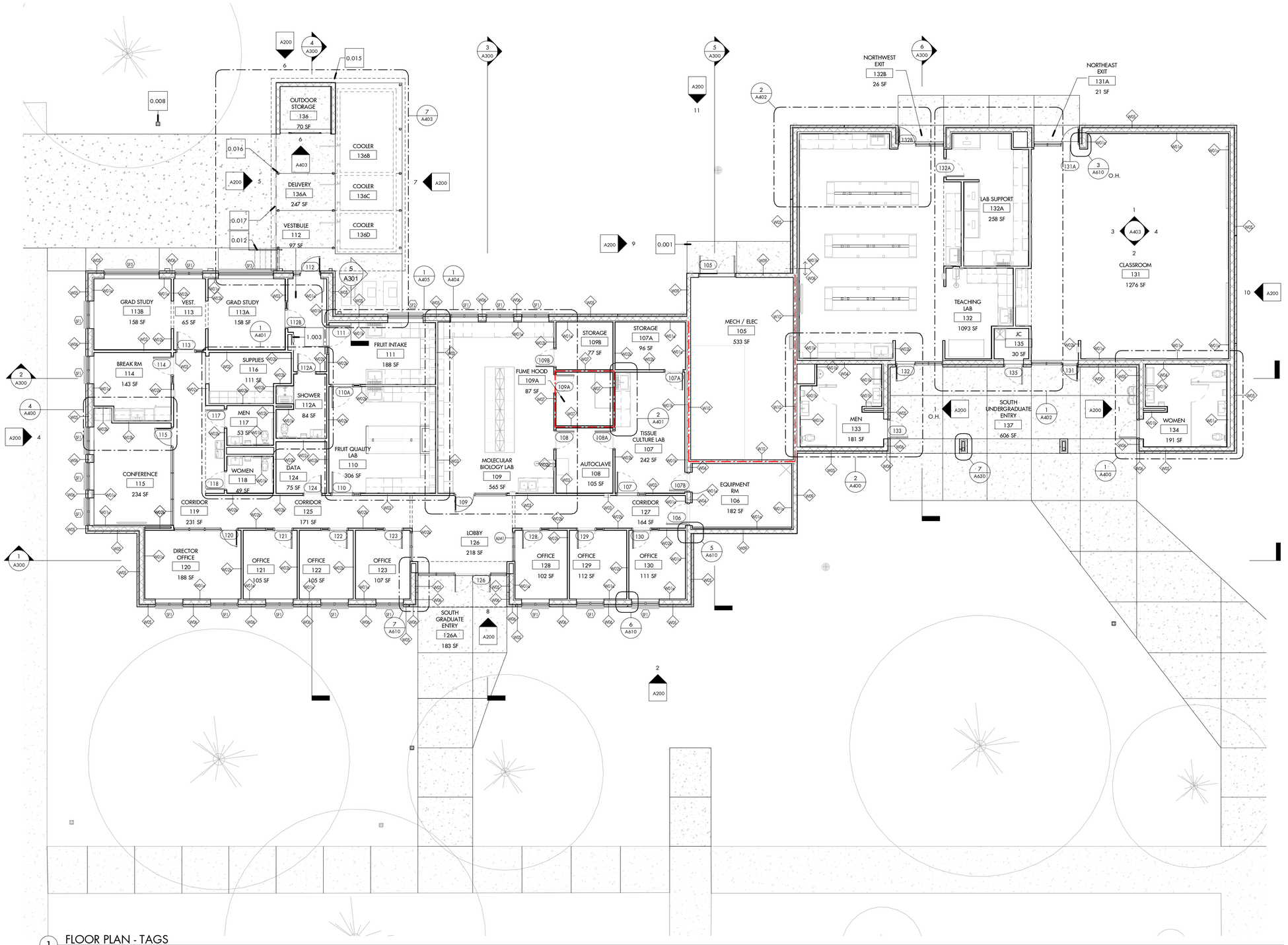
Sheet Information

ARCHITECTURAL SITE PLAN - HARDSCAPE

0' 1'-2" 4' 8' 16'
1/8" = 1'-0"

A002



1 FLOOR PLAN - TAGS
scale : 1/8" = 1'-0"

KEYED NOTES

0.001	CONCRETE SIDEWALK.
0.008	LED SITE LIGHTING.
0.012	HANDRAIL
0.015	PRE-FABRICATED ALUMINUM CANOPY SYSTEM.
0.016	PRE-FABRICATED ALUMINUM COLUMN.
0.017	LOADING DOCK BUMPER, 10" TALL BY 24" WIDE SEGMENTS.
1.003	RECESSED DEFIBRILLATOR CABINET.

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FLOOR PLAN - TAGS

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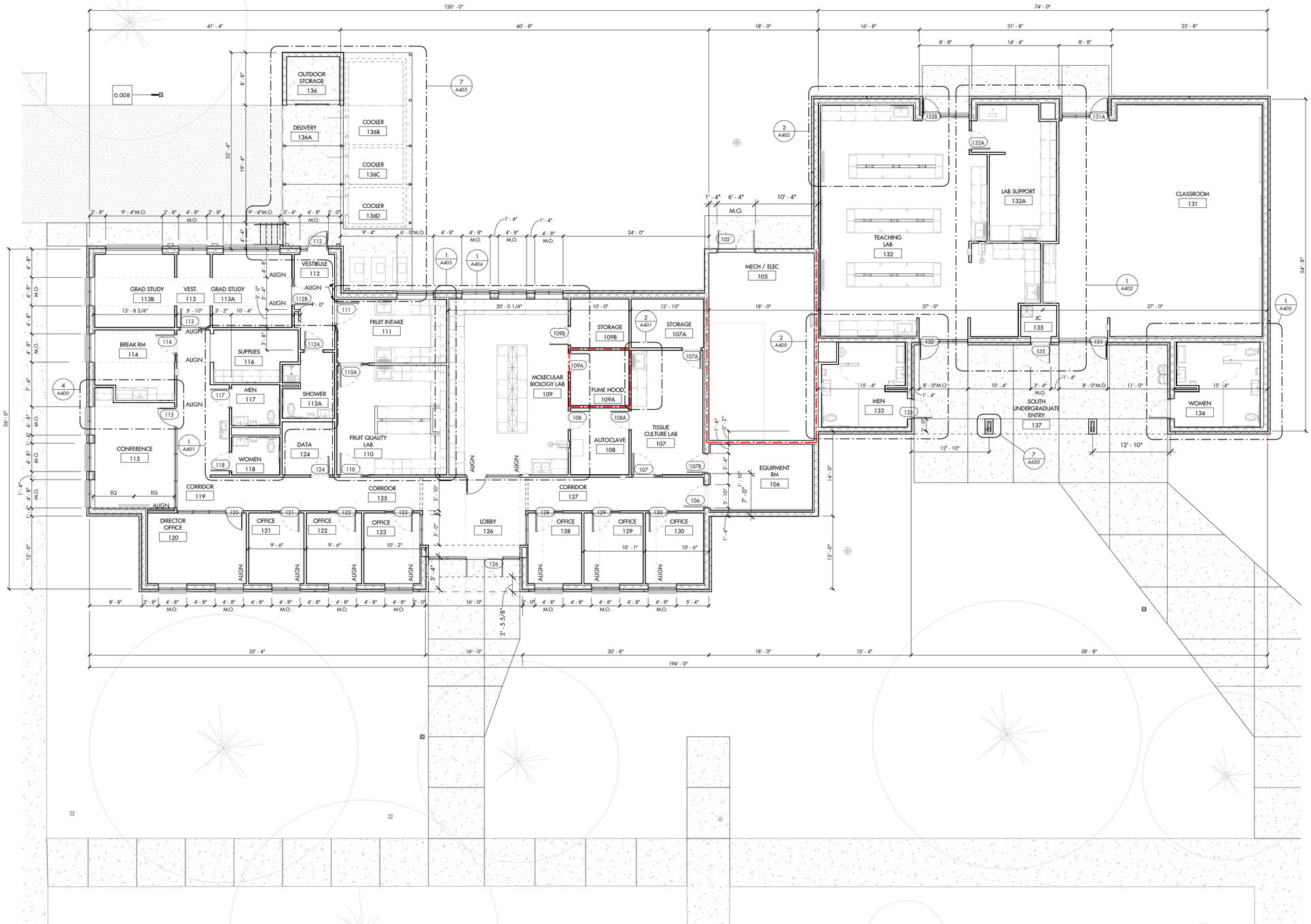
1/8 = 1'-0"

A100



1 FLOOR PLAN - DIMENSIONED
scale : 1/8" = 1'-0"

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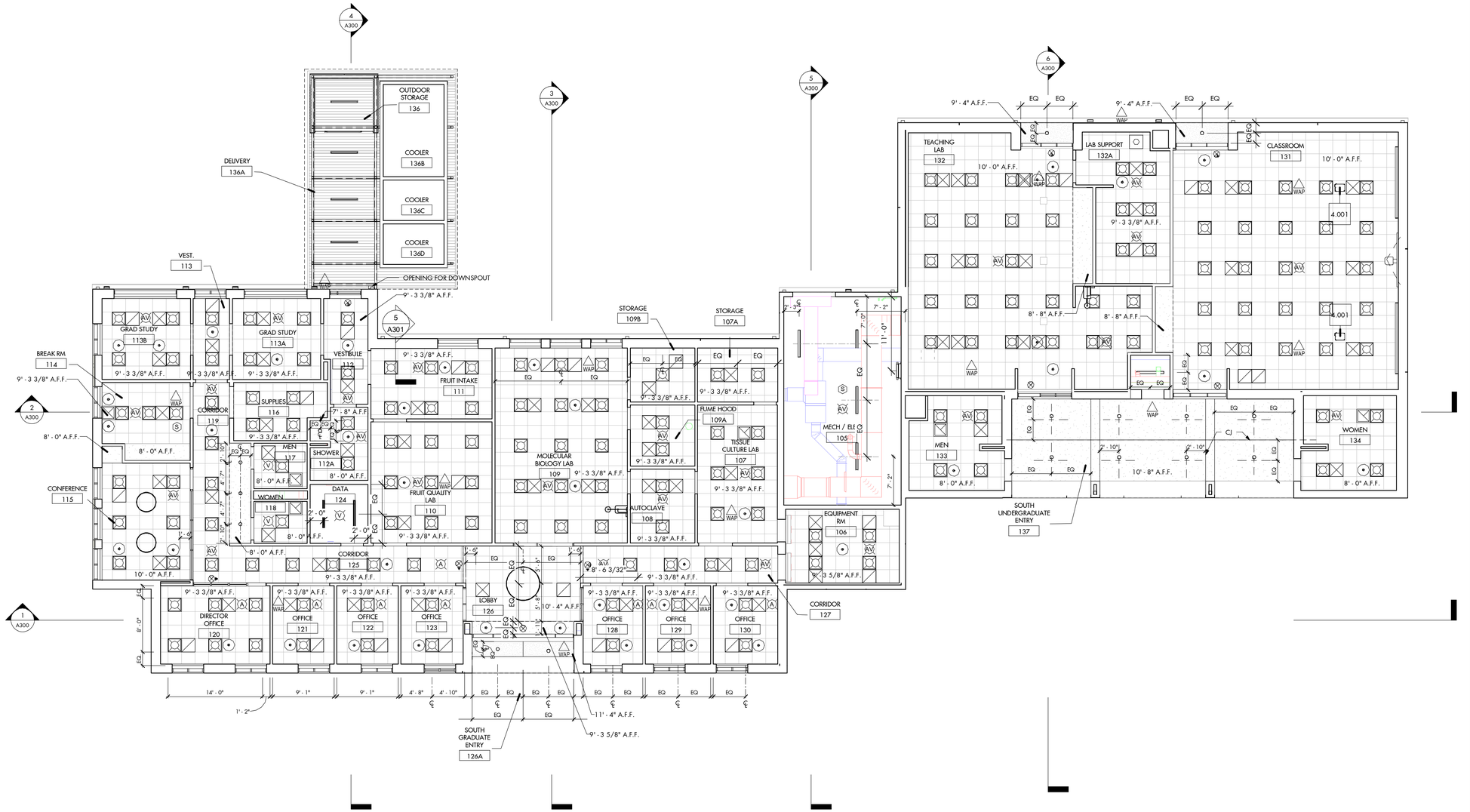
FLOOR PLAN - DIMENSIONED

0' 1' 2' 4' 8' 16'
1/8" = 1'-0"

A101



1 REFLECTED CEILING PLAN
scale : 1/8" = 1'-0"

KEYED NOTES

4.001 CEILING MOUNTED PROJECTOR, PROVIDED AND INSTALLED BY OWNER.

RCP LEGEND

FINISHES

GENERAL NOTE: SEE FINISH SCHEDULE AND LEGEND FOR ADDITIONAL COORDINATION

- OPEN TO STRUCTURE, PAINT
- WALKWAY CANOPY
- GYPSUM BOARD, PAINT
- CEMENT BOARD, PAINT

LUMINARIES

- RECESSED CAN LED LUMINAIRE
- 1'-0" x 4'-0" SUSPENDED LED LUMINAIRE
- 2'-0" x 2'-0" LED LUMINAIRE
- WALL MOUNTED LED LUMINAIRE

MECHANICAL

- MECHANICAL AIR SUPPLY DIFFUSER
- MECHANICAL AIR RETURN GRILLE
- MECHANICAL EXHAUST GRILLE

LOW VOLTAGE

- OS — CEILING MOUNTED OCCUPANCY, VACANCY, OR DAYLIGHT SENSOR
- CEILING MOUNTED DIGITAL PROJECTOR
- WAP — CEILING MOUNTED WIRELESS ACCESS POINT

FIRE PROTECTION

- EXIT SIGN
- FIRE ALARM SPEAKER AND STROBE
- FIRE ALARM SPEAKER
- FIRE ALARM STROBE

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REFLECTED CEILING PLAN

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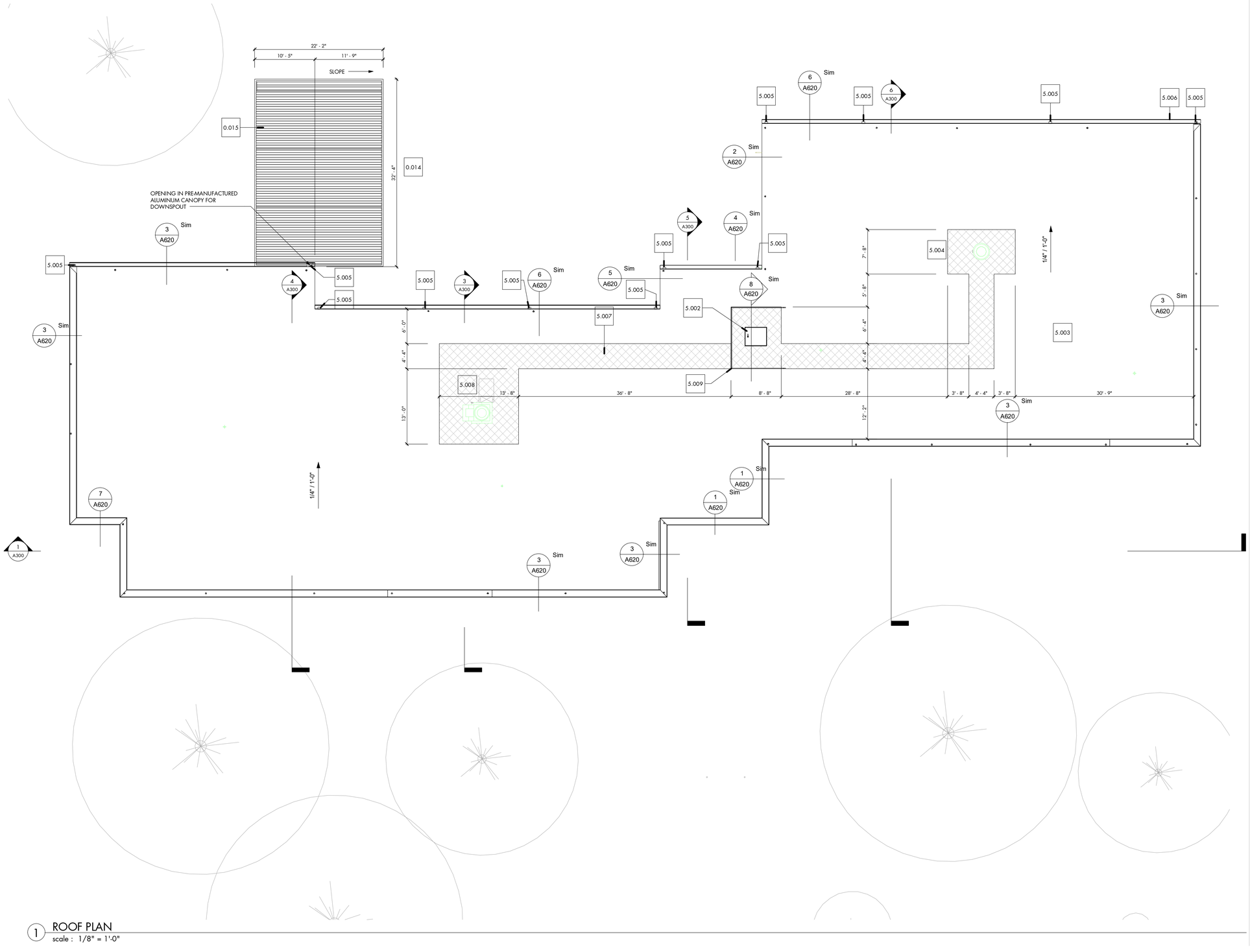
1/8" = 1'-0"

A102



1 ROOF PLAN
scale : 1/8" = 1'-0"

KEYED NOTES

0.015	PRE-FABRICATED ALUMINUM CANOPY SYSTEM.
5.002	ROOF HATCH.
5.003	MODIFIED BITUMEN ROOFING SYSTEM ON TAPERED BOARD INSULATION.
5.004	ROOF MOUNTED FAN ON CURB.
5.005	PRE-FINISHED DOWNSPOUT.
5.006	PRE-FINISHED GUTTER.
5.007	WALKWAY PADS, TYPICAL.
5.009	OSHA 1910.23 COMPLIANT STEEL SELF-CLOSING SAFETY GUARDRAIL WITH SWING GATE.

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ROOF PLAN

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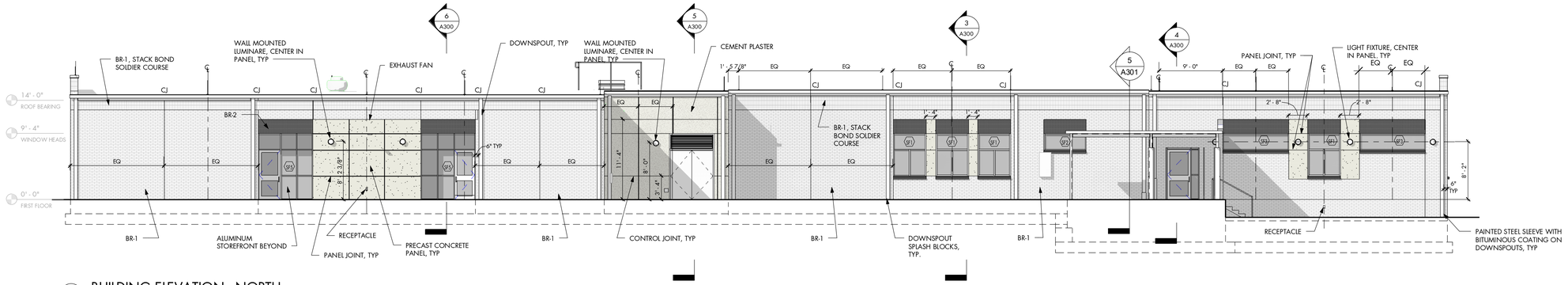
1/8" = 1'-0"

A103



11 BUILDING ELEVATION - NORTH
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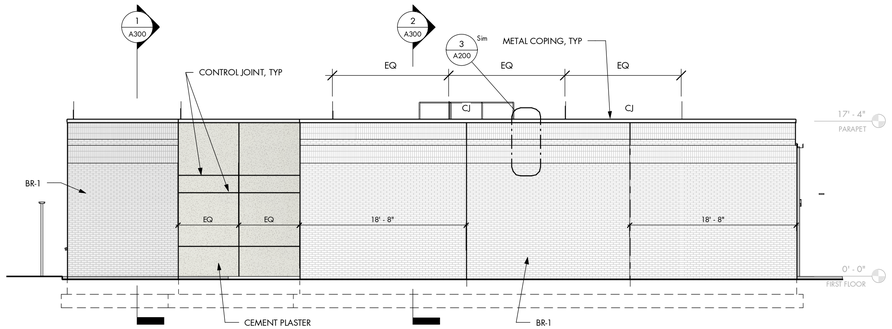

10 BUILDING ELEVATION - EAST
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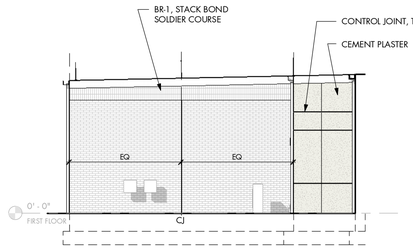

9 BUILDING ELEVATION - WEST PARTIAL
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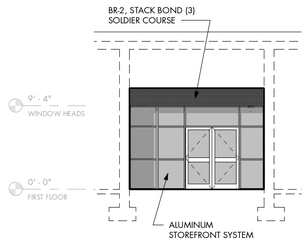

8 126 - S. GRADUATE ENTRY
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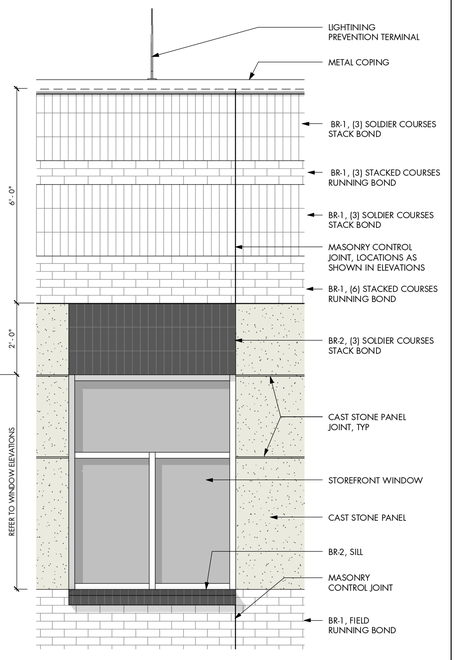

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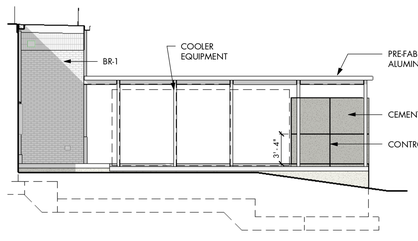

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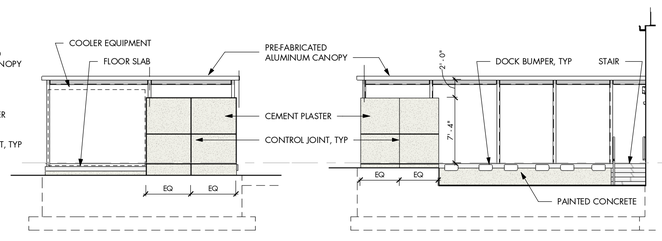

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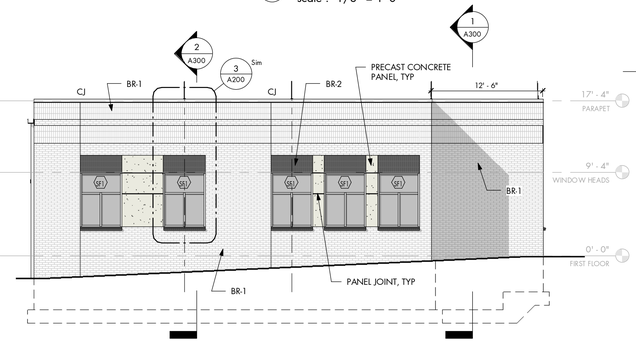
scale : 1/8" = 1'-0"

5 LOADING DOCK - WEST
scale : 1/8" = 1'-0"



4 BUILDING ELEVATION - WEST
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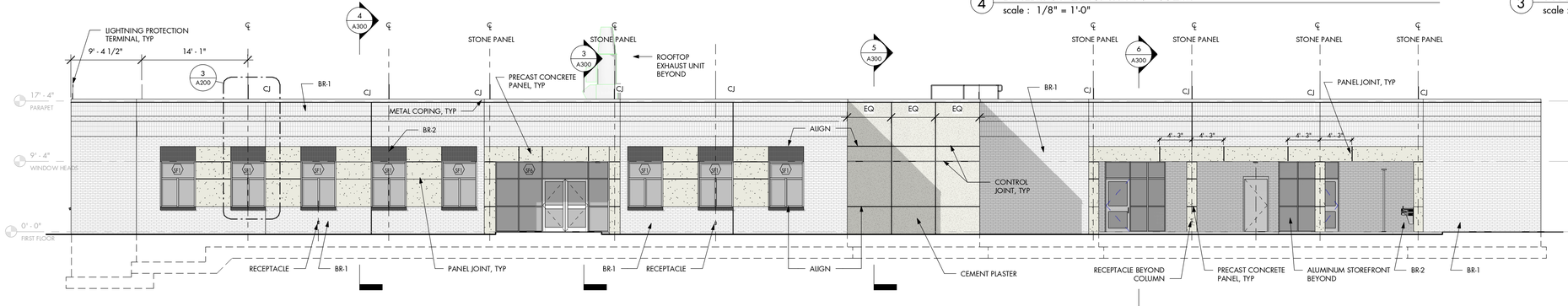

2 BUILDING ELEVATION - SOUTH
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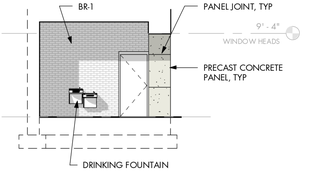

1 137-SOUTH ENTRY
scale : 1/8" = 1'-0"

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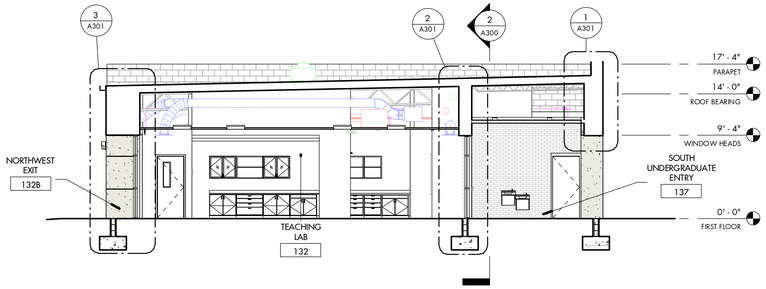
EXTERIOR ELEVATIONS

0' 1' 2' 4' 8' 16'
1/8" = 1'-0"

A200



6 BUILDING SECTION - TRANSVERSE @ CLASSROOM #100
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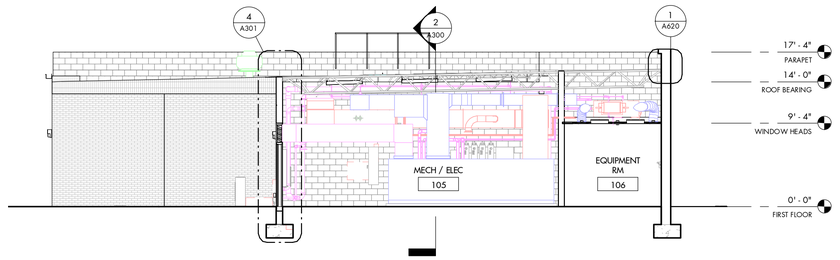

5 BUILDING SECTION - TRANSVERSE @ LOBBY #1
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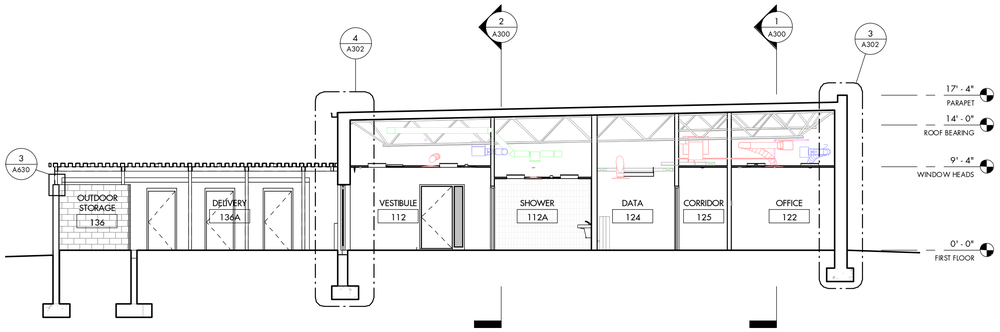

4 BUILDING SECTION - TRANSVERSE @ OUTDOOR STORAGE #136
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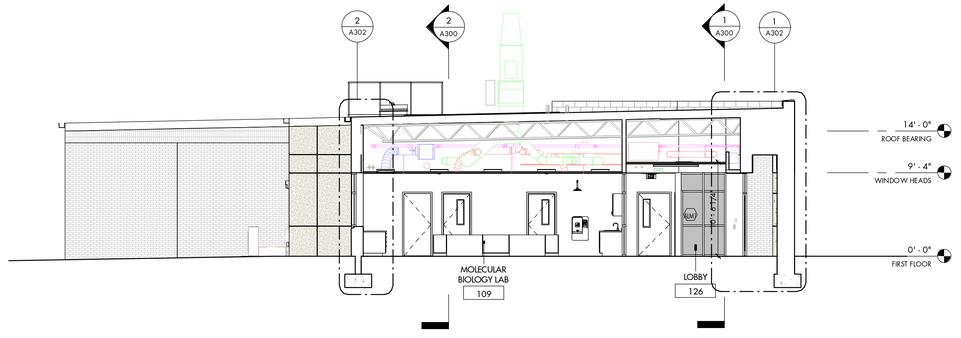

3 BUILDING SECTION - TRANSVERSE @ MOLECULAR BIOLOGY LAB #109
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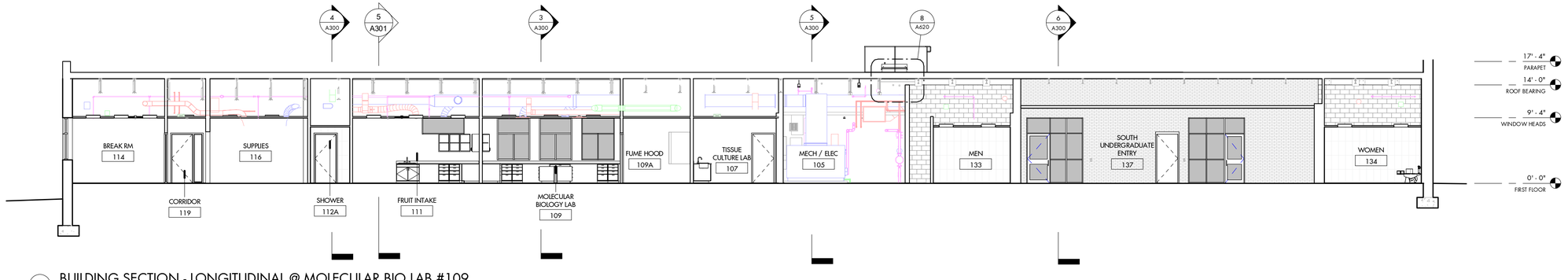

2 BUILDING SECTION - LONGITUDINAL @ MOLECULAR BIO LAB #109
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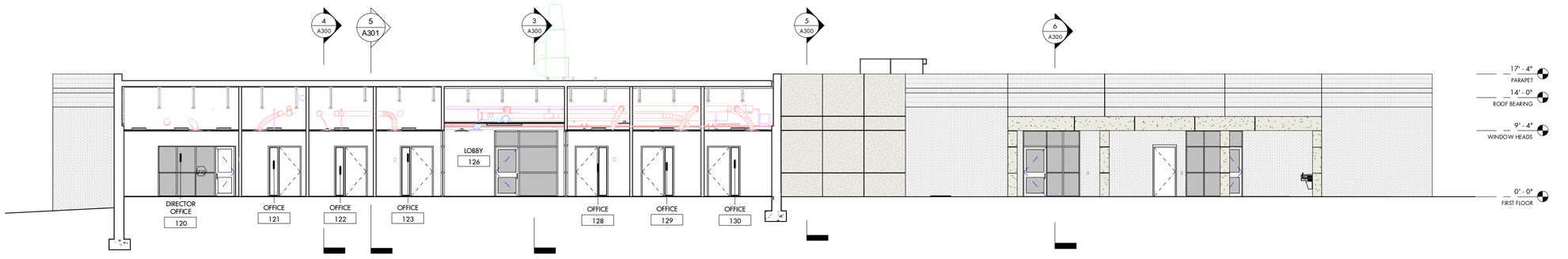

1 BUILDING SECTION - LONGITUDINAL @ LOBBY #126
scale : 1/8" = 1'-0"

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Rick Rowe
AR0013510 2020.11.17

Project Information

UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
GAINESVILLE, FLORIDA
32611

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

Revisions

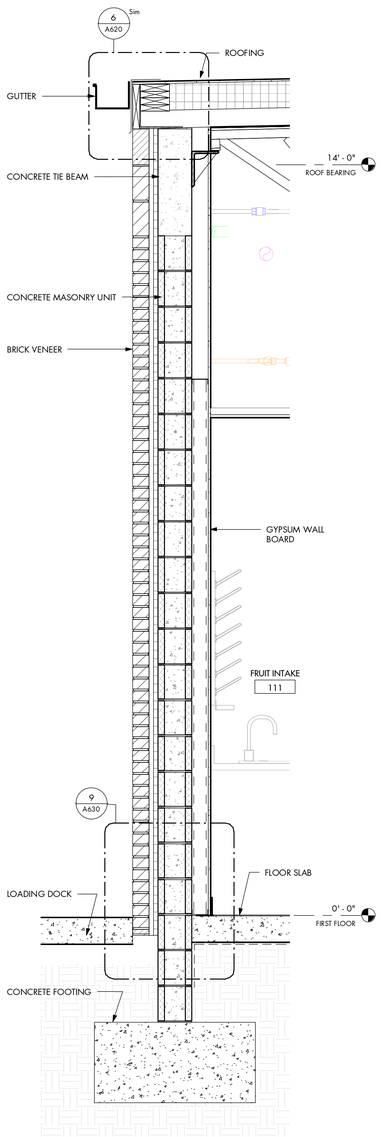
No.	Description	Date

Sheet Information

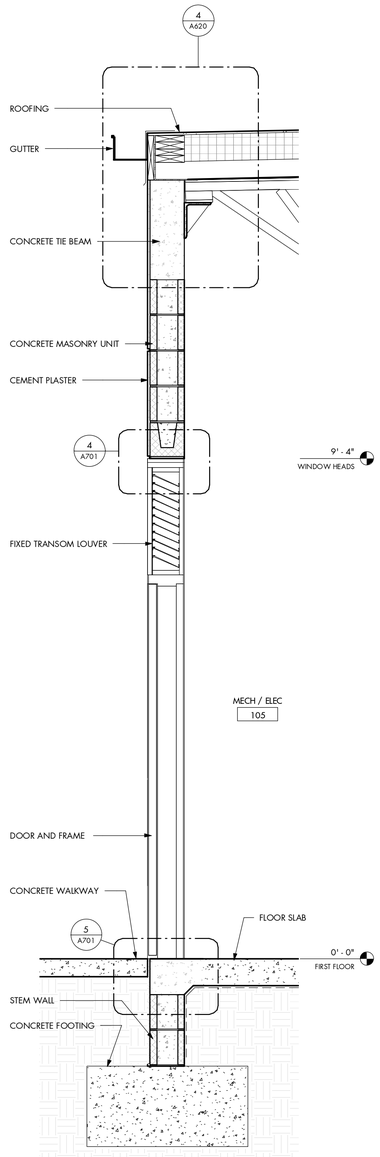
BUILDING SECTIONS

0' 1' 2' 4' 8' 16'
1/8 = 1'-0"

A300



5 WALL SECTION AT FRUITE INTAKE #111
scale : 3/4" = 1'-0"



4 WALL SECTION AT MECH/ELEC #105
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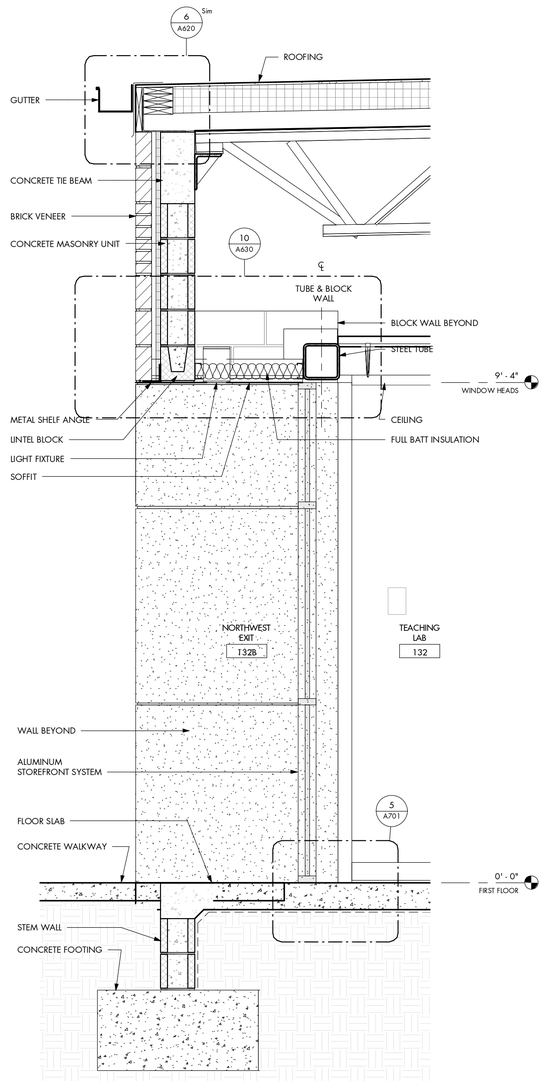
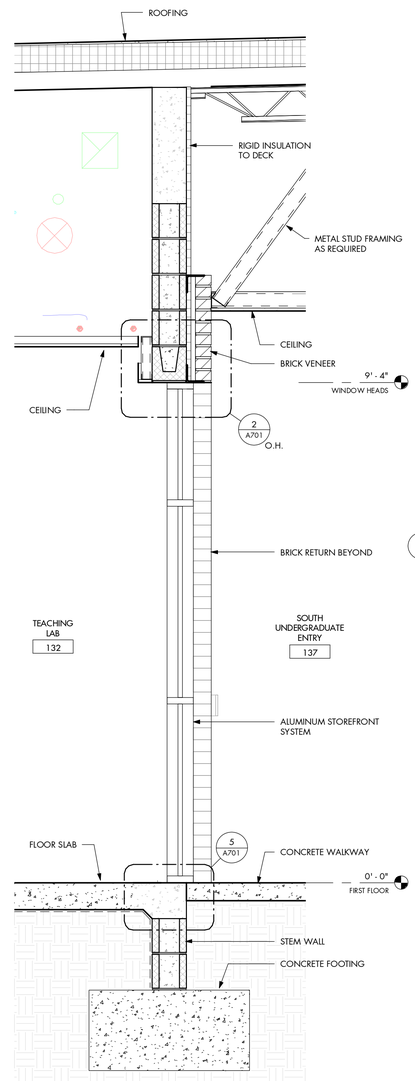
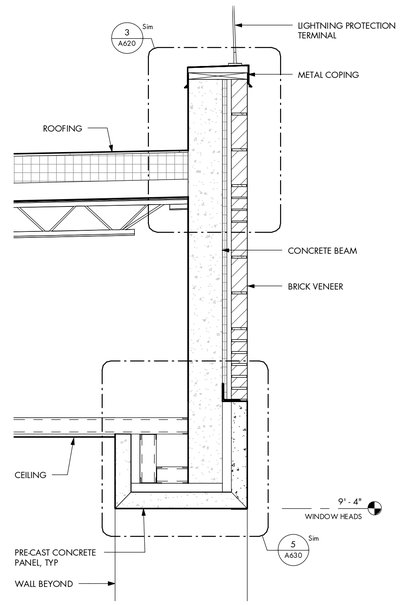


3 WALL SECTION AT NORTHWEST EXIT #132B
scale : 3/4" = 1'-0"



2 WALL SECTION AT SOUTH UNDERGRADUATE ENTRY #137
scale : 3/4" = 1'-0"



1 WALL SECTION AT 137 - S. UNDERGRADUATE ENTRY
scale : 3/4" = 1'-0"

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Revisions

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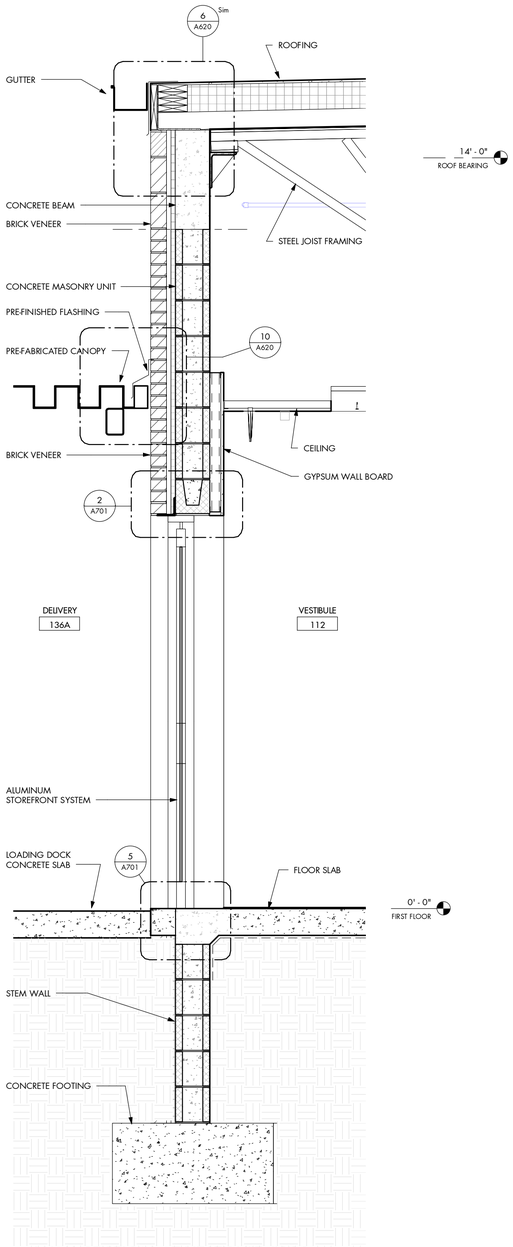
Sheet Information

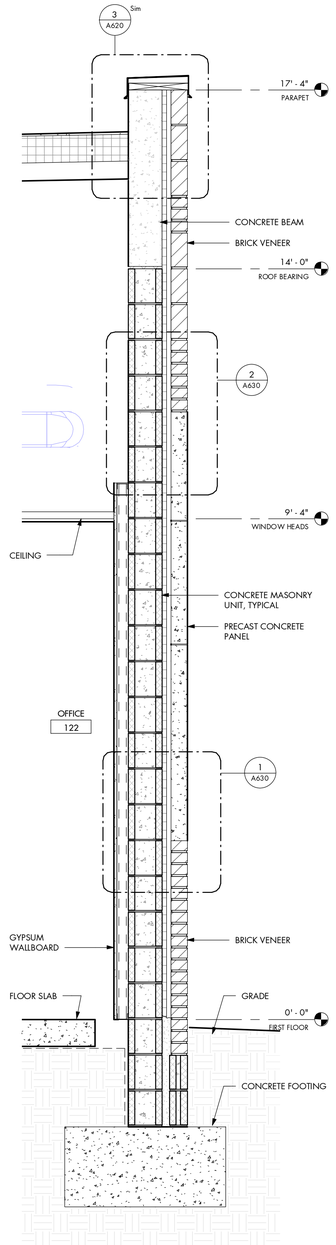
WALL SECTIONS

0' 3" 6" 1' 2'
3/4" = 1'-0"

A301



4 WALL SECTION AT VESTIBULE #112
scale : 3/4" = 1'-0"



3 WALL SECTION AT OFFICE #122
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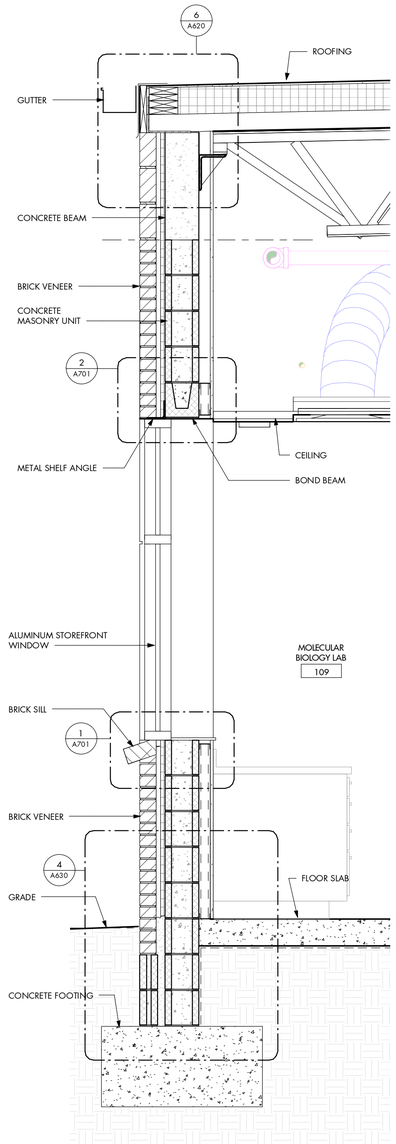
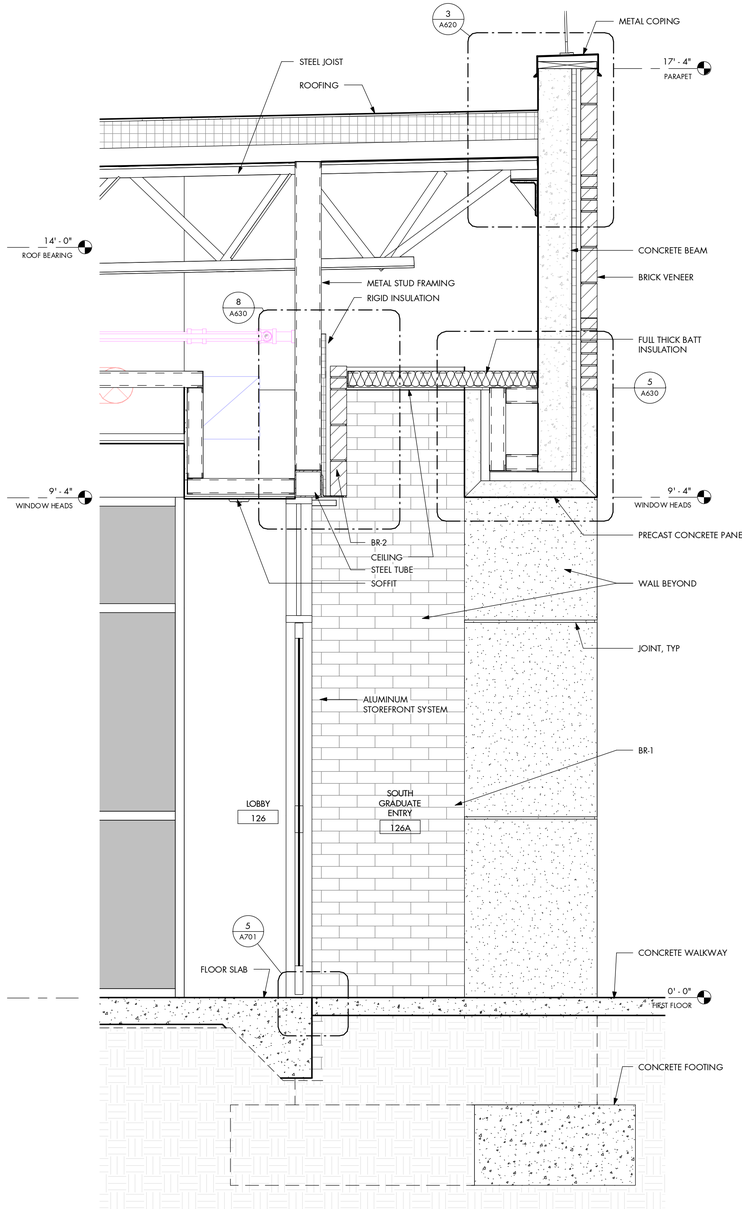


2 WALL SECTION AT MOLECULAR BIOLOGY LAB #109
scale : 3/4" = 1'-0"



1 WALL SECTION AT LOBBY #126
scale : 3/4" = 1'-0"

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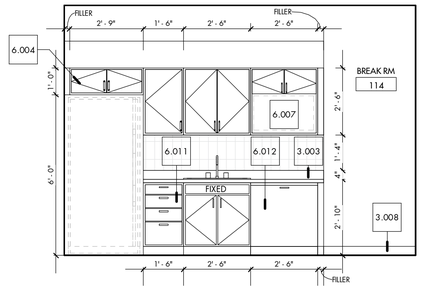
No.	Description	Date

Sheet Information

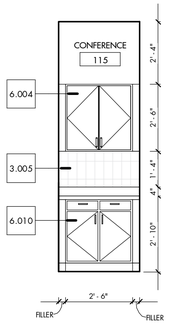
WALL SECTIONS

0' 3" 6" 1' 2'
3/4" = 1'-0"

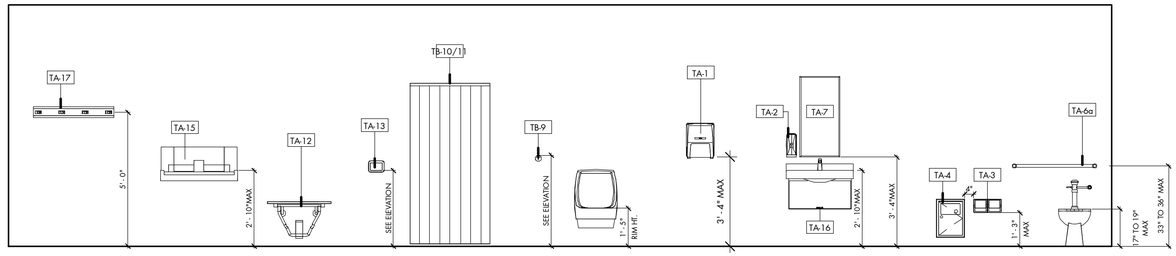
A302



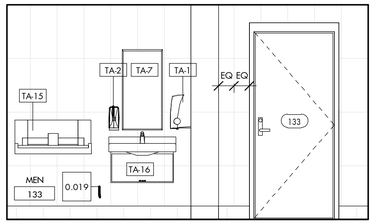
4B BREAK ROOM #114 (SOUTH)
scale : 3/8" = 1'-0"



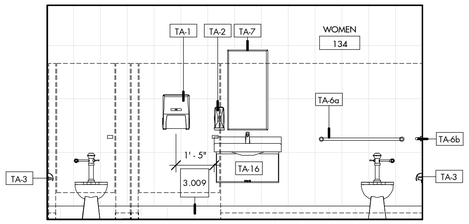
4A CONFERENCE #115 (NORTH)
scale : 3/8" = 1'-0"



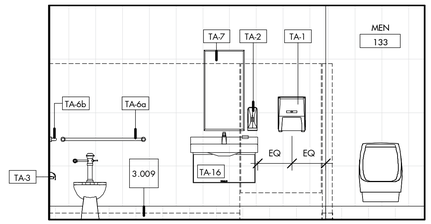
3 TOILET ACCESSORY LEGEND
scale : 3/8" = 1'-0"



2B MEN #133 - (EAST)
scale : 3/8" = 1'-0"



1B WOMEN #134 (EAST)
scale : 3/8" = 1'-0"



2A MEN #133 (WEST)
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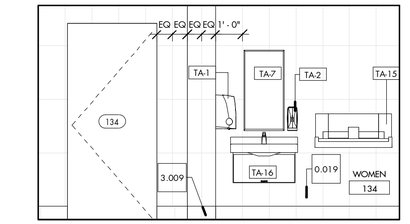

1A WOMEN #134 - (WEST)
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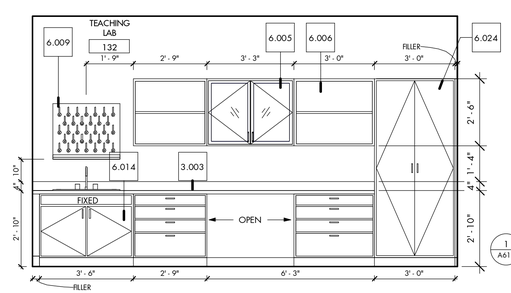
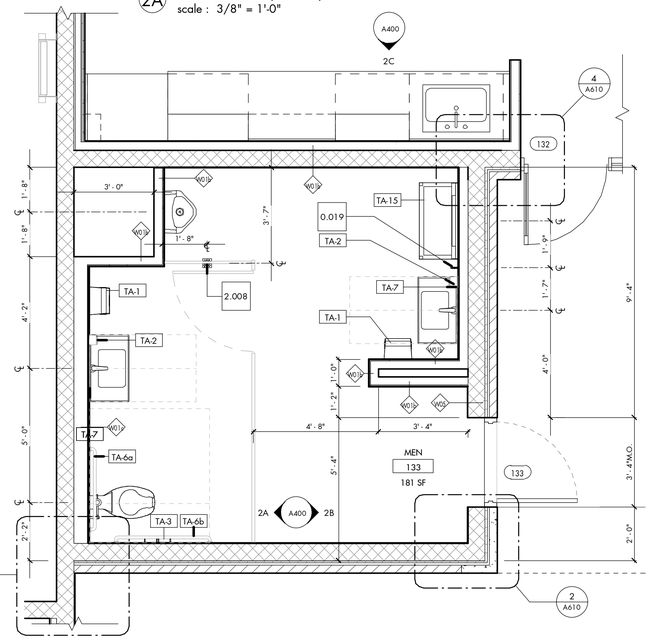
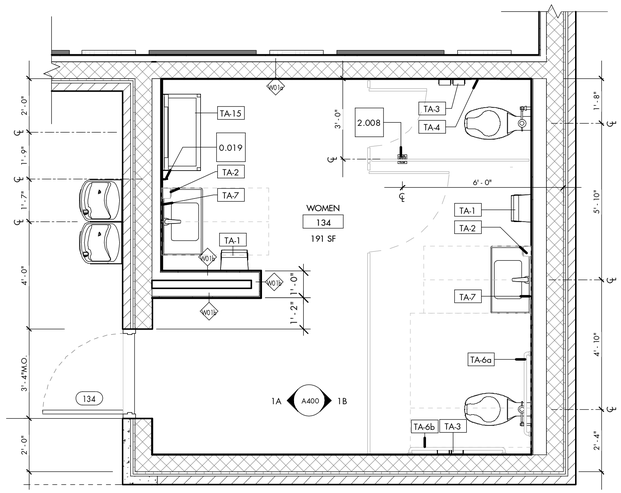


4 ENLARGED PLAN AT BREAK ROOM #114
scale : 3/8" = 1'-0"

2C TEACHING LAB #132 - (SOUTH)
scale : 3/8" = 1'-0"



2 ENLARGED PLAN AT MEN #133
scale : 3/8" = 1'-0"



1 ENLARGED PLAN AT WOMEN #134
scale : 3/8" = 1'-0"

KEYED NOTES

0.019	HOSE BIBB.
2.008	FLOOR DRAIN.
3.003	EPOXY RESIN COUNTERTOP AND BACKSPLASH.
3.005	CERAMIC ACCENT WALL TILE.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
3.009	TILE BASE, AS SCHEDULED.
6.004	12" DEEP UPPER CABINET WITH DOORS.
6.005	12" DEEP UPPER CABINET WITH GLASS DOORS.
6.006	12" DEEP UPPER CABINET WITH OPEN SHELVING.
6.007	12" DEEP UPPER MICROWAVE CABINET.
6.009	PEG BOARD AND DRAINAGE RACK.
6.010	24" DEEP BASE CABINET WITH DRAWERS AND DOORS.
6.011	24" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.012	24" DEEP BASE CABINET WITH WASTE AND RECYCLE COMPARTMENTS ON HEAVY DUTY GLIDES.
6.014	30" DEEP BASE CABINET WITH FIXED DRAWER - SINK UNIT.
6.024	IT CABINET, WITH ADJUSTABLE SHELVING AND NO BACK CABINET FACE, COORDINATE WITH UF IT.

TOILET ACCESSORY SCHEDULE

TA-1	PAPER TOWEL DISPENSER
TA-2	SOAP DISPENSER
TA-3	TOILET PAPER DISPENSER
TA-4	SANITARY NAPKIN DISPOSAL UNIT
TA-5	NOT USED
TA-6	GRAB BAR
TA-7	FRAMED MIRROR UNIT
TA-8	NOT USED
TA-9	COAT HOOK
TA-10	SHOWER CURTAIN ROD
TA-11	SHOWER CURTAIN
TA-12	FOLDING SHOWER SEAT
TA-13	SOAP DISH
TA-14	CLOTHES HOOK
TA-15	DIAPER CHANGING STATION
TA-16	UNDERLAVATORY GUARD
TA-17	CUSTODIAL MOP AND BROOM HOLDER

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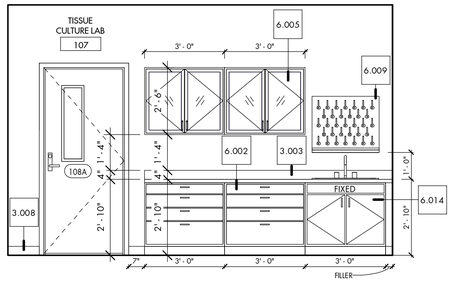
Sheet Information

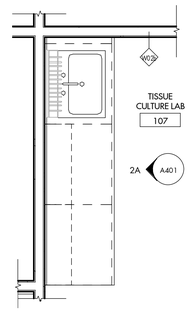
ENLARGED PLANS AND INTERIOR ELEVATIONS

0' 6" 1' 2' 4'
3/8" = 1'-0"

A400



2A TISSUE CULTURE LAB #107 (WEST)
scale : 3/8" = 1'-0"



2 PLAN AT TISSUE CULTURE LAB #107
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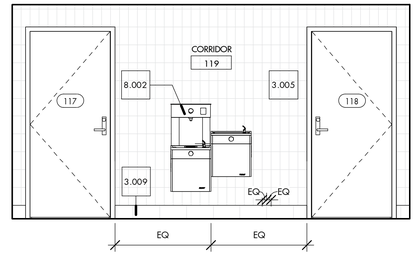

1G CORRIDOR #119 (EAST)
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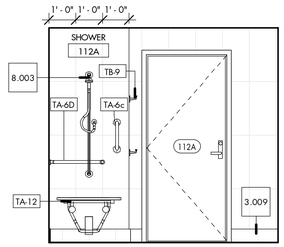
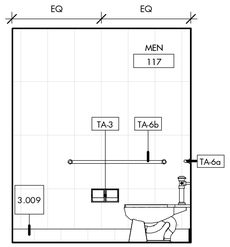
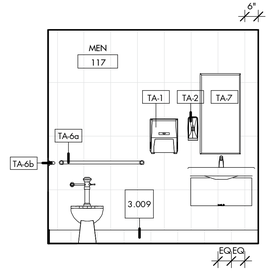


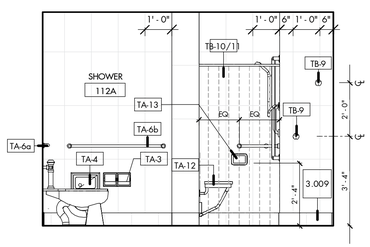
1F SHOWER #112A (NORTH)
scale : 3/8" = 1'-0"



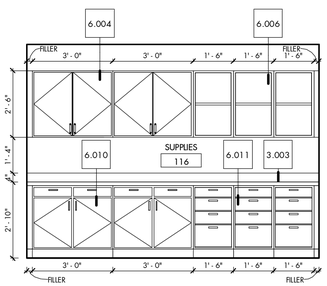
1E TOILET RM #117 AND #118 (WEST)
scale : 3/8" = 1'-0"



1D TOILET RM #117 AND #118
scale : 3/8" = 1'-0"



1B SHOWER #112A (WEST)
scale : 3/8" = 1'-0"



1C SUPPLIES #116 (SOUTH)
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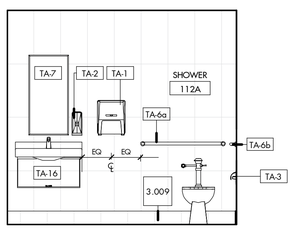
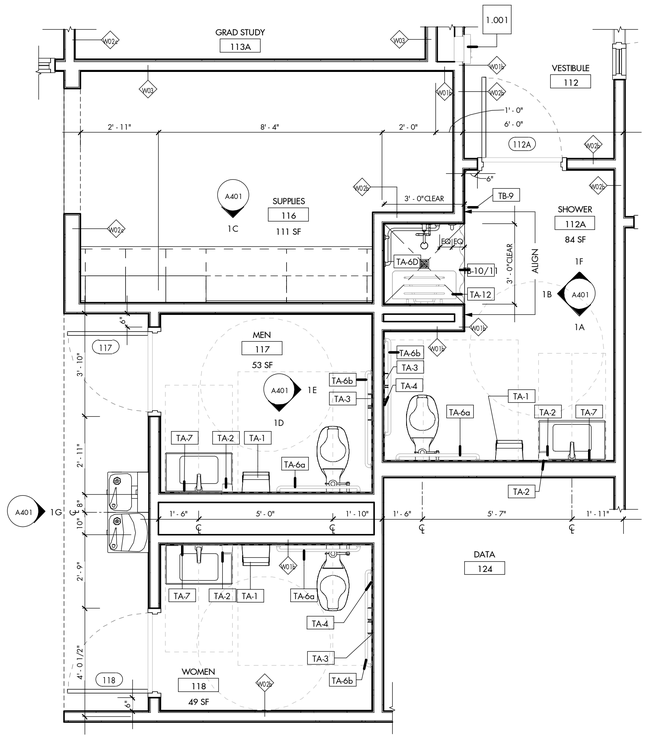


1A SHOWER #112A (SOUTH)
scale : 3/8" = 1'-0"



1 FLOOR PLAN AT TOILET ROOMS #117, #118, AND SHOWER #112A
scale : 3/8" = 1'-0"

KEYED NOTES

1.001	RECESSED FIRE EXTINGUISHER CABINET (FEC).
3.003	EPOXY RESIN COUNTERTOP AND BACKSPLASH.
3.005	CERAMIC ACCENT WALL TILE.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
3.009	TILE BASE, AS SCHEDULED.
6.002	30" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.004	12" DEEP UPPER CABINET WITH DOORS.
6.005	12" DEEP UPPER CABINET WITH GLASS DOORS.
6.006	12" DEEP UPPER CABINET WITH OPEN SHELVING.
6.009	PEG BOARD AND DRAINAGE RACK.
6.010	24" DEEP BASE CABINET WITH DRAWERS AND DOORS.
6.011	24" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.014	30" DEEP BASE CABINET WITH FIXED DRAWER - SINK UNIT.
8.002	WATER COOLER.
8.003	SHOWER TAP AND CONTROLS.

TOILET ACCESSORY SCHEDULE

TA-1	PAPER TOWEL DISPENSER
TA-2	SOAP DISPENSER
TA-3	TOILET PAPER DISPENSER
TA-4	SANITARY NAPKIN DISPOSAL UNIT
TA-5	NOT USED
TA-6	GRAB BAR
TA-7	FRAMED MIRROR UNIT
TA-8	NOT USED
TA-9	COAT HOOK
TA-10	SHOWER CURTAIN ROD
TA-11	SHOWER CURTAIN
TA-12	FOLDING SHOWER SEAT
TA-13	SOAP DISH
TA-14	CLOTHES HOOK
TA-15	DIAPER CHANGING STATION
TA-16	UNDERLAVATORY GUARD
TA-17	CUSTODIAL MOP AND BROOM HOLDER

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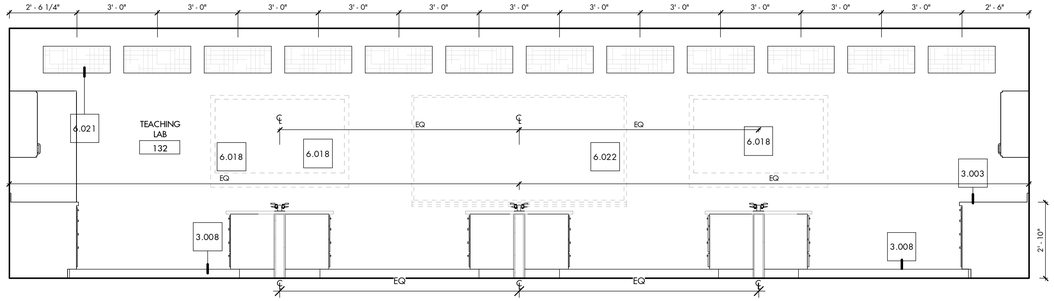
0' 6" 1' 2' 4'
3/8" = 1'-0"

A401



2B TEACHING LAB #132 (WEST)
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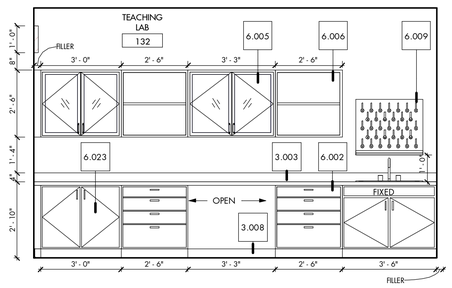

2A TEACHING LAB #132 (NORTH)
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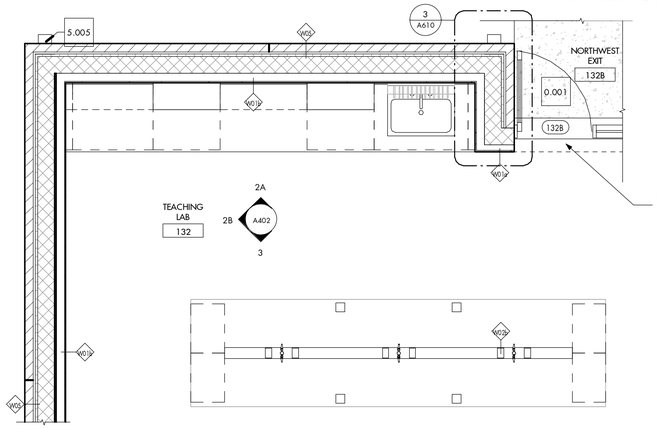
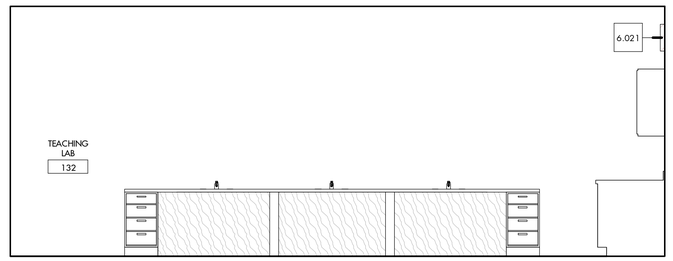
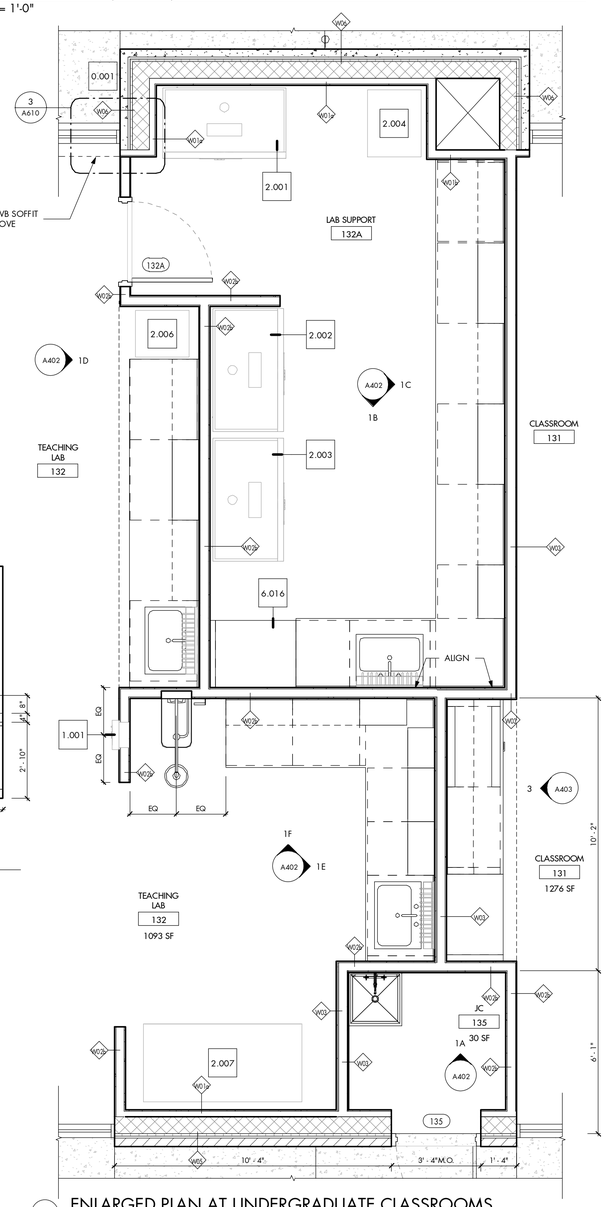


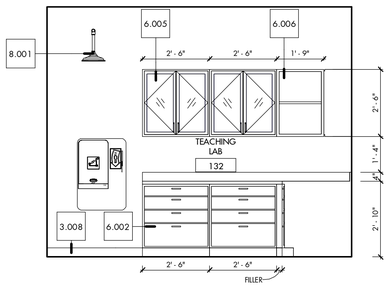
2 TEACHING LAB #132 - NORTH
scale : 3/8" = 1'-0"



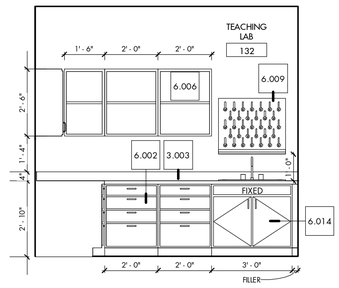
3 TEACHING LAB #132 - (SOUTH) WORKSTATIONS
scale : 3/8" = 1'-0"



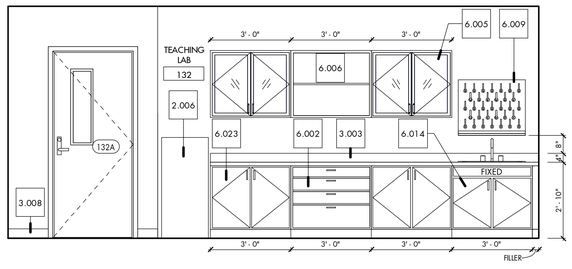
1 ENLARGED PLAN AT UNDERGRADUATE CLASSROOMS
scale : 3/8" = 1'-0"



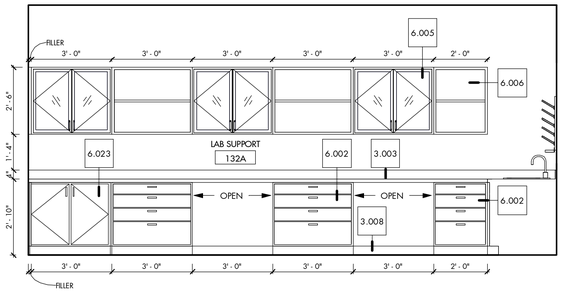
1F TEACHING LAB #132 (NORTH) ALCOVE
scale : 3/8" = 1'-0"



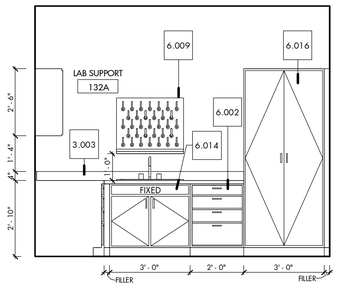
1E TEACHING LAB #132 (EAST) ALCOVE
scale : 3/8" = 1'-0"



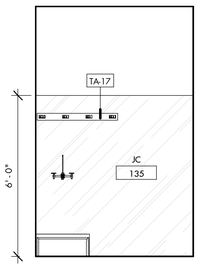
1D TEACHING LAB #132 (EAST)
scale : 3/8" = 1'-0"



1C LAB SUPPORT #132A (EAST)
scale : 3/8" = 1'-0"



1B LAB SUPPORT #132A (SOUTH)
scale : 3/8" = 1'-0"



1A JC #135 - (NORTH)
scale : 3/8" = 1'-0"

KEYED NOTES

0.001	CONCRETE SIDEWALK.
1.001	RECESSED FIRE EXTINGUISHER CABINET (FEC).
2.001	OWNER FURNISHED, CONTRACTOR INSTALLED ICE MAKER.
2.002	OWNER FURNISHED, CONTRACTOR INSTALLED FREEZER.
2.003	OWNER FURNISHED, CONTRACTOR INSTALLED REFRIGERATOR.
2.004	OWNER FURNISHED, CONTRACTOR INSTALLED AUTOCLAVE.
2.006	OWNER FURNISHED, CONTRACTOR INSTALLED CENTRIFUGE.
2.007	OWNER FURNISHED, CONTRACTOR INSTALLED FUME HOOD.
3.003	EPOXY RESIN COUNTERTOP AND BACKSPLASH.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
5.005	PRE-FINISHED DOWNSPOUT.
6.002	30" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.005	12" DEEP UPPER CABINET WITH GLASS DOORS.
6.006	12" DEEP UPPER CABINET WITH OPEN SHELVING.
6.009	PEG BOARD AND DRAINAGE RACK.
6.014	30" DEEP BASE CABINET WITH FIXED DRAWER - SINK UNIT.
6.016	24" DEEP FLAMMABLE STORAGE CABINET WITH LOCKS.
6.018	OWNER PROVIDED, OWNER INSTALLED TELEVISION. COORDINATE ELECTRICAL.
6.021	1'-0" X 2'-6" SOUND ABSORBING PANEL (ADD ALTERNATE) BASE BID, NO PANELS.
6.022	4'-0" X 8'-0" MARKERBOARD.
6.023	30" DEEP BASE CABINET WITH DOORS.
8.001	EMERGENCY SHOWER UNIT.

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AR0013510 2020.11.17

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UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
GAINESVILLE, FLORIDA
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Project Number 1918

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No.	Description	Date
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Revisions

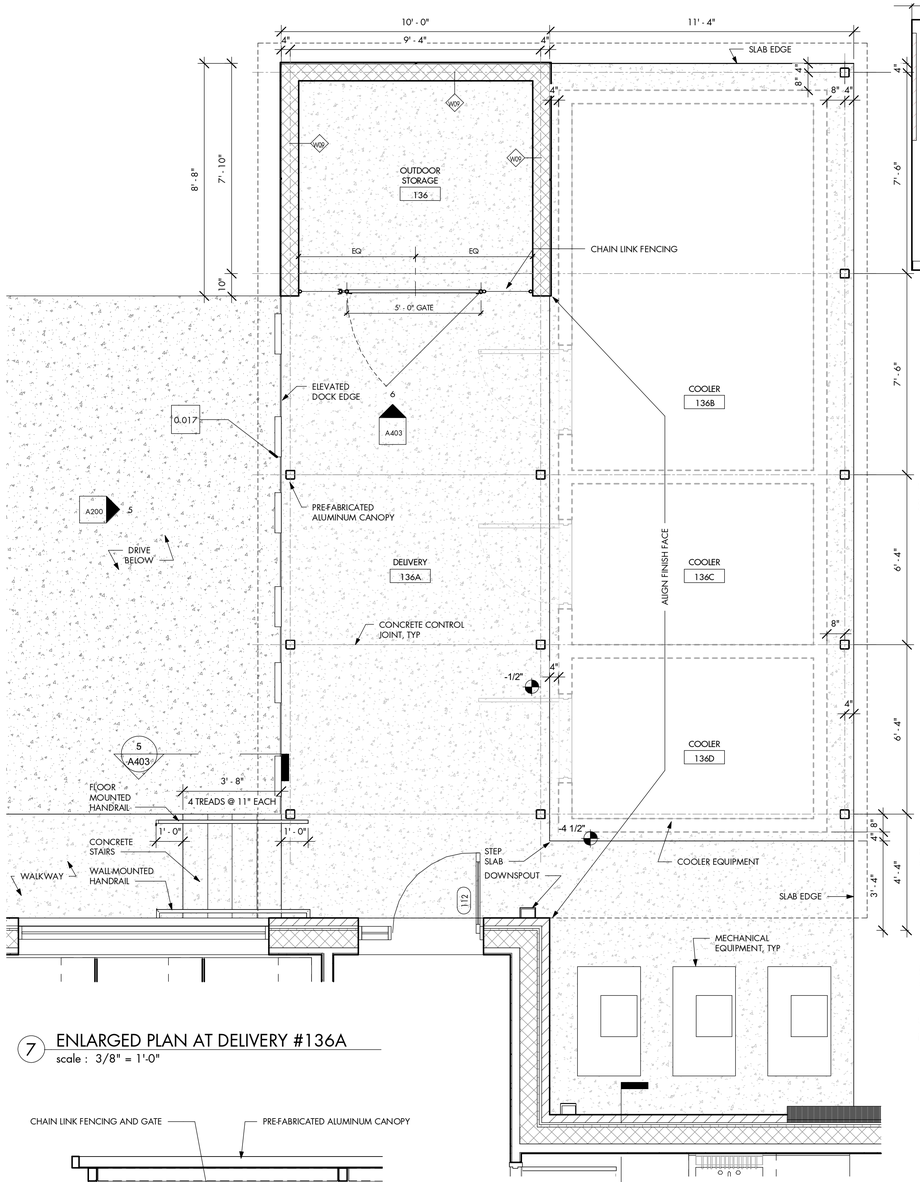
No.	Description	Date

Sheet Information

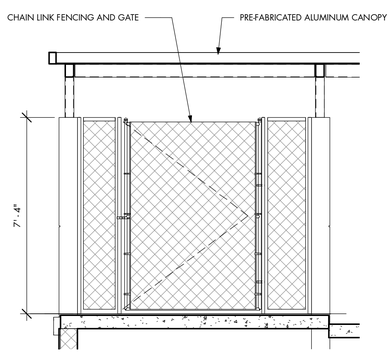
ENLARGED PLANS AND INTERIOR ELEVATIONS

0' 6" 1' 2' 4'
3/8" = 1'-0"

A402



7 ENLARGED PLAN AT DELIVERY #136A
scale : 3/8" = 1'-0"



6 SECTION AT OUTDOOR STORAGE #136
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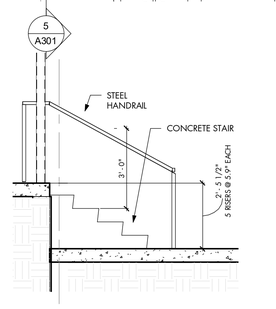
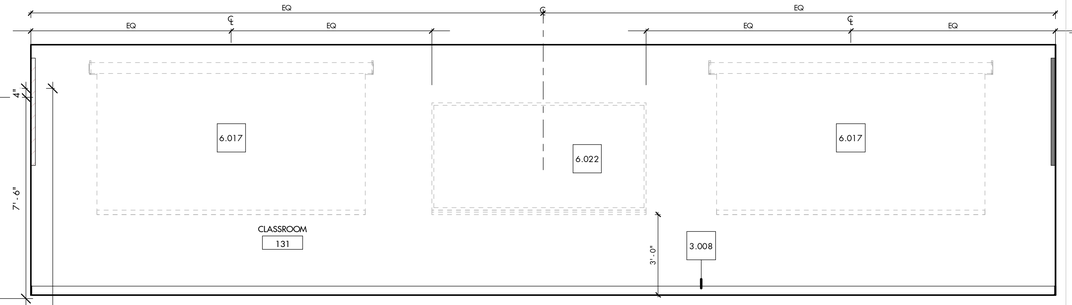
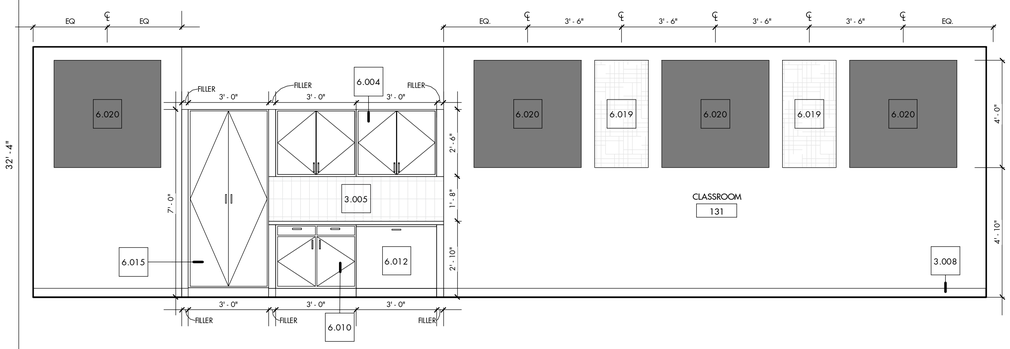


5 SECTION AT STAIR #136A
scale : 3/8" = 1'-0"

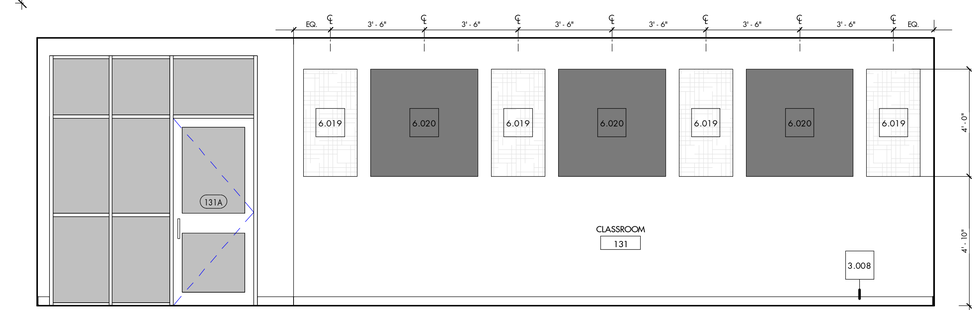


4 CLASSROOM # 131 (EAST)
scale : 3/8" = 1'-0"



3 CLASSROOM # 131 (WEST)
scale : 3/8" = 1'-0"

2 CLASSROOM #131 (SOUTH)
scale : 3/8" = 1'-0"



1 CLASSROOM #131 (NORTH)
scale : 3/8" = 1'-0"

KEYED NOTES

0.017	LOADING DOCK BUMPER, 10" TALL BY 24" WIDE SEGMENTS.
3.005	CERAMIC ACCENT WALL TILE.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
6.004	12" DEEP UPPER CABINET WITH DOORS.
6.010	24" DEEP BASE CABINET WITH DRAWERS AND DOORS.
6.012	24" DEEP BASE CABINET WITH WASTE AND RECYCLE COMPARTMENTS ON HEAVY DUTY GUIDES.
6.015	24" DEEP FULL HEIGHT CABINET WITH DOORS.
6.017	OWNER PROVIDED, OWNER INSTALLED MOTORIZED PROJECTOR SCREEN.
6.019	2'-0" x 4'-0" SOUND ABSORBING PANEL (ADD ALTERNATE) BASE BID, NO PANELS.
6.020	4'-0" x 4'-0" SOUND ABSORBING PANEL (ADD ALTERNATE) BASE BID, NO PANELS.
6.022	4'-0" X 8'-0" MARKERBOARD.

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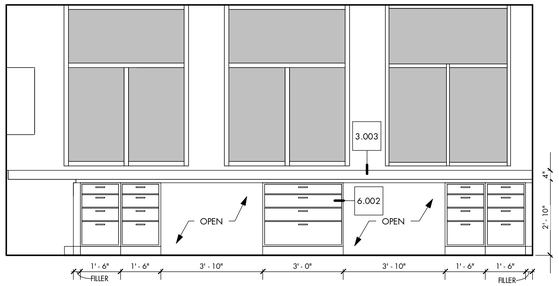
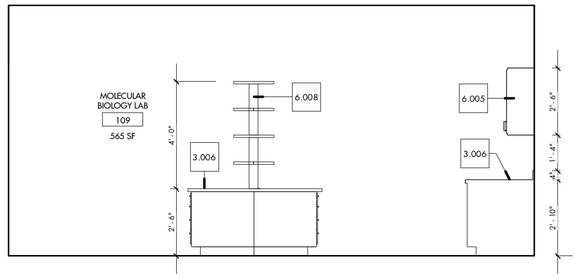
ENLARGED PLANS AND INTERIOR ELEVATIONS

0' 6" 1' 2' 4'
3/8" = 1'-0"

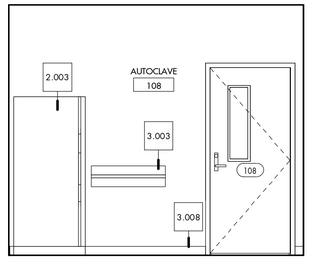
A403



1F MOLECULAR BIO #109 (NORTH)
scale : 3/8" = 1'-0"



1E MOLECULAR BIO #109 (SOUTH) ISLAND
scale : 3/8" = 1'-0"



1D AUTOCLAVE #108 (WEST)
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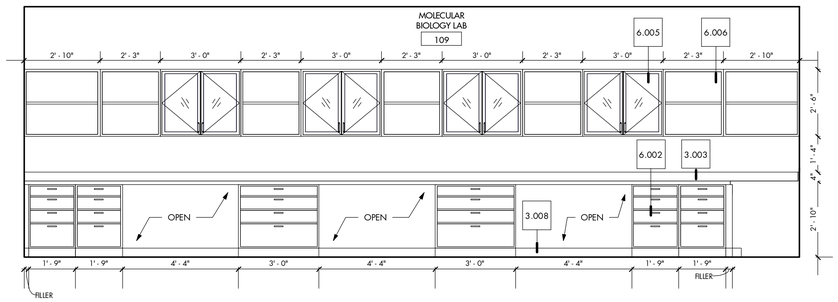
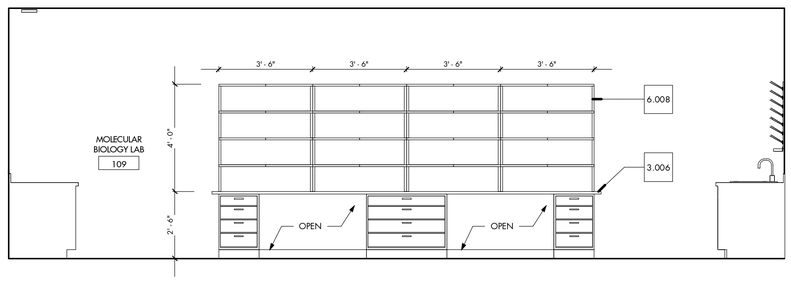
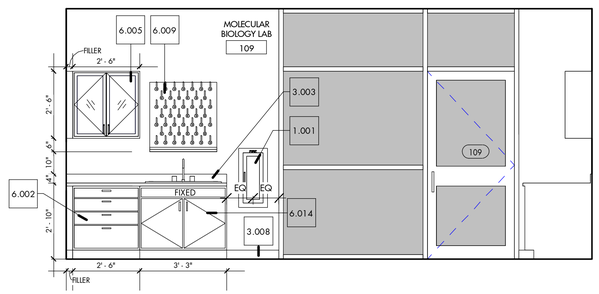


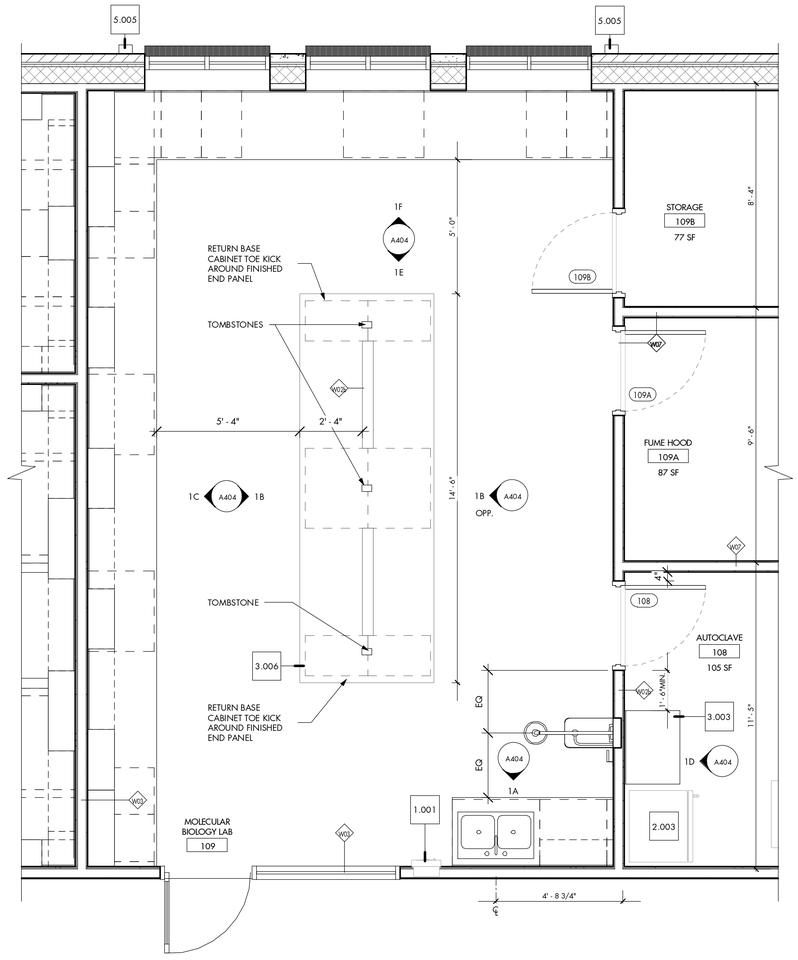
1C MOLECULAR BIO #109 (WEST)
scale : 3/8" = 1'-0"



1B MOLECULAR BIO #109 (EAST) ISLAND
scale : 3/8" = 1'-0"



1A MOLECULAR BIO #109 (SOUTH)
scale : 3/8" = 1'-0"



1 ENLARGED FLOOR PLAN AT MOLECULAR BIOLOGY LAB #108
scale : 3/8" = 1'-0"

KEYED NOTES

1.001	RECESSED FIRE EXTINGUISHER CABINET (FEC).
2.003	OWNER FURNISHED, CONTRACTOR INSTALLED REFRIGERATOR.
3.003	EPOXY RESIN COUNTERTOP AND BACKSPLASH.
3.006	EPOXY RESIN COUNTERTOP.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
5.005	PRE-FINISHED DOWNSPOUT.
6.002	30" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.005	12" DEEP UPPER CABINET WITH GLASS DOORS.
6.006	12" DEEP UPPER CABINET WITH OPEN SHELVING.
6.008	12" DEEP REAGENT SHELVING.
6.009	PEG BOARD AND DRAINAGE RACK.
6.014	30" DEEP BASE CABINET WITH FIXED DRAWER - SINK UNIT.

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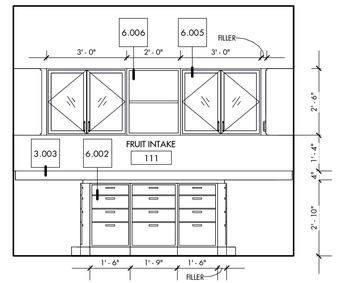
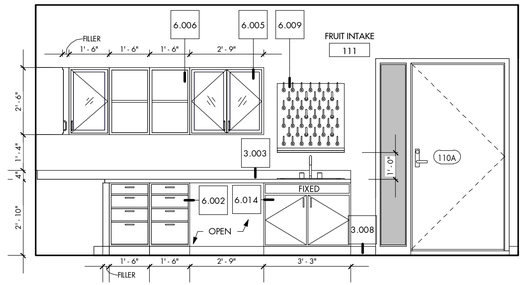
0' 6" 1' 2' 4'
3/8" = 1'-0"

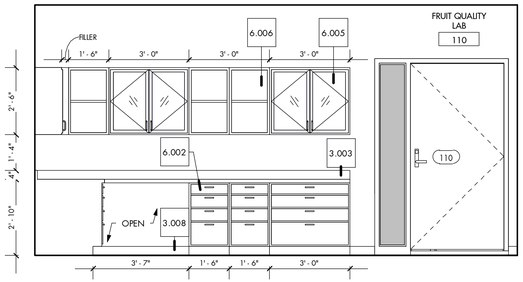
A404



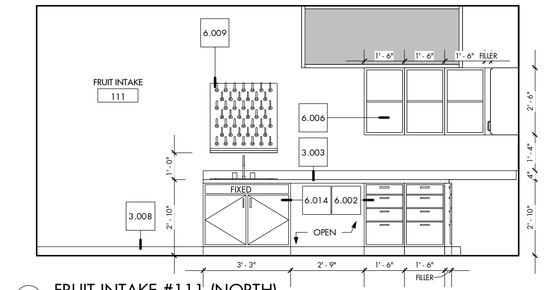
1G FRUIT INTAKE #111 (EAST)
scale : 3/8" = 1'-0"



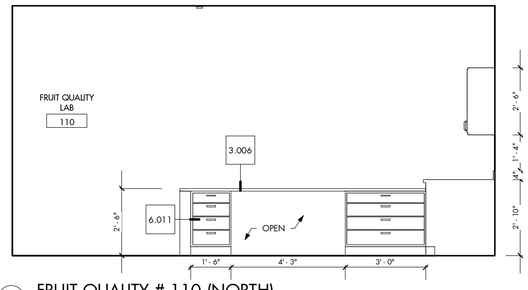
1F FRUIT INTAKE #111 (SOUTH)
scale : 3/8" = 1'-0"



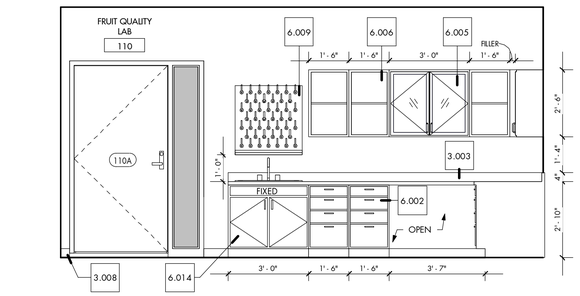
1B FRUIT QUALITY #110 (SOUTH)
scale : 3/8" = 1'-0"



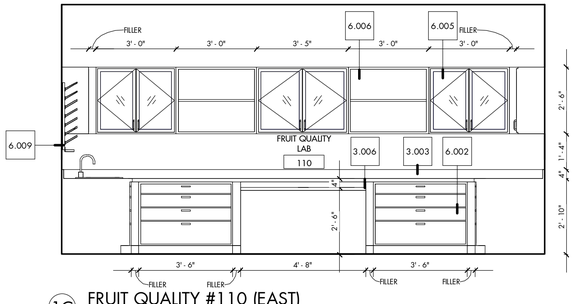
1E FRUIT INTAKE #111 (NORTH)
scale : 3/8" = 1'-0"



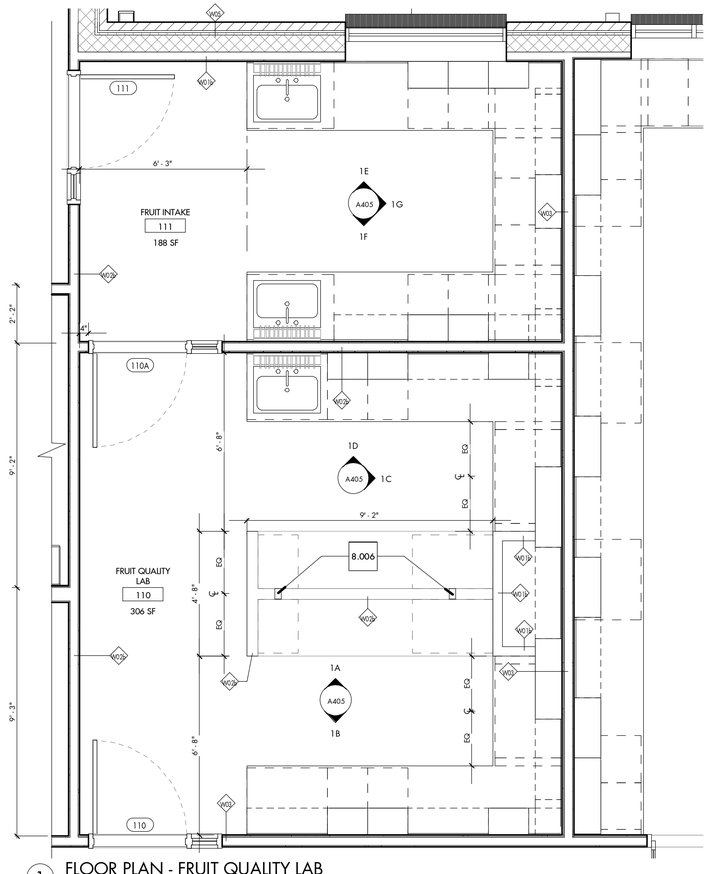
1A FRUIT QUALITY # 110 (NORTH)
scale : 3/8" = 1'-0"



1D FRUIT QUALITY #110 (NORTH)
scale : 3/8" = 1'-0"



1C FRUIT QUALITY #110 (EAST)
scale : 3/8" = 1'-0"



1 FLOOR PLAN - FRUIT QUALITY LAB
scale : 3/8" = 1'-0"

KEYED NOTES

3.003	EPOXY RESIN COUNTERTOP AND BACKSPLASH.
3.006	EPOXY RESIN COUNTERTOP.
3.008	RESILIENT FLOOR BASE, AS SCHEDULED.
6.002	30" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.005	12" DEEP UPPER CABINET WITH GLASS DOORS.
6.006	12" DEEP UPPER CABINET WITH OPEN SHELVING.
6.009	PEG BOARD AND DRAINAGE RACK.
6.011	24" DEEP BASE CABINET WITH FOUR EQUAL DRAWERS.
6.014	30" DEEP BASE CABINET WITH FIXED DRAWER - SINK UNIT.
8.006	COUNTER MOUNTED ELECTRICAL TOMBSTONE.

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0' 6" 1' 2' 4'
3/8" = 1'-0"

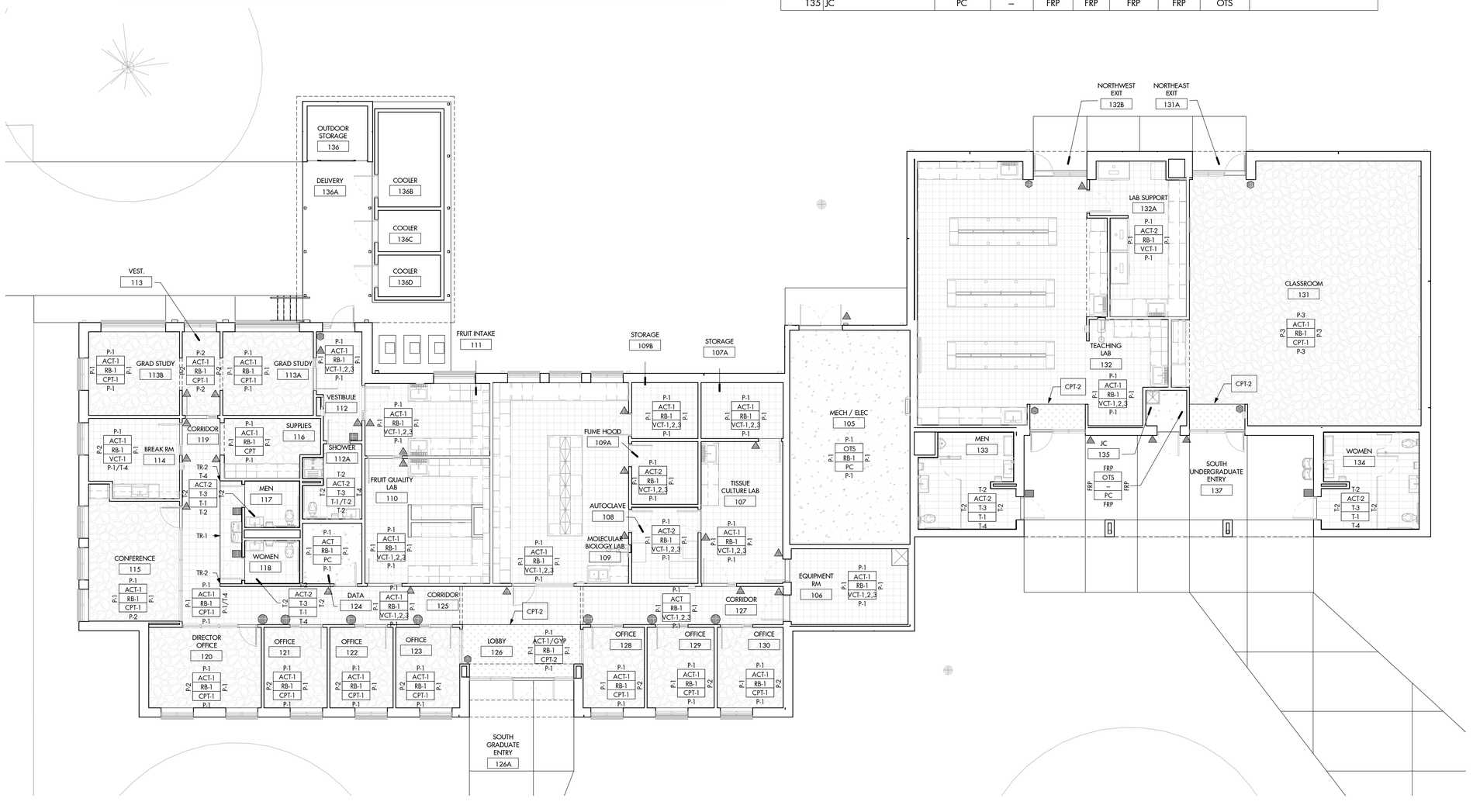
A405

FINISH SCHEDULE

ROOM NUMBER	ROOM NAME	FLOOR	FLOOR BASE	WALLS				CEILING	COMMENTS
				NORTH	EAST	SOUTH	WEST		
105	MECH / ELEC	PC	RB-1	P-1	P-1	P-1	P-1	OTS	
106	EQUIPMENT RM	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
107	TISSUE CULTURE LAB	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
107A	STORAGE	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
108	AUTOCLAVE	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-2	
109	MOLECULAR BIOLOGY LAB	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
109A	FUME HOOD	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-2	
109B	STORAGE	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
110	FRUIT QUALITY LAB	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
111	FRUIT INTAKE	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
112	VESTIBULE	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
112A	SHOWER	T-1/T-2	T-3	T-2	T-4	T-2	T-2	ACT-2	
113	VEST.	CPT-1	RB-1	P-2	P-2	P-2	P-2	ACT-1	
113A	GRAD STUDY	CPT-1	RB-1	P-1	P-1	P-1	P-1	ACT-1	
113B	GRAD STUDY	CPT-1	RB-1	P-1	P-1	P-1	P-1	ACT-1	
114	BREAK RM	VCT-1	RB-1	P-1	P-1	P-1/T-4	P-2	ACT-1	
115	CONFERENCE	CPT-1	RB-1	P-1	P-1	P-2	P-1	ACT-1	
116	SUPPLIES	CPT	RB-1	P-1	P-1	P-1	P-1	ACT-1	
117	MEN	T-1	T-3	T-4	T-2	T-2	T-2	ACT-2	

FINISH SCHEDULE

ROOM NUMBER	ROOM NAME	FLOOR	FLOOR BASE	WALLS				CEILING	COMMENTS
				NORTH	EAST	SOUTH	WEST		
118	WOMEN	T-1	T-3	T-2	T-2	T-4	T-2	ACT-2	
119	CORRIDOR	CPT-1	RB-1	P-1	P-1/T-4	P-1	P-1	ACT-1	
120	DIRECTOR OFFICE	CPT-1	RB-1	P-1	P-1	P-1	P-2	ACT-1	
121	OFFICE	CPT-1	RB-1	P-1	P-1	P-1	P-2	ACT-1	
122	OFFICE	CPT-1	RB-1	P-1	P-1	P-1	P-2	ACT-1	
123	OFFICE	CPT-1	RB-1	P-1	P-1	P-1	P-2	ACT-1	
124	DATA	PC	RB-1	P-1	P-1	P-1	P-1	ACT	
125	CORRIDOR	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-1	
126	LOBBY	CPT-2	RB-1	P-1	P-1	P-1	P-1	ACT-1/GYP	
127	CORRIDOR	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT	
128	OFFICE	CPT-1	RB-1	P-1	P-2	P-1	P-1	ACT-1	
129	OFFICE	CPT-1	RB-1	P-1	P-2	P-1	P-1	ACT-1	
130	OFFICE	CPT-1	RB-1	P-1	P-2	P-1	P-1	ACT-1	
131	CLASSROOM	CPT-1	RB-1	P-3	P-3	P-3	P-3	ACT-1	
132	TEACHING LAB	VCT-1,2,3	RB-1	P-1	P-1	P-1	P-1	ACT-2	
132A	LAB SUPPORT	VCT-1	RB-1	P-1	P-1	P-1	P-1	ACT-2	
133	MEN	T-1	T-3	T-2	T-2	T-4	T-2	ACT-2	
134	WOMEN	T-1	T-3	T-2	T-2	T-4	T-2	ACT-2	
135	JC	PC	–	FRP	FRP	FRP	FRP	OTS	



1 FINISH FLOOR PLAN
scale : 1/8" = 1'-0"

FINISH PLAN LEGEND

- CPT-1
- CPT-2
- T-1
- T-2
- VCT
- PC

CEILING ABBREVIATIONS

ACT	ACOUSTIC CEILING TILE
GWB	GYPSUM BOARD
OTS	OPEN TO STRUCTURE, ALL EXPOSED

FLOORING / BASE ABBREVIATIONS

CPT	CARPET TILE
PC	PAINTED CONCRETE
RB	RESILIENT BASE
T	TILE, AS SCHEDULED
TR	TRANSITION
VCT	VINYL COMPOSITION TILE

INTERIOR ABBREVIATIONS

GWB	GYPSUM WALLBOARD
HD	HARDWARE
PL	PLASTIC LAMINATE
SS	SOLID SURFACE
TP	TOILET PARTITION

WALL ABBREVIATIONS

FRP	FIBERGLASS REINFORCED PANEL
P	PAINT, SEE FINISH SCHEDULE
T	WAIL TILE, SEE FINISH SCHEDULE
WP	WAIL PANEL ACOUSTIC FABRIC

SYMBOLS

ROOM FINISH TAG

XX
CX — CEILING
B X — BASE
FX — FLOORING
XX — WALL FINISH

DOOR SIGNAGE LEGEND

- ROOM NAME/NUMBER WITH OCCUPANTS WITH BRAILLE CHARACTERS
- ROOM NAME/NUMBER/OCCUPANT NAME WITH BRAILLE CHARACTERS
- TOILET ROOM NAME WITH GENDER SYMBOL AND BRAILLE
- EXIT SIGNAGE WITH BRAILLE CHARACTERS

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Rick Rowe
AR0013510 2020.11.17

Project Information

UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
GAINESVILLE, FLORIDA
32611

Project Number 1918

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FINISH FLOOR PLAN

0' 1'-2" 4' 8' 16'
1/8" = 1'-0"

A500

ABBREVIATIONS

AF ACOUSTIC FABRIC
ACT ACOUSTICAL CEILING TILE
BR BRICK
CPT CARPET TILE
GWB GYPSUM WALLBOARD
HD HARDWARE
OTS OPEN TO STRUCTURE
P PAINT
PC PAINTED CONCRETE
PL PLASTIC LAMINATE
RB RESILIENT BASE
SS SOLID SURFACE
TBD TO BE DETERMINED
T TILE
TP TOILET PARTITION
TR TRANSITION
VCT VINYL COMPOSITE TILE

CASEWORK FINISH SCHEDULE

PL-1 PLASTIC LAMINATE
MANUFACTURER: WILSONART
FINISH: FINE VELVET FINISH
COLOR: MISSION MAPLE 7990-38
GRAIN ORIENTATION: VERTICAL
ARCHITECTURAL REPRESENTATIVE: TERESA FINCH
CONTACT: (813) 293-0588
EMAIL: FINCHT@WILSONART.COM

SS-1 SOLID SURFACE
MANUFACTURER: WILSONART
COLOR: DESIGNER WHITE D354SL
ARCHITECTURAL REPRESENTATIVE: TERESA FINCH

SS-2 SOLID SURFACE
MANUFACTURER: TRESPA TOPLAB, SCIENTIFIC SURFACE SOLUTIONS
COLOR: SLATE GREY, CRYSTAL MATT

CEILING FINISH SCHEDULE

ACT-1 ACOUSTIC CEILING TILE
MANUFACTURER: ROCKFRON
STYLE: TROPIC
LAYOUT: 2'-0" x 2'-0"
TILE COLOR: WHITE
GRID COLOR: WHITE

ACT-2 ACOUSTIC CEILING TILE
MANUFACTURER: ROCKFRON
STYLE: TROPIC
LAYOUT: 24" X 24" VINYLFACED
TILE COLOR: WHITE
GRID COLOR: WHITE

GWB GYPSUM WALLBOARD
PAINT FINISH: FLAT
PAINT COLOR: SW 7005 PURE WHITE

FLOOR FINISH SCHEDULE

CPT-1 CARPET
MANUFACTURER: INTERFACE
SIZE: 24" X 24"
COLLECTION: NY+LON STREETS
SERIES: BROOME STREET
COLOR: 106216 BLUE GLASS
INSTALL METHOD: MONOLITHIC
ARCHITECTURAL REPRESENTATIVE: SHANE STEED
CONTACT: (813) 313-0329
EMAIL: SHANE.STEED@INTERFACE.COM

CPT-2 CARPET
MANUFACTURER: INTERFACE
SIZE: 24" X 24"
COLLECTION: STEP REPEAT
STYLE: 1388502500
COLOR: 104936 IRON
INSTALL METHOD: QUARTER TURN
ARCHITECTURAL REPRESENTATIVE: SHANE STEED

T-1 FLOOR TILE
MANUFACTURER: CROSSVILLE
SIZE: 12" X 24"
COLLECTION: COLOR BLOX
COLOR: SEE THE MOON, A1117
INSTALL METHOD: STACKED GRID
GROUT COLOR: TBD
ARCHITECTURAL REPRESENTATIVE: ANETTE GABRELCIK
CONTACT: (727) 808.5131
EMAIL: AGABRELCIK@CROSSVILLESTUDIOS.COM

T-2 FLOOR TILE
MANUFACTURER: CROSSVILLE
SIZE: 3" X 3" MOSAICS
COLLECTION: COLOR BLOX
COLOR: SEE THE MOON, A1117
INSTALL METHOD: STACKED GRID
GROUT COLOR: TBD
ARCHITECTURAL REPRESENTATIVE: ANETTE GABRELCIK

VCT-1 VINYL COMPOSITION TILE
MANUFACTURER: ARMSTRONG
COLLECTION: STANDARD EXCELON
SERIES: IMPERIAL TEXTURE
COLOR: 51861 SOFT WARM GRAY
ARCHITECTURAL REPRESENTATIVE: WILL WISE
CONTACT: (803) 728.7077
EMAIL: WIWISE@ARMSTRONGFLOORING.COM

VCT-2 VINYL COMPOSITION TILE
MANUFACTURER: ARMSTRONG
COLLECTION: STANDARD EXCELON
SERIES: IMPERIAL TEXTURE
COLOR: 59240 PEAT
ARCHITECTURAL REPRESENTATIVE: WILL WISE

VCT-3 VINYL COMPOSITION TILE
MANUFACTURER: ARMSTRONG
COLLECTION: STANDARD EXCELON
SERIES: IMPERIAL TEXTURE
COLOR: 57508 BLUE DREAMS
ARCHITECTURAL REPRESENTATIVE: WILL WISE

PC PAINTED CONCRETE
COLOR: TBD

HARDWARE AND ACCESSORIES

TP-1 TOILET PARTITION
MANUFACTURER: SCRANTON PRODUCTS
MATERIAL: SOLID PLASTIC
COLOR: STAINLESS
TEXTURE: GRIP EX

HD-1 HARDWARE PULL
MANUFACTURER: RICHELIEU OR EQUAL
STYLE: CONTEMPORARY PULL #873
LENGTH: 4-13/16"
FINISH: BRUSHED NICKEL

TR-1 FLOOR TRANSITION PROFILE
LOCATION: CERAMIC TILE TO CARPET
MANUFACTURER: SCHLUTER
PROFILE: SCHIENE
FINISH: BRUSHED STAINLESS STEEL

TR-2 TILE CORNER TRANSITION
LOCATION: CORIDOR #119
MANUFACTURER: SCHLUTER
PROFILE: QUADEC
FINISH: BRUSHED STAINLESS STEEL

TR-3 TILE CORNER TRANSITION
LOCATION: FLOOR TO WALL TILE TRANSITION
MANUFACTURER: SCHLUTER
PROFILE: JOLLY
FINISH: BRUSHED STAINLESS STEEL

WALL BASE SCHEDULE

RB-1 MANUFACTURER: ROPPE
PROFILE: 700 SERIES, STANDARD TOE BASE
SIZE: 4"
COLOR: 63 BURNT UMBER

T-3 FLOOR TILE
MANUFACTURER: CROSSVILLE
SIZE: 4" X 12" BULLNOSE
COLLECTION: COLOR BLOX
COLOR: SEE THE MOON, A1117
INSTALL METHOD: STACKED GRID
GROUT COLOR: TBD
ARCHITECTURAL REPRESENTATIVE: ANETTE GABRELCIK

WALL FINISH SCHEDULE

T-4 WALL TILE
MANUFACTURER: CROSSVILLE
SIZE: 3" X 12"
COLLECTION: BRILLIANT DEDUCTION
COLOR: COBALT
FINISH: GLOSS
INSTALL METHOD: STACKED GRID
GROUT COLOR: TBD
ARCHITECTURAL REPRESENTATIVE: ANETTE GABRELCIK

BR-1 BRICK
MANUFACTURER: OLDCASTLE COASTAL
COLLECTION: CHEROKEE MS
COLOR: CHEROKEE FLASH 536308

BR-2 BRICK
MANUFACTURER: OLDCASTLE COASTAL
COLLECTION: CHEROKEE MS
COLOR: CHEROKEE SMOOTH BLACK

FRP FIBERGLASS REINFORCED PANEL
MANUFACTURER: PANOLAM SURFACE SYSTEMS
COLOR: SKY FRP

P-1 PAINT
MANUFACTURER: SHERWIN WILLIAMS
FINISH: EGGSHELL
COLOR: SW 7005 PURE WHITE

P-2 PAINT
MANUFACTURER: SHERWIN WILLIAMS
FINISH: EGGSHELL
COLOR: SW 7671 ON THE ROCKS

WALL PANEL SCHEDULE

WP-1 WALL PANEL ACOUSTIC FABRIC
MANUFACTURER: GUILFORD OF MAINE
COLLECTION: ANCHORAGE 2335 / OPEN HOUSE 2334
COLOR: ASTEROID 2053
*WALL PANELS TO BE PRICED AS A BID ADDITIVE ITEM . BASE BID IS TO PROVIDE PAINTED SURFACE ONLY.

WP-2 WALL PANEL ACOUSTIC FABRIC
MANUFACTURER: GUILFORD OF MAINE
COLLECTION: ANCHORAGE 2335 / OPEN HOUSE 2334
COLOR: LAPIS 2094
*WALL PANELS TO BE PRICED AS A BID ADDITIVE ITEM . BASE BID IS TO PROVIDE PAINTED SURFACE ONLY.

**GENERAL NOTE

FINISHES INDICATED ABOVE ARE NOTED AS BASIS OF DESIGN PRODUCT SELECTIONS, AND ARE INCLUDED FOR GENERAL REFERENCE TO FACILITATE THE BIDDING PROCESS. APPROVED EQUALS WILL BE ACCEPTABLE.

FINAL OWNER APPROVAL REQUIRED PRIOR TO ALL MATERIAL PURCHASES.

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Rick Rowe
AR0013510 2020.11.17

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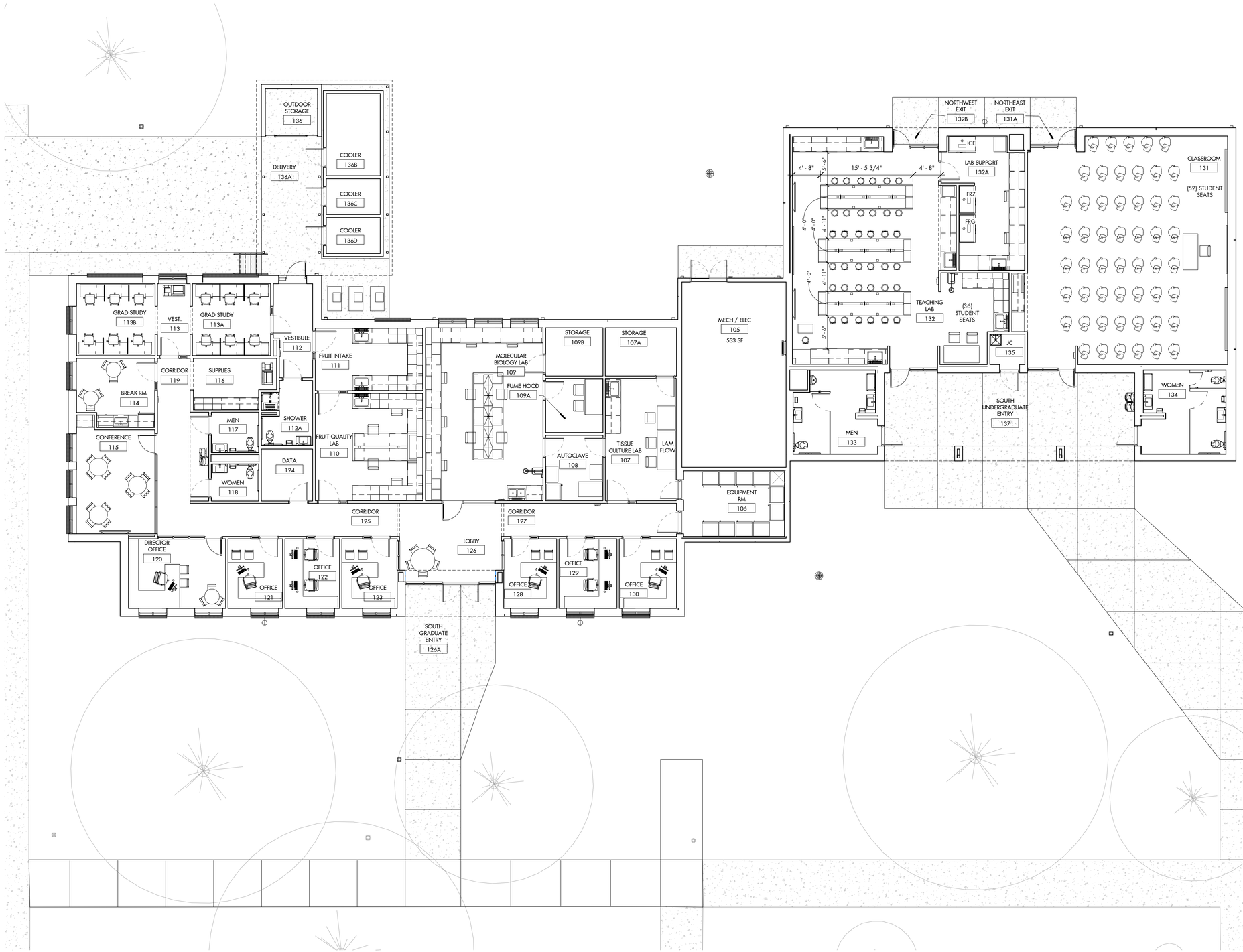
FINISH SCHEDULE

A501



1 FLOOR PLAN - FURNITURE AND EQUIPMENT
scale : 1/8" = 1'-0"

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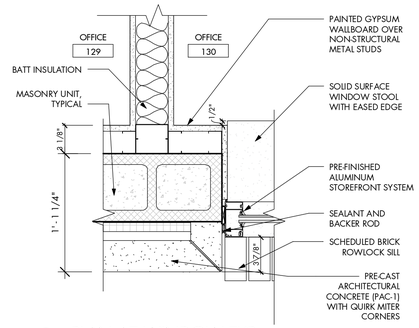
FURNITURE AND EQUIPMENT PLAN

0' 1' 2' 4' 8' 16'
1/8 = 1'-0"

A502



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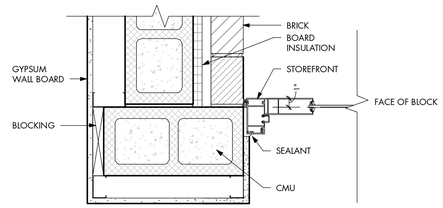

3 DETAIL AT DOOR #132B
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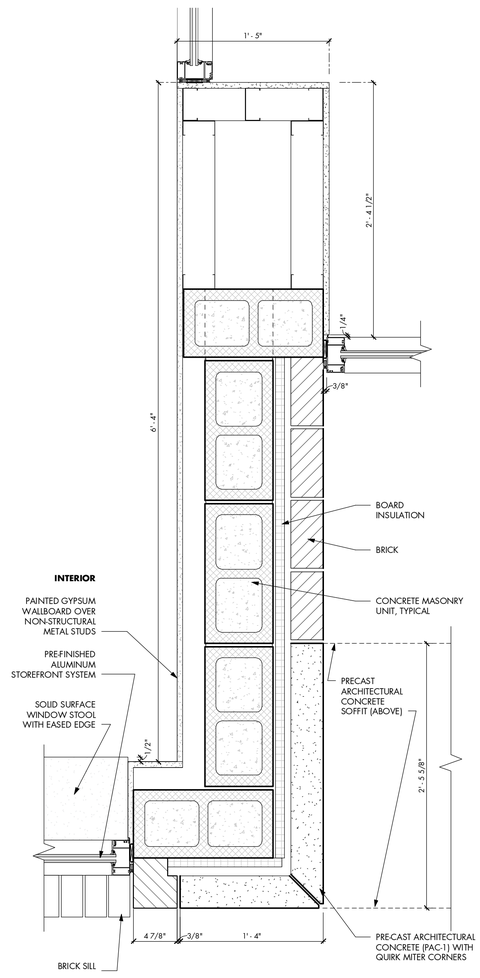

7 DETAIL AT SOUTH GRADUATE ENTRY #126A
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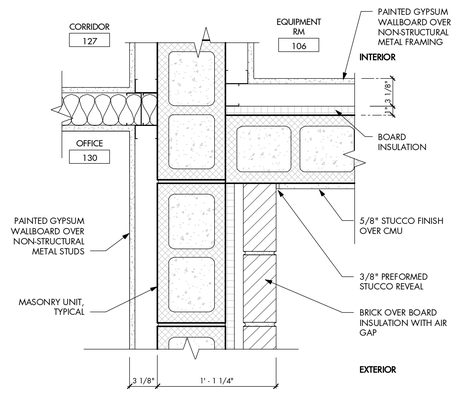

5 DETAIL AT BRICK TO CEMENT PLASTER CORNER
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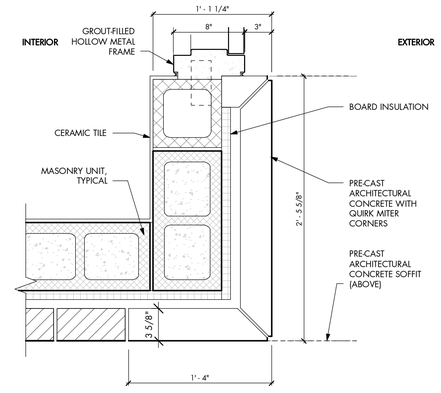

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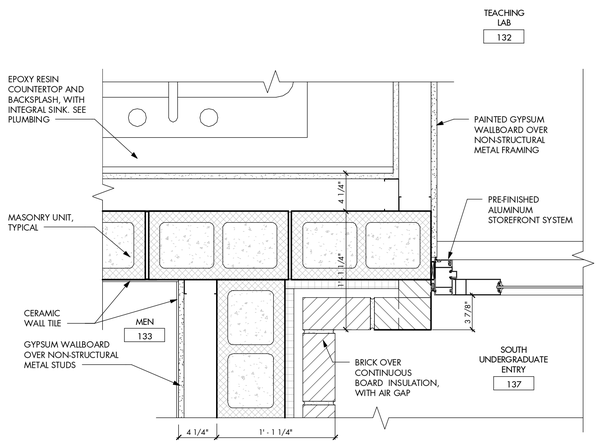

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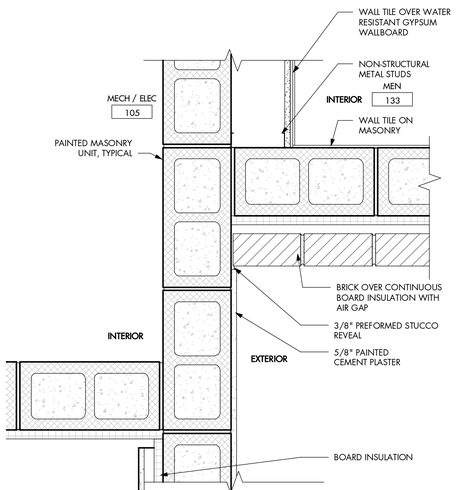

1 DETAIL AT MEN #133
scale : 1 1/2" = 1'-0"

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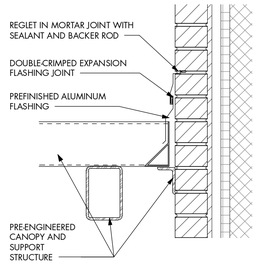
PLAN DETAILS

0" 3" 6" 1'
1-1/2" = 1'-0"

A610



10 CANOPY FLASHING DETAIL
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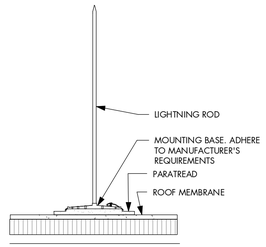

9 LIGHTNING ROD DETAIL
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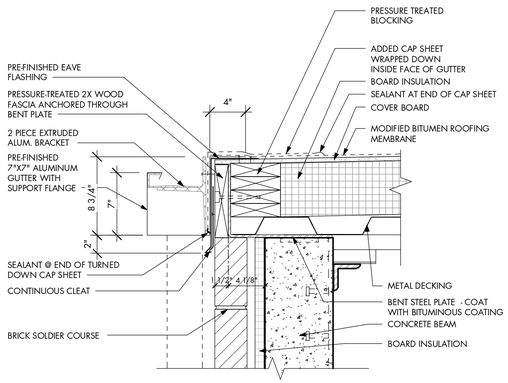
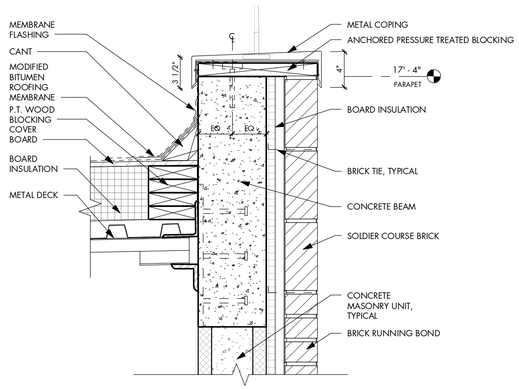
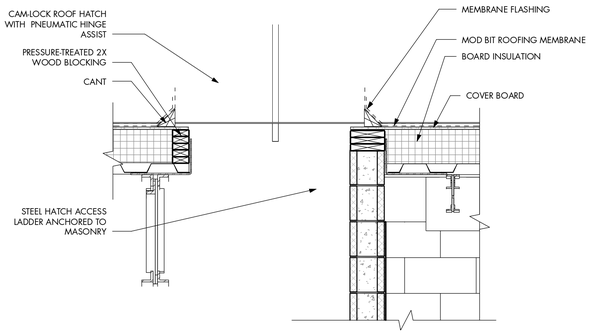


6 ROOF - GUTTER EAVE @ BRICK
scale : 1 1/2" = 1'-0"



3 ROOF - PARAPET @ BRICK
scale : 1 1/2" = 1'-0"



8 WALL SECTION AT ROOF HATCH
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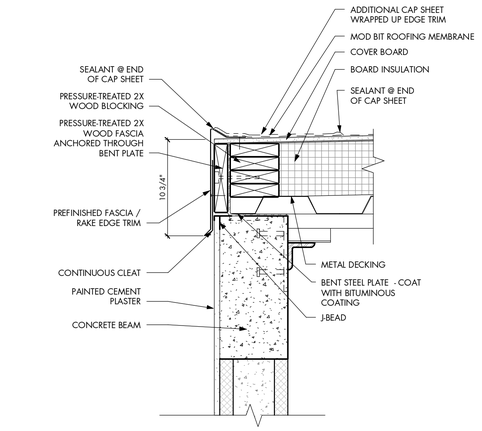

5 ROOF - RAKE EDGE DETAIL @ STUCCO
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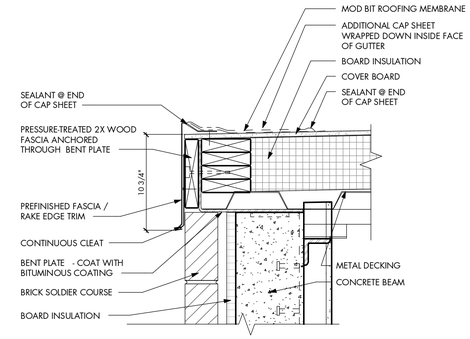

2 ROOF - RAKE EDGE DETAIL @ BRICK
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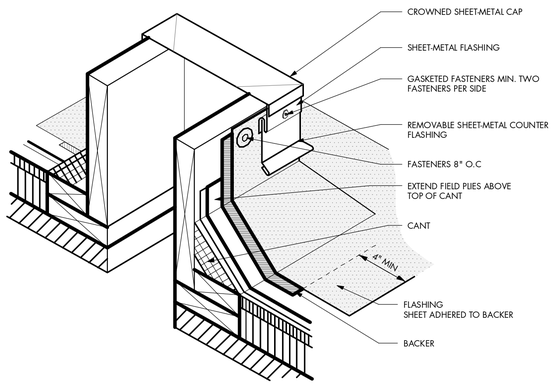
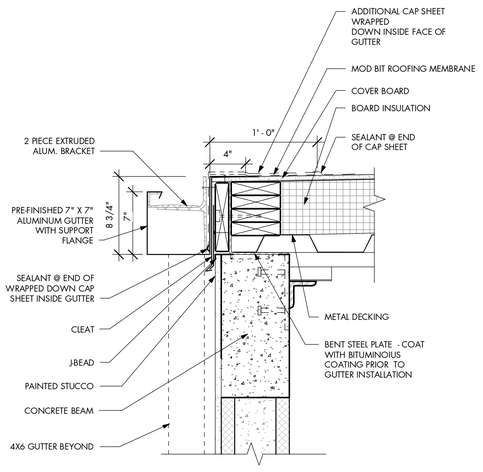


7 ROOF CURB
scale : 1" = 1'-0"



4 ROOF - GUTTER EAVE @ STUCCO
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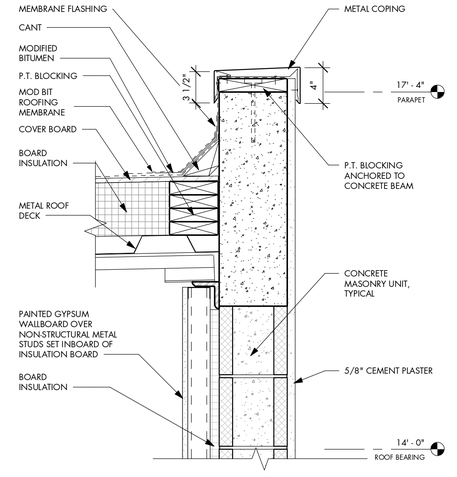

1 ROOF - PARAPET AT STUCCO
scale : 1 1/2" = 1'-0"

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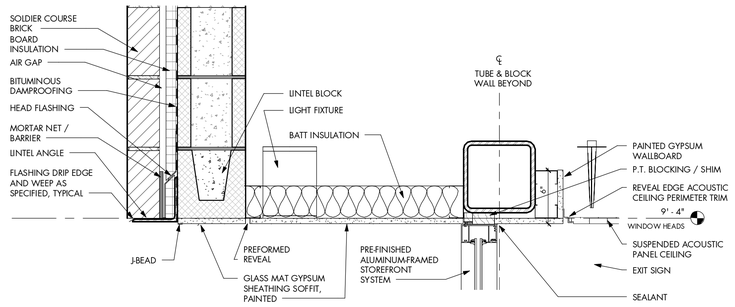
ROOF DETAILS

Scale as Noted

A620



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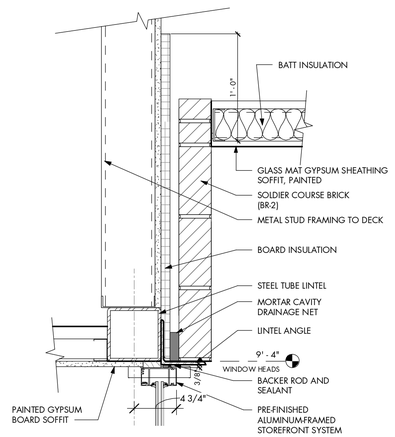
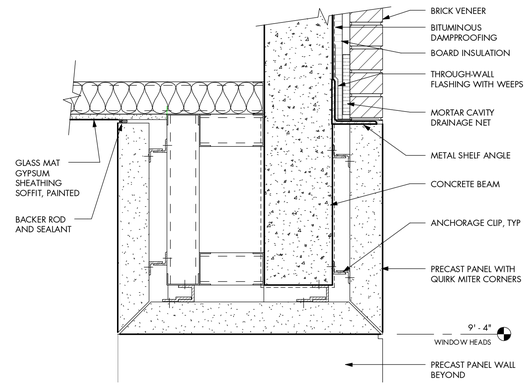
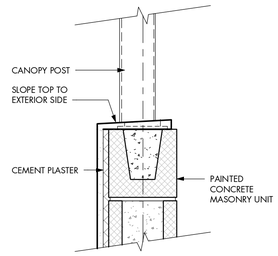


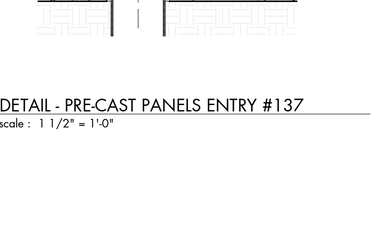
8 DETAIL SOUTH GRADUATE ENTRY #126
scale : 1 1/2" = 1'-0"



5 DETAIL @ PRE-CAST ENTRY
scale : 1 1/2" = 1'-0"

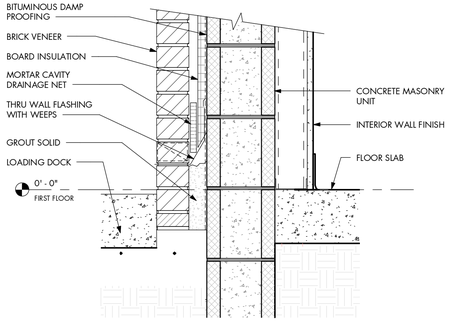


3 DETAIL AT OUTDOOR STORAGE #136
scale : 1 1/2" = 1'-0"

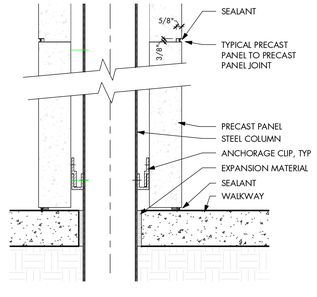


7 PLAN DETAIL AT ENTRY #137
scale : 1 1/2" = 1'-0"

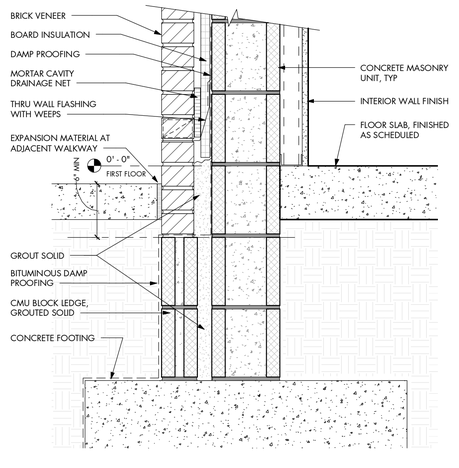
2 DETAIL AT BRICK TO PRE-CAST
scale : 1 1/2" = 1'-0"



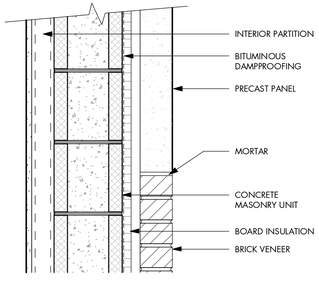
9 DETAIL AT DELIVERY #136A
scale : 1 1/2" = 1'-0"



6 DETAIL - PRE-CAST PANELS ENTRY #137
scale : 1 1/2" = 1'-0"



4 DETAIL AT TYPICAL BELOW GRADE BRICK SHELF
scale : 1 1/2" = 1'-0"



1 DETAIL AT PRE-CAST TO BRICK
scale : 1 1/2" = 1'-0"

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Rick Rowe
AR0013510 2020.11.17

Project Information

UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
GAINESVILLE, FLORIDA
32611

Project Number 1918

Distribution

No.	Description	Date
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03	100% CONSTRUCTION DOCUMENTS	2020-11-17
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Revisions

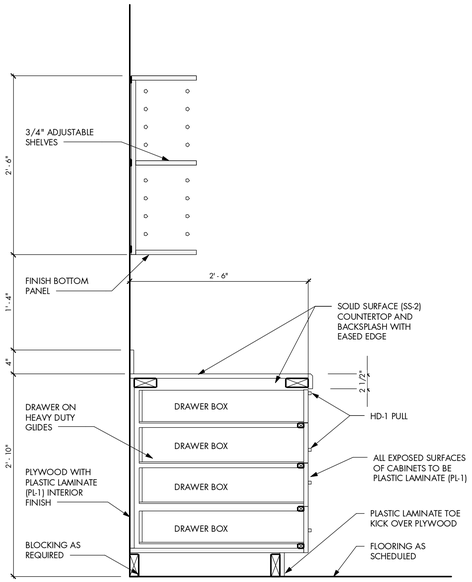
No.	Description	Date

Sheet Information

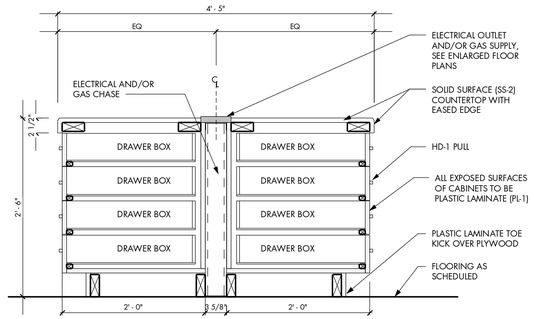
SECTION DETAILS

0' 3" 6" 1'
1-1/2" = 1'-0"

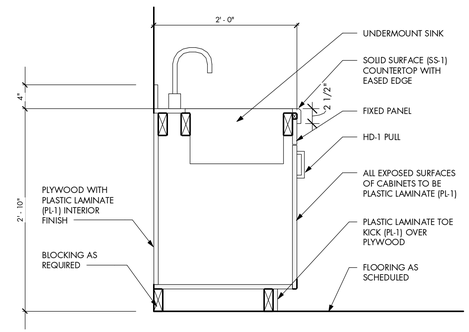
A630



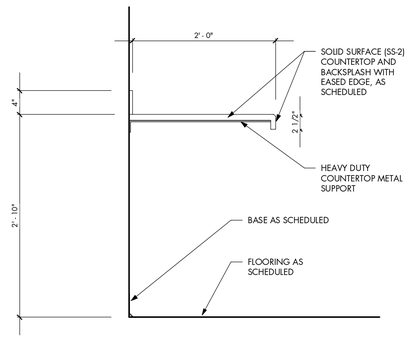
8 SECTION AT OPEN SHELF AND EQUAL DRAWER LOWER (30" DEEP)
scale : 1" = 1'-0"



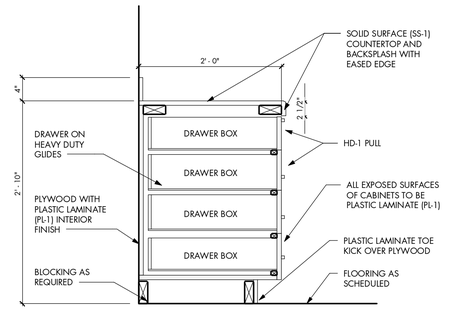
6 SECTION AT EQUAL DRAWER LOWER (24" DEEP) WITH CHASE
scale : 1" = 1'-0"



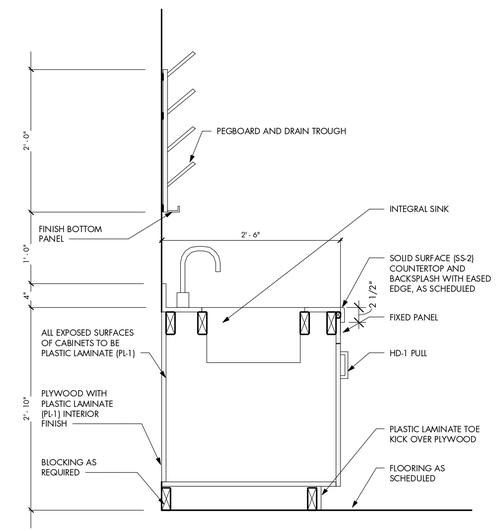
3 SECTION AT SINK BASE CABINET (24" DEEP)
scale : 1" = 1'-0"



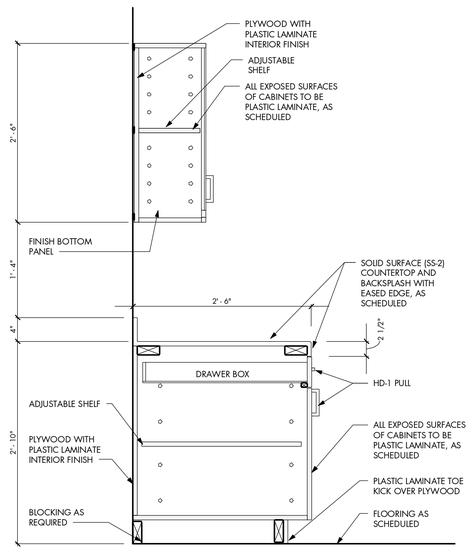
5 SECTION AT COUNTERTOP WITHOUT LOWER (24" DEEP)
scale : 1" = 1'-0"



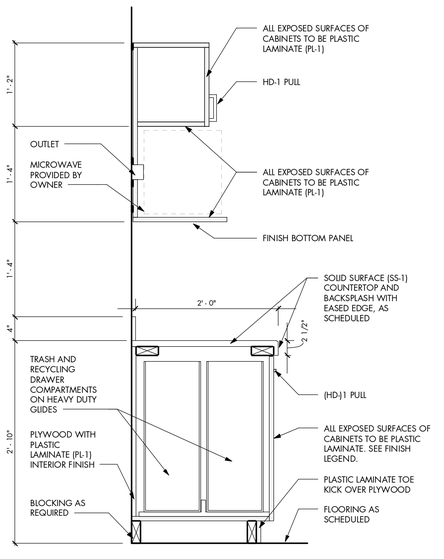
2 SECTION AT EQUAL DRAWER LOWER (24" DEEP)
scale : 1" = 1'-0"



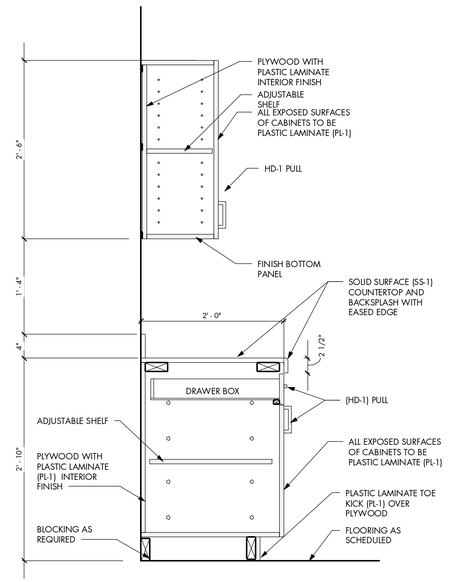
9 SECTION AT SINK LOWER AND PEGBOARD (30" DEEP)
scale : 1" = 1'-0"



7 SECTION AT TYPICAL UPPER AND LOWER (30" DEEP)
scale : 1" = 1'-0"



4 SECTION AT MICRO UPPER AND WASTE LOWER (24 DEEP")
scale : 1" = 1'-0"



1 SECTION AT TYPICAL UPPER AND LOWER (24" DEEP)
scale : 1" = 1'-0"

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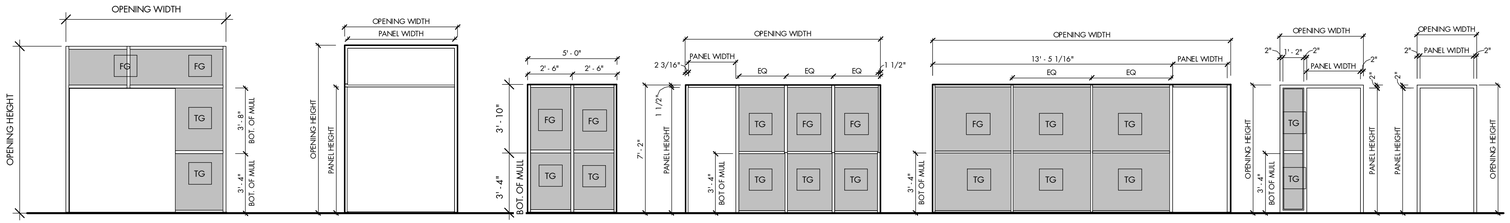
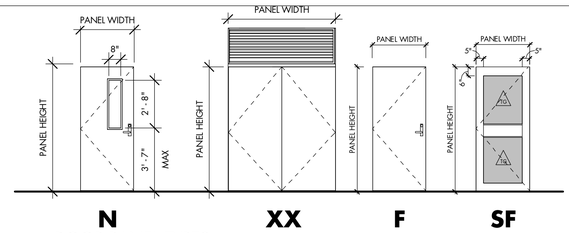
CASEWORK DETAILS

0' 6" 1' 2' 4'
3/8" = 1'-0"

A640



FRAME TYPES
scale : 1/4" = 1'-0"



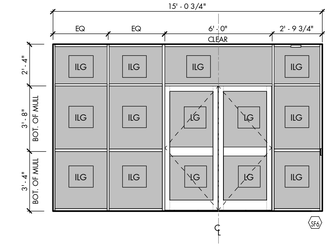
DOOR PANEL TYPES
scale : 1/4" = 1'-0"

DOORS AND GLAZING LEGEND

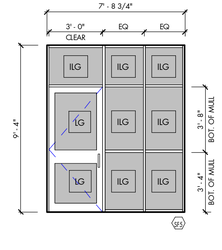
MATERIAL	ALM	ALUMINUM
	HM	HOLLOW METTAL
	WD	WOOD
DOOR PANEL	SF	STOREFRONT
	F	FLUSH PANEL
FINISH	ANO	ANODIZED
	ST	STAIN
	PT	PAINT
GLASS TYPE	ILG	INSULATED LAMINATED GLASS
	TG	TEMPERED GLASS
	FG	FLOAT GLASS
	LG	LAMINATED GLASS

OPENING SCHEDULE

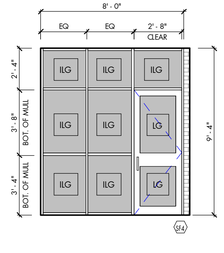
MARK	OPENING		PANEL						FRAME			COMMENTS
	HEIGHT	WIDTH	LEAF QUANTITY	TYPE	WIDTH	HEIGHT	MATERIAL	FINISH	TYPE	MATERIAL	FINISH	
105	9' - 4"	6' - 4"	2	XX	3' - 0"	7' - 0"	HM	PT	6	HM	PT	
106	7' - 2"	3' - 10"	1	N	3' - 6"	7' - 0"	ALUM	ANO	1	ALUM	ANO	
107	7' - 2"	5' - 0"	1	F	3' - 6"	7' - 0"	WD	STD	2	AUM	ANO	
107A	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	AUM	ANO	
107B	7' - 2"	3' - 4"	1	N	3' - 0"	7' - 0"	WD	STD	1	ALUM	ANO	
108	7' - 2"	3' - 4"	1	N	3' - 0"	7' - 0"	WD	STD	1	HM	PT	
108A	7' - 2"	3' - 4"	1	N	3' - 0"	7' - 0"	WD	STD	1	HM	PT	
109	7' - 2"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	2	ALM	ANO	
109A	7' - 2"	3' - 4"	1	N	3' - 0"	7' - 0"	WD	STD	1	HM	PT	45 MINUTE FIRE RATED
109B	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	ALM	ANO	
110	7' - 2"	5' - 0"	1	F	3' - 6"	7' - 0"	WD	STD	2	ALM	ANO	
110A	7' - 2"	5' - 0"	1	F	3' - 6"	7' - 0"	WD	STD	2	ALM	ANO	
111	7' - 2"	5' - 0"	1	F	3' - 6"	7' - 0"	WD	STD	2	ALM	ANO	
112	7' - 2"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	2	ALM	ANO	EGRESS DOOR, FOB ACCESS
112A	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	ALM	ANO	
112B	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	ALM	PT	EGRESS DOOR
113	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	ALM	PT	EGRESS DOOR
114	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	ALM	PT	
115	7' - 2"	12' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	3	ALM	ANO	
117	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	AUM	ANO	
118	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	AUM	ANO	
120	7' - 2"	12' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	3	AUM	ANO	
121	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
122	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
123	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
124	7' - 2"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	STD	1	AUM	ANO	
126	7' - 2"	7' - 0"	2	SF	3' - 0"	7' - 0"	ALM	ANO	SF6	ALM	ANO	EGRESS DOOR, FOB ACCESS, ADA ACTUATOR
128	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
129	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
130	7' - 2"	4' - 8"	1	F	3' - 0"	7' - 0"	WD	PT	2	AUM	PT	
131	9' - 4"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	SF5	ALM	ANO	EGRESS DOOR, FOB ACCESS, ADA ACTUATOR
131A	9' - 4"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	SF4	ALM	ANO	EGRESS DOOR
132	9' - 4"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	SF5	ALM	ANO	EGRESS DOOR, FOB ACCESS, ADA ACTUATOR
132A	7' - 2"	3' - 4"	1	N	3' - 0"	7' - 0"	WD	STD	1	HM	PT	
132B	9' - 4"	8' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	SF4	ALM	ANO	EGRESS DOOR
133	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	HM	PT	1	HM	PT	ADA ACCTUATOR
134	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	HM	PT	1	HM	PT	
135	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	HM	PT	1	HM	PT	
136J	7' - 0"	6' - 0"	2	SF	3' - 0"	7' - 0"	ALM	ANO	7	AUM	ANO	
137	7' - 4"	12' - 0"	1	SF	3' - 0"	7' - 0"	ALM	ANO	SF4	AUM	ANO	
1913	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	ST	1	HM	PT	
2842	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	ST	1	HM	PT	
2843	7' - 4"	3' - 4"	1	F	3' - 0"	7' - 0"	WD	ST	1	HM	PT	



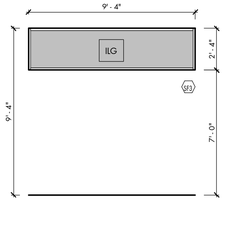
6 EXTERIOR STOREFRONT TYPE 6 (SF6)
scale : 1/4" = 1'-0"



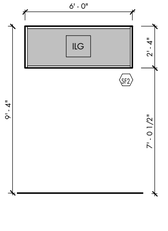
5 EXTERIOR STOREFRONT TYPE 5 (SF5)
scale : 1/4" = 1'-0"



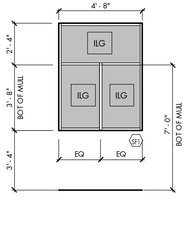
4 EXTERIOR STOREFRONT TYPE 4 (SF4)
scale : 1/4" = 1'-0"



3 STOREFRONT TYPE 3 (SF3)
scale : 1/4" = 1'-0"



2 STOREFRONT TYPE 2 (SF2)
scale : 1/4" = 1'-0"



1 STOREFRONT TYPE 1 (SF1)
scale : 1/4" = 1'-0"

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AR0013510 2020.11.17

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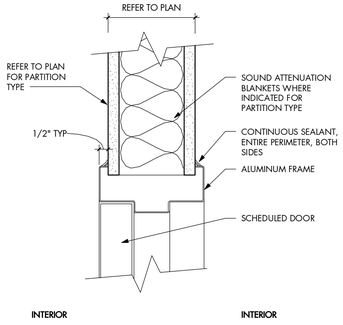
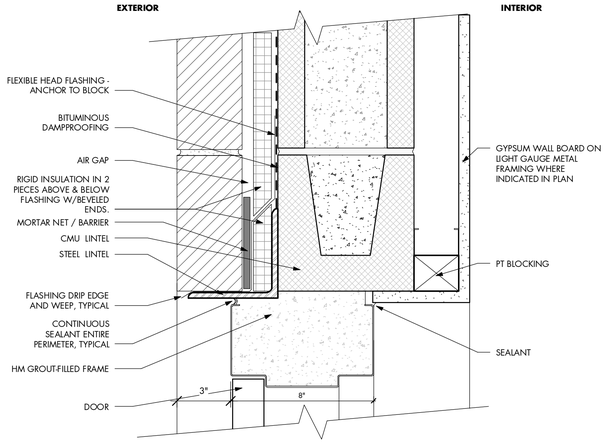
DOORS AND GLAZING

0' 6" 1' 2' 4' 8'
1/4" = 1'-0"

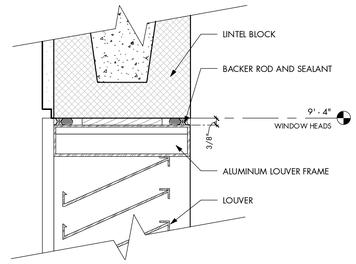
A700



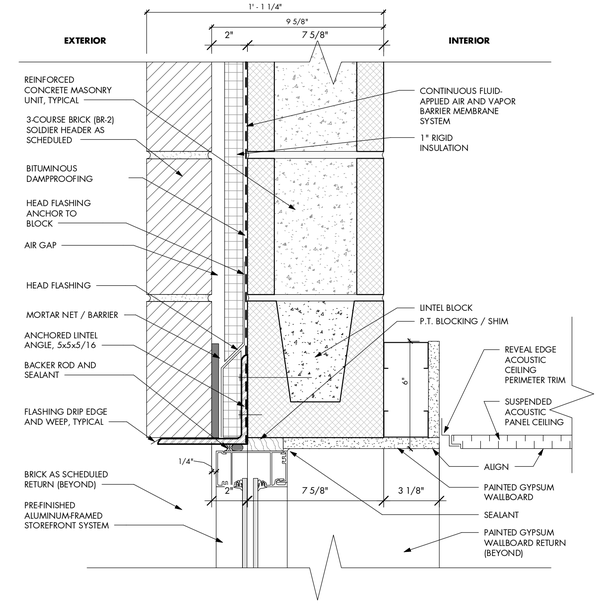
8 ALUMINUM DOOR HEAD AT INTERIOR
scale : 3" = 1'-0"



7 HM DOOR HEAD AT EXTERIOR
scale : 3" = 1'-0"



4 HM EXTERIOR DOOR HEAD AT LOUVER
scale : 3" = 1'-0"

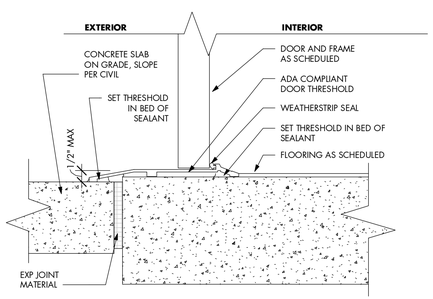


2 EXTERIOR STOREFRONT AT HEAD
scale : 3" = 1'-0"

6 HM DOOR JAMB AT EXTERIOR
scale : 3" = 1'-0"

3 EXTERIOR STOREFRONT - HEAD @ SOFFIT
scale : 3" = 1'-0"

1 EXTERIOR STOREFRONT AT SILL
scale : 3" = 1'-0"



5 DOOR THRESHOLD AT EXTERIOR
scale : 3" = 1'-0"

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DOORS AND GLAZING DETAILS

0" 1" 2" 3" 6"
3" = 1'-0"

A701

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Rick Rowe
AR0013510 2020.11.17

Project Information

UNIVERSITY OF FLORIDA

UF #640 - IFAS BLUEBERRY RESEARCH FACILITY BUILDING #0906

UNIVERSITY OF FLORIDA
2560 HULL ROAD
GAINESVILLE, FLORIDA
32611

Project Number 1918

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01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
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Sheet Information

COVER

G000

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GENERAL
G000 COVER
G001 SHEET INDEX

LIFE SAFETY
LS001 CODE INFORMATION
LS002 LIFE SAFETY PLAN

CIVIL
C100 GENERAL NOTES
C200 SITE GEOMETRY AND MARKING PLAN
C300 PAVING, GRADING, AND DRAINAGE PLAN
C400 UTILITIES PLAN
C401 LIFT STATION DETAILS

STRUCTURAL
S000 COVER SHEET
S001 GENERAL STRUCTURAL NOTES
S002 GENERAL STRUCTURAL NOTES
S003 STRUCTURAL SYMBOLS AND NOTATIONS
S004 STRUCTURAL SYMBOLS AND NOTATIONS
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A404 ENLARGED PLANS AND INTERIOR ELEVATIONS
A405 ENLARGED PLANS AND INTERIOR ELEVATIONS
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A501 FINISH SCHEDULE
A502 FURNITURE AND EQUIPMENT PLAN
A610 PLAN DETAILS
A620 ROOF DETAILS
A630 SECTION DETAILS
A640 CASEWORK DETAILS
A700 DOORS AND GLAZING
A701 DOORS AND GLAZING DETAILS

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P101 FLOOR PLAN - WATER, GAS, AND VENT
P102 RISERS AND ENLARGED PLANS

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IC203 LAB SUPPLY / GENERAL EXHAUST TRACKING CONTROLS
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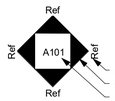
F001 LEGEND, NOTES AND DESIGN CRITERIA
F100 SITE PLAN
F101 REFLECTED CEILING PLAN

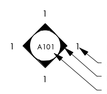
TELECOMMUNICATIONS
T001 TELECOM - LEGEND, ABBREVIATIONS, RESPONSIBILITIES & COORDINATION
T002 DETAILS
T100 FLOOR PLAN

SYMBOLS LEGEND

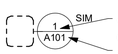
SECTION / DETAIL TAG
section number indicator
sheet where section is located



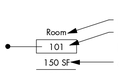
ELEVATION TAG (exterior)
elevation number indicator
indicates direction of elevation
sheet where elevation is located



ELEVATION TAG (interior)
elevation number indicator
indicates direction of elevation
sheet where elevation is located

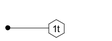


drawing number indicator
CALL OUT
sheet where drawing is located



room name
room number
ROOM TAG
actual area (nsf)
target area (nsf)

OPENING TAG
opening number



WINDOW / FRAME TAG

WALL / PARTITION TAG

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G001

BUILDING CODE SUMMARY

Building Occupancy: Business Group B

Construction Type: II-B

Automatic Fire Sprinkler System: Yes

Building Height: 17' - 4" (Top of Parapet)

Building Area: 8,441 NSF
9,530 GSF

Total Occupant Load: 207 persons

Means of Egress Sizing: (FBC *Building* Section 1005)
39.2" Total Required.

Exit and Exit Access Doorways from Spaces
(FBC *Building* Section 1006)

Groups A & B One (1) if occupant load is ≤ 49
Two (2) if occupant load is > 49
Provide three (3) exits or exit access doorways from any space with an occupant load of 501 to 1,000.
Provide four (4) exits or exit access doorways from any space with an occupant load greater than 1,000.

Maximum Allowable Common Path of Egress Travel:
(FBC *Building* Section 1006.2.1)

Groups A, Sprinklered 75' max allowable
Groups B, Sprinklered 100' max allowable

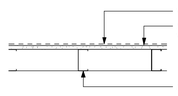
Maximum Allowable Exit Access Travel Distance:
(FBC *Building* Section 1017.2)

Groups A, Sprinklered 250' max allowable
Groups B, Sprinklered 300' max allowable

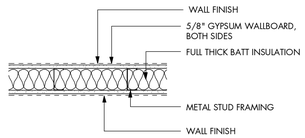
WALL TYPES LEGEND

GENERAL NOTES
1. All interior partitions to extend to roof deck.
2. Refer to exterior elevations for full extent of wall types.
3. Coordinate interior wall finish with finish plans.

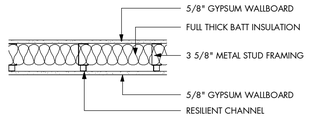
W01
STUD SIZE
(a) 2-1/2"
(b) 3-5/8"
(c) 6"



W02
STUD SIZE
(a) 2-1/2"
(b) 3-5/8"
(c) 6"



W03
STC 49
UL U419



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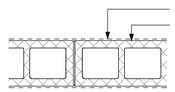

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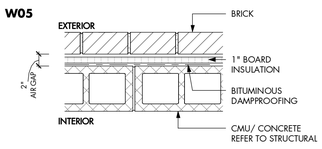

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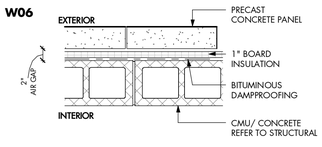
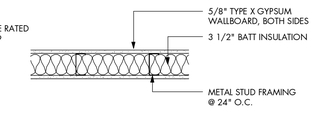


W07
1HR FIRE RATED
UL U419



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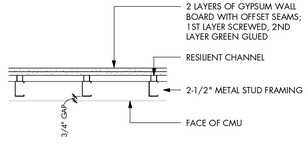

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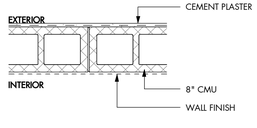
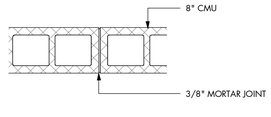


W10
1 HR
UL U906



CODE CALCULATIONS

Number	ROOM NAME	PER SECTION 302 - FBC 2017 OCCUPANCY CLASSIFICATION	ROOM AREA	PER TABLE1004.1.2 - FBC 2017			OCCUPANT LOAD(SPACE TOTAL)
				FUNCTION OF SPACE	AREA / OCCUPANT	GROSS OR NET	
105	MECH / ELEC	BUSINESS	533 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	2
106	EQUIPMENT RM	BUSINESS	182 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	1
107	TISSUE CULTURE LAB	BUSINESS	242 SF	Educational: Shops and other vocational areas	50 SF	Net	5
107A	STORAGE	BUSINESS	96 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	1
108	AUTOCLAVE	BUSINESS	105 SF	Educational: Shops and other vocational areas	50 SF	Net	3
109	MOLECULAR BIOLOGY LAB	BUSINESS	565 SF	Educational: Shops and other vocational areas	50 SF	Net	12
109A	FUME HOOD	BUSINESS	87 SF	Educational: Shops and other vocational areas	50 SF	Net	2
109B	STORAGE	BUSINESS	77 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	1
110	FRUIT QUALITY LAB	BUSINESS	306 SF	Educational: Shops and other vocational areas	50 SF	Net	7
111	FRUIT INTAKE	BUSINESS	188 SF	Educational: Shops and other vocational areas	50 SF	Net	4
112	VESTIBULE	BUSINESS	97 SF	(none)		Net	
112A	SHOWER	BUSINESS	84 SF	(none)		Gross	
113	VEST.	BUSINESS	65 SF	Business Area	100 SF	Gross	1
113A	GRAD STUDY	BUSINESS	158 SF	Business Area	100 SF	Gross	2
113B	GRAD STUDY	BUSINESS	158 SF	Business Area	100 SF	Gross	2
114	BREAK RM	BUSINESS	143 SF	Business Area	100 SF	Gross	2
115	CONFERENCE	BUSINESS	234 SF	Assembly without fixed seats: Unconcentrated (tables and chairs)	15 SF	Net	16
116	SUPPLIES	BUSINESS	111 SF	Business Area	100 SF	Gross	2
117	MEN	BUSINESS	53 SF	(none)		Gross	
118	WOMEN	BUSINESS	49 SF	(none)		Gross	
119	CORRIDOR	BUSINESS	231 SF	(none)		Gross	
120	DIRECTOR OFFICE	BUSINESS	188 SF	Business Area	100 SF	Gross	2
121	OFFICE	BUSINESS	105 SF	Business Area	100 SF	Gross	2
122	OFFICE	BUSINESS	105 SF	Business Area	100 SF	Gross	2
123	OFFICE	BUSINESS	107 SF	Business Area	100 SF	Gross	2
124	DATA	BUSINESS	75 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	1
125	CORRIDOR	BUSINESS	171 SF	(none)		Gross	
126	LOBBY	BUSINESS	218 SF	Business Area	100 SF	Gross	3
126A	SOUTH GRADUATE ENTRY	BUSINESS	183 SF	(none)		Gross	
127	CORRIDOR	BUSINESS	164 SF	(none)		Gross	
128	OFFICE	BUSINESS	102 SF	Business Area	100 SF	Gross	2
129	OFFICE	BUSINESS	112 SF	Business Area	100 SF	Gross	2
130	OFFICE	BUSINESS	111 SF	Business Area	100 SF	Gross	2
131	CLASSROOM	ASSEMBLY	1276 SF	Educational: Classroom areas	20 SF	Net	64
131A	NORTHEAST EXIT	BUSINESS	21 SF	(none)		Gross	
132	TEACHING LAB	ASSEMBLY	1093 SF	Educational: Classroom areas	20 SF	Net	55
132A	LAB SUPPORT	BUSINESS	258 SF	Educational: Shops and other vocational areas	50 SF	Net	6
132B	NORTHWEST EXIT	BUSINESS	26 SF	(none)		Gross	
133	MEN	BUSINESS	181 SF	(none)		Gross	
134	WOMEN	BUSINESS	191 SF	(none)		Gross	
135	JC	BUSINESS	30 SF	(none)		Gross	
136	OUTDOOR STORAGE	STORAGE	70 SF	Accessory storage area, mechanical equipment room	300 SF	Gross	1
136A	DELIVERY	STORAGE	247 SF	(none)		Gross	
136B	COOLER	STORAGE	124 SF	(none)			
136C	COOLER	STORAGE	53 SF	(none)			
136D	COOLER	STORAGE	53 SF	(none)			
137	SOUTH UNDERGRADUATE ENTRY	BUSINESS	606 SF	(none)		Gross	
Totals			9635 SF				207

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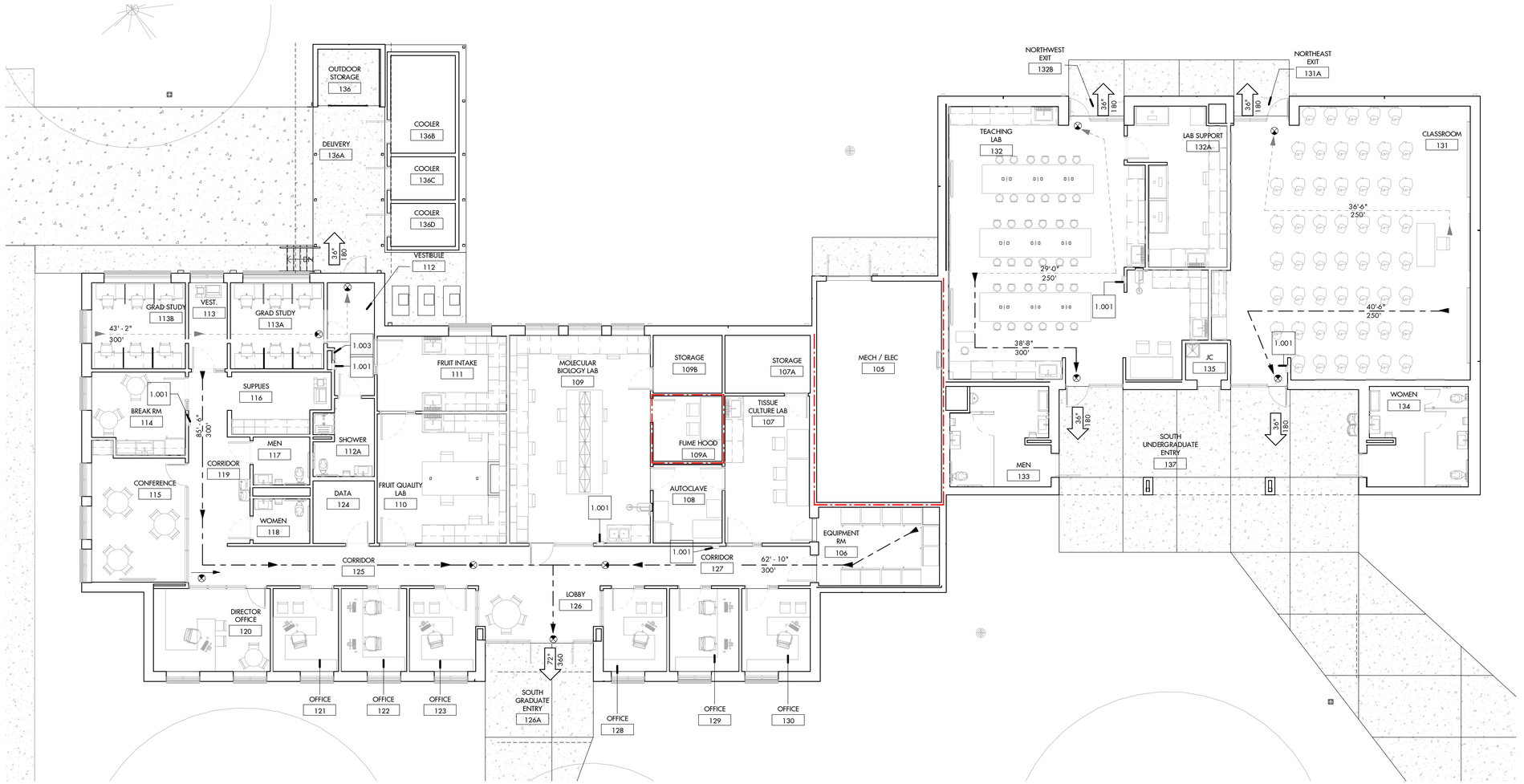
CODE INFORMATION

LS001



1 LIFE SAFETY PLAN
scale : 1/8" = 1'-0"

KEYED NOTES

1.001 RECESSED FIRE EXTINGUISHER CABINET (FEC).
1.003 RECESSED DEFIBRILLATOR CABINET.

SYMBOL LEGEND

- TRAVEL DISTANCE
- 54'-6" / XXX' — PATH OF EGRESS
- INDICATES DIRECTION OF TRAVEL
- MAXIMUM TRAVEL DISTANCE
- TRAVEL DISTANCE
- 54'-6" / XXX' — SECONDARY PATH OF EGRESS
- INDICATES DIRECTION OF TRAVEL
- MAXIMUM TRAVEL DISTANCE
- EXIT SIGN
  DIRECTIONAL ARROW AS INDICATED, SHADED AREAS DENOTE FACES
- 35" / 175 — EGRESS WIDTH
  ALLOWBLE NUMBER OF OCCUPANTS FOR WIDTH PROVIDED
- FE — BRACKET MOUNTED FIRE EXTINGUISHER
- FEC — RECESSED FIRE EXTINGUISHER CABINET
- 1-HOUR RATED WALL

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LIFE SAFETY PLAN

0' 1'-2" 4' 8' 16'
1/8" = 1'-0"

LS002

SITE GENERAL NOTES

1. THE OVERALL SITE TOPOGRAPHIC AND BOUNDARY INFORMATION SHOWN HEREON WAS ORIGINALLY PREPARED BY FLOWERS SURVEYING AND MAPPING, INC. DATED FEBRUARY 6, 2020.
2. THE CONTRACTOR SHALL EMPLOY A LAND SURVEYOR REGISTERED IN THE STATE OF FLORIDA TO REFERENCE AND RESTORE PROPERTY CORNERS AND LAND MARKERS WHICH MAY BE DISTURBED BY CONSTRUCTION.
3. ALL PAVEMENT DIMENSIONS SHOWN ARE TO EDGE OF PAVEMENT, OR FACE OF CURB UNLESS OTHERWISE NOTED.
4. ALL NEW TRAFFIC CONTROL DEVICES (SIGNS AND PAVEMENT MARKINGS) SHALL CONFORM TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) AND FDOT STANDARDS.
5. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING TRAFFIC AND USAGE OF THE EXISTING STREETS AND DRIVEWAYS ADJACENT TO THE PROJECT. ALL TRAFFIC MAINTENANCE CONTROL SHALL BE IN ACCORDANCE WITH FDOT MANUAL OF TRAFFIC CONTROL AND SAFE PRACTICES FOR STREET CONSTRUCTION, MAINTENANCE, AND UTILITY OPERATIONS.
6. ALL NON-CONFORMING SIGNS SHALL BE REMOVED FROM THE SITE.
7. ALL WORK PERFORMED IN THE CITY RIGHT-OF-WAY SHALL BE IN COMPLIANCE WITH THE LATEST FDOT AND CITY OF GAINESVILLE STANDARDS. PLEASE INFORM CITY INSPECTORS 24 HOURS PRIOR TO COMMENCING ANY WORK IN THE RIGHT-OF-WAY.
8. CONTRACTOR TO REVIEW GEOTECHNICAL REPORT AND BORINGS PRIOR TO BIDDING THE PROJECT AND FOLLOW OUTLINED CONSTRUCTION TECHNIQUES.
9. THE CONTRACTOR IS TO PREPARE THE SITE PRIOR TO BEGINNING ACTUAL CONSTRUCTION IN ACCORDANCE WITH THE GEOTECHNICAL REPORT.
10. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATING APPLICABLE TESTING WITH THE SERVICES OF AN APPROVED TESTING LABORATORY AND SOILS ENGINEER APPLICABLE REGULATORY AGENCIES AND AS MAY BE FOUND IN THE ENGINEERING RING CONSTRUCTION DRAWINGS. CONTRACTOR TO VERIFY ALL TESTING WITH THE OWNER PRIOR TO COMMENCING CONSTRUCTION. UPON COMPLETION OF THE WORK, THE SOILS ENGINEER MUST SUBMIT TO THE OWNER'S ENGINEER CERTIFICATIONS STATING THAT ALL REQUIREMENTS HAVE BEEN MET.
11. CONTRACTOR SHALL CLEAR AND GRUB ONLY THOSE PORTIONS OF THE SITE NECESSARY FOR CONSTRUCTION. DISTURBED AREAS WILL BE SODDED, SEEDED, MULCHED OR PLANTED WITH OTHER APPROVED LANDSCAPE MATERIAL IMMEDIATELY FOLLOWING CONSTRUCTION PER LOCAL INSPECTOR.
12. LOCATIONS, ELEVATIONS, AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES AND OTHER FEATURES ARE BASED UPON BEST AVAILABLE INFORMATION REVIEWED AT THE TIME OF DOCUMENT PREPARATION. THIS INFORMATION MAY NOT BE OF SUITABLE ACCURACY OR CORRECTNESS FOR THE CONTRACTOR'S CONSTRUCTION NEEDS. THEREFORE, THE CONTRACTOR SHALL VERIFY THE LOCATIONS, ELEVATIONS, AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES, AND OTHER FEATURES AFFECTING THE WORK BEFORE CONSTRUCTION.
13. THE CONTRACTOR SHALL REPLACE ALL PAVING, STABILIZED EARTH DRIVEWAYS, SIDEWALKS, CURBS, FENCING, ETC., DAMAGED DURING CONSTRUCTION, WITH THE SAME TYPE AND QUALITY OF MATERIALS AND WORKMANSHIP AS PREVIOUSLY EXISTED. AREAS DISTURBED BY CONSTRUCTION THAT ARE NOT INDICATED TO BE SODDED SHALL BE SEEDED.
14. IT IS THE CONTRACTOR'S RESPONSIBILITY TO BECOME FAMILIAR WITH THE PERMIT AND INSPECTION REQUIREMENTS OF THE VARIOUS GOVERNMENTAL AGENCIES. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS PRIOR TO CONSTRUCTION, AND SCHEDULE INSPECTIONS ACCORDING TO AGENCY INSTRUCTIONS.
15. ALL WORK TO BE PERFORMED FOR THE COMPLETION OF THIS PROJECT SHALL BE CONSTRUCTED ACCORDING TO THE BEST PRACTICES OF THE INDUSTRY AND IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, COUNTY AND/OR CITY CODES, ORDINANCES, STANDARDS, AND PERMIT CONDITIONS.
16. THE CONTRACTOR SHALL FURNISH ALL NECESSARY MATERIALS, EQUIPMENT, MACHINERY, TOOLS, MEANS OF TRANSPORTATION AND LABOR NECESSARY TO COMPLETE THE WORK IN FULL AND COMPLETE ACCORDANCE WITH THE CONSTRUCTION DOCUMENTS AND JURISDICTIONAL AGENCY REQUIREMENTS. IN THE EVENT THE CONSTRUCTION DOCUMENTS AND THE JURISDICTIONAL AGENCY REQUIREMENTS ARE NOT IN AGREEMENT, THE MOST STRINGENT SHALL GOVERN.
17. WORK BEING PERFORMED UNDER THE CONTRACT SHALL INTERFACE SMOOTHLY WITH OTHER WORK BEING PERFORMED ON THE SITE BY OTHER CONTRACTORS AND UTILITY COMPANIES. IT WILL BE NECESSARY FOR THE CONTRACTOR TO COORDINATE AND SCHEDULE HIS ACTIVITIES, WHERE NECESSARY, WITH OTHER CONTRACTORS AND UTILITY COMPANIES.
18. REPAIR AND REPLACEMENT OF ALL PRIVATE AND PUBLIC PROPERTY AFFECTED BY THIS WORK SHALL BE RESTORED TO THE CONDITION EQUAL TO OR BETTER THAN EXISTING CONDITIONS BEFORE COMMENCING CONSTRUCTION WORK UNLESS SPECIFICALLY EXEMPTED BY THE PLANS. ADDITIONAL COSTS ARE INCIDENTAL TO OTHER CONSTRUCTION AND NO EXTRA COMPENSATION WILL BE ALLOWED.
19. THROUGHOUT THE CONSTRUCTION PERIOD OF THIS PROJECT, ALL SAFETY REGULATIONS ARE TO BE ENFORCED. THE CONTRACTOR OR HIS REPRESENTATIVE SHALL BE RESPONSIBLE FOR THE CONTROL AND SAFETY OF ONSITE PERSONNEL, THE TRAVELING PUBLIC, AND THE CONTRACTOR'S WORKFORCE. LABOR SAFETY REGULATIONS SHALL CONFORM TO THE LATEST EDITION PROVISIONS ESTABLISHED BY OSHA. ALL SUBSURFACE CONSTRUCTION SHALL COMPLY WITH THE TRENCH SAFETY ACT. IT SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO COMPLY AND ENFORCE ALL APPLICABLE SAFETY REGULATIONS. THIS INFORMATION HAS BEEN PROVIDED FOR THE CONTRACTOR'S INFORMATION ONLY AND DOES NOT IMPLY THAT THE OWNER OR ENGINEER WILL INSPECT AND/OR ENFORCE SAFETY REGULATIONS..
20. ALL HANDICAP RAMPS SHALL COMPLY WITH ADA, STATE OF FLORIDA ACCESSIBILITY CODES AND STANDARDS, AND FLORIDA DEPARTMENT OF TRANSPORTATION SPECIFICATIONS. SEE DETECTABLE WARNING STRIP DETAIL ON SHEET C2.30.
21. PROVIDE LEVEL PLATFORM IN FRONT OF ALL EGRESS DOORS. THE FLOOR SURFACE ON BOTH SIDES OF A DOOR SHALL BE AT THE SAME ELEVATION. THE FLOOR SURFACE OR LANDING ON EACH SIDE OF THE DOOR SHALL EXTEND FROM THE DOOR IN THE CLOSED POSITION A DISTANCE EQUAL TO THE DOOR WIDTH AND SHALL COMPLY WITH SECTION 4.13.6 MANEUVERING CLEARANCES AT DOORS OF THE FLORIDA ACCESSIBILITY CODE FOR BUILDING CONSTRUCTION.
22. CONTRACTOR TO GUARANTEE ALL WORK FOR A PERIOD OF ONE YEAR UNLESS OTHERWISE SPECIFIED IN CONTRACT DOCUMENTS.

DEMOLITION GENERAL NOTES

1. THE CONTRACTOR SHALL ACCURATELY LOCATE ALL UNDERGROUND PIPES, CABLES AND UTILITIES IN THE AREAS OF CONSTRUCTION. THIS SHALL BE DONE SEVEN DAYS PRIOR TO EXCAVATION TO AVOID DAMAGE TO THESE FACILITIES. ALL DAMAGE RESULTING FROM CONTRACTOR'S FAILURE TO COMPLY WITH THIS REQUIREMENT SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
2. THE CONTRACTOR SHALL PROVIDE TEMPORARY SUPPORT AND/OR BRACING TO MAINTAIN THE STRUCTURAL INTEGRITY OF ALL POWER POLES AND SUPPORTS LOCATED WITHIN THE IMMEDIATE VICINITY OF TRENCH EXCAVATIONS. THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH THE POWER COMPANY TO PROVIDE TEMPORARY SUPPORT AND/OR BRACING IN ACCORDANCE WITH THE POWER COMPANY REQUIREMENTS.
3. LOCATIONS, ELEVATIONS AND DIMENSIONS OF EXISTING UTILITIES, STRUCTURES AND OTHER FEATURES ARE SHOWN BASED ON THE BEST INFORMATION AVAILABLE AT THE TIME OF PREPARATION OF THESE DRAWINGS BUT ARE NOT PURPORTED TO BE ABSOLUTELY CORRECT. THERE MAY BE OTHER IMPROVEMENTS, UTILITIES, ETC. WHICH ARE WITHIN THE PROPOSED PROJECT AREA. CONTRACTOR SHALL VERIFY PRIOR TO CONSTRUCTION THE LOCATIONS, ELEVATIONS AND DIMENSIONS OF ALL EXISTING UTILITIES, STRUCTURES AND OTHER FEATURES (WHETHER OR NOT SHOWN ON THE DRAWINGS) AFFECTING HIS WORK.
4. THE CONTRACTOR SHALL NOTE THAT OVERHEAD UTILITIES MAY NOT BE SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL FIELD LOCATE AND INCLUDE CONSIDERATION OF SUCH UTILITIES IN PLANNING AND EXECUTING HIS WORK.
5. THE CONTRACTOR SHALL FOLLOW ALL STATE, LOCAL AND FEDERAL REGULATIONS AND PROPERLY DISPOSE OF ALL DEMOLITION DEBRIS AT AN APPROVED OFF-SITE LOCATION IN A LEGAL MANNER.
6. CONDUCT SITE DEMOLITION OPERATIONS TO ENSURE MINIMUM INTERFERENCE WITH ROADS, STREETS, WALKS AND OTHER ADJACENT OCCUPIED OR USED FACILITIES. DO NOT CLOSE OR OBSTRUCT STREETS, WALKS OR OTHER USABLE FACILITIES WITHOUT PERMISSION FROM OWNERS AND AUTHORITIES HAVING JURISDICTION. CLOSURE OF THESE FACILITIES MAY REQUIRE A MAINTENANCE OF TRAFFIC PLAN PREPARED BY A REGISTERED PROFESSIONAL AT THE CONTRACTOR'S EXPENSE.

PAVING, GRADING, AND DRAINAGE GENERAL NOTES

1. THE CONTRACTOR SHALL FIELD VERIFY HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING UTILITIES. CONTRACTOR SHALL NOT DISTURB OR RELOCATE ANY EXISTING UTILITY WITHOUT WRITTEN PERMISSION FROM THE UTILITY OWNER.
2. ALL CONCRETE USED SHALL BE 3,000 PSI MINIMUM.
3. THE CONTRACTOR IS RESPONSIBLE FOR EROSION/SEDIMENTATION CONTROL PRACTICES DURING CONSTRUCTION TO MINIMIZE ON-SITE EROSION/SEDEMENTATION AND TO PROTECT AGAINST DAMAGE TO OFF SITE PROPERTY.
4. AREAS WITHIN THE RIGHT-OF-WAY AND EASEMENTS SHALL BE CLEARED OF ALL TREES, ROOTS, VEGETATION, AND ALL OTHER OBSTRUCTIONS RESTING ON OR PROTRUDING THROUGH THE SURFACE. AREAS OF EXCLUSION SUCH AS TREES OR DESIGNATED BUFFERS SHALL BE ADEQUATELY MARKED FOR PROTECTION.
5. STOCKPILES OF WASTE OR EXCESS MATERIAL SHALL NOT REMAIN WITHIN THE RIGHT-OF-WAY OR EASEMENTS AND SHALL BE REMOVED FROM THE BOUNDS OF THE PROJECT IN A LEGAL MANNER.
6. STOCKPILES OF EXCAVATED TOPSOIL OR FILL MATERIAL SHALL BE LOCATED SUCH THAT SITE DRAINAGE OR WATERWAYS ARE NOT OBSTRUCTED. THE OWNER OF PROPERTY MAY TEMPORARILY STOCKPILE TOPSOIL OR ROCKS, OUTSIDE OF ALL RIGHTS-OF-WAY AND EASEMENTS, TO REMAIN FOR FUTURE LANDSCAPING. STOCKPILES OF EXCESS SUITABLE MATERIAL MUST BE REMOVED PRIOR TO FINAL INSPECTION OR APPROPRIATELY PERMITTED TO REMAIN ON SITE. STOCKPILE LOCATION APPROVAL MUST BE OBTAINED THROUGH THE APPROPRIATE REGULATING AGENCY AND A PERMIT MUST BE OBTAINED.
7. EXCAVATION SHALL INCLUDE REMOVAL OF ALL MATERIALS AND STRUCTURES NECESSARY TO CONSTRUCT ROADWAY AND DRAINAGE FACILITIES TO THE APPROPRIATE LINE AND GRADE.
8. CONTRACTOR SHALL BE EXTREMELY CAUTIOUS WHEN WORKING NEAR TREES WHICH ARE TO BE SAVED, WHETHER SHOWN ON THE PLANS OR DESIGNATED IN THE FIELD.
9. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING AND DISPOSING ALL WASTE MATERIALS CONSISTENT WITH ALL RULES AND REGULATIONS APPLICABLE TO THE SPECIFIC MATERIAL FOUND. ALL DELETERIOUS SUBSURFACE MATERIAL (I.E. MULCH, PEAT, BURIED DEBRIS, ETC.) IS TO BE EXCAVATED AND REPLACE WITH SUITABLE/COMPACTED SOILS AS DIRECTED BY THE OWNER, ENGINEER OR GEOTECHNICAL ENGINEER. EXCAVATED AREAS ARE TO BE BACKFILLED WITH APPROVED MATERIALS AND COMPACTED AS SHOWN ON THESE PLANS. CONTRACTOR IS RESPONSIBLE FOR ACQUIRING ANY PERMITS THAT ARE NECESSARY FOR REMOVING DELETERIOUS MATERIAL FROM THE SITE.
10. CONTRACTOR IS RESPONSIBLE FOR GRADING ALL PAVEMENTS TO DRAIN POSITIVELY. SHOULD AREAS OF POOR DRAINAGE BE OBSERVED, CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO FINAL GRADING.
11. ALL STORM STRUCTURES SHALL CONFORM WITH FDOT STANDARD INDEX DRAWINGS AND SPECIFICATIONS EXCEPT THAT DITCH BOTTOM INLETS IN PAVED AREAS SHALL HAVE TRAVERSABLE, TRAFFIC BEARING GRATES SUPPORTED BY STEEL ANGLE SEATS OR SUPPORTED ON FOUR SIDES. GRATES SHALL BE CAST IRON UNLESS OTHERWISE SPECIFIED OR APPROVED.
12. CONTRACTOR SHALL SUBMIT FOR REVIEW TO THE OWNER AND OWNER'S ENGINEER SHOP DRAWINGS ON ALL PRECAST AND MANUFACTURED ITEMS TO BE USED ON THIS SITE. FAILURE TO OBTAIN APPROVAL BEFORE INSTALLATION MAY RESULT IN REMOVAL AND REPLACEMENT AT CONTRACTOR'S EXPENSE. ENGINEER'S APPROVAL OF A SHOP DRAWING DOES NOT RELIEVE THE CONTRACTOR'S RESPONSIBILITY FOR THE PERFORMANCE OF THE ITEM.
13. THE CONTRACTOR SHALL MAINTAIN AND PROTECT FROM MUD, DIRT, DEBRIS, ETC. THE STORM DRAINAGE SYSTEM UNTIL FINAL ACCEPTANCE OF THE PROJECT. THE STORM SYSTEM WILL BE REINSPECTED BY THE OWNER'S ENGINEER PRIOR TO FINAL APPROVAL. THE CONTRACTOR MAY BE REQUIRED TO RECLEAN PIPES AND INLETS FOR THESE PURPOSES.
14. THE CONTRACTOR SHALL MAINTAIN IN HIS POSSESSION A COPY OF THE WATER MANAGEMENT DISTRICT CONSTRUCTION PERMIT. HE SHALL BE RESPONSIBLE FOR ADHERENCE TO ALL CONDITIONS CONTAINED IN THE PERMIT.
15. THE COST OF ALL TESTING OF COMPACTION AND OTHER REQUIRED TESTS SHALL BE PAID BY THE CONTRACTOR AND MADE AVAILABLE TO THE ENGINEERING OF RECORD DURING SITE INSPECTIONS.
16. IF LIMEROCK IS ENCOUNTERED DURING EXCAVATION OF THE SWALES/BASINS OR IF A SINKHOLE FORMS IN THE AREA OF A DRAINAGE SWALE/BASIN, THE ENGINEER OF RECORD SHALL BE NOTIFIED BY EITHER THE CONTRACTOR OR THE ESTABLISHED OPERATION AND MAINTENANCE ENTITY. THE ENGINEER OF RECORD SHALL INSPECT THE REPAIRED AREA UPON COMPLETION OF THE REPAIR.
17. REMOVAL OF ALL CONSTRUCTION DEBRIS, LIMEROCK, EXCESS OF BUILDERS SAND, CONCRETE AND MORTAR DEBRIS, EXISTING WEEDS AND GRASSES, AND ALL FOREIGN MATERIALS IN THE PLANTING BED AND SOD AREAS SHALL BE REMOVED. 12" OF CLEAN FLORIDA FILL WITH THE pH OF 5.5-6.5 SHALL BE INSTALLED PRIOR TO ANY INSTALLATION OF PLANTS OR TREES.

MAINTENANCE OF TRAFFIC (MOT) NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR CREATING A MAINTENANCE OF TRAFFIC (MOT) PLAN FOR CONSTRUCTION ACTIVITY THAT OCCURS WITHIN THE CITY OF GAINESVILLE RIGHT-OF-WAY, INCLUDING BUT NOT LIMITED TO SIDEWALK WORK AND ACTIVITIES THAT REQUIRE A LANE (OR ROAD) CLOSURE, SUCH AS CONNECTION TO SEWER MANHOLES AND WATER MAINS. THE MOT PLAN MUST BE CREATED BY AN INDIVIDUAL WHO IS CERTIFIED TO DO SO BY THE FDOT MOT CERTIFICATION TRAINING. THE MOT PLAN MUST ALSO BE IN ACCORDANCE WITH FDOT DESIGN STANDARDS, FDOT STANDARD SPECIFICATIONS, AND CITY OF GAINESVILLE MOT REQUIREMENTS AND MUST BE REVIEWED AND APPROVED BY THE CITY OF GAINESVILLE PUBLIC WORKS DEPARTMENT. IN CASES WHERE THE WORK OCCURS IN AN FDOT RIGHT-OF-WAY OR REQUIRES PLACEMENT OF WORK ZONE SIGNS IN AN FDOT RIGHT-OF-WAY, THE MOT PLAN MUST ALSO BE REVIEWED AND APPROVED BY FDOT.

ENVIRONMENTAL GENERAL NOTES

1. SYNTHETIC HAY BALES OR FABRIC FENCE (SILT TYPE) SHALL BE UTILIZED AS SILT BARRIERS AND PLACED IN LOCATIONS SHOWN ON THE PLANS AND AT OTHER LOCATIONS AS REQUIRED TO KEEP SEDIMENT FROM REACHING WATER BODIES OR WETLAND AREAS (REFERENCE STORM WATER POLLUTION PREVENTION PLANS). THESE BARRIERS SHALL BE INSTALLED BEFORE COMMENCING WITH ANY CONSTRUCTION WITHIN OR ADJACENT TO JURISDICTIONAL AREAS. THE CONTRACTOR SHALL MONITOR AND MAINTAIN ALL SILT BARRIERS AND FENCING INCLUDING DAILY INSPECTIONS TO CHECK THEIR INTEGRITY. ANY LOOSE OR DAMAGED SILT BARRIERS AND FENCING SHALL BE IMMEDIATELY REPAIRED OR REPLACED AS NECESSARY. ONCE CONSTRUCTION IS COMPLETED AND FINISHED GRADING AND STABILIZATION HAS BEEN ACHIEVED, SILT BARRIERS AND FENCING SHALL BE COMPLETELY REMOVED TO THE SATISFACTION OF THE ENGINEER AND BEFORE FINAL ACCEPTANCE.
2. ALL WATER COLLECTED AND PUMPED DURING TRENCH DEWATERING ACTIVITIES SHALL BE DISPOSED OF IN UPLAND AREAS INTO DOUBLE STAKED HAY BALES. DISCHARGE LOCATIONS SHALL BE A MINIMUM OF 75 FEET FROM THE NEAREST WATER BODY OR WETLAND AREA TO ALLOW FOR MAXIMUM OVERLAND FILTRATION OF SOIL PARTICLES. EXCAVATION ACROSS ALL WETLANDS SHALL BE ACCOMPLISHED BY STRIPPING THE TOP 10 INCHES OF SURFICIAL SOILS FROM THE FULL WIDTH OF THE AREA TO BE DISTURBED. SURFICIAL SOILS SHALL BE REPLACED LAST AND SHALL BE SPREAD ACROSS THE ENTIRE DISTURBED WETLAND AREA TO HELP PROMOTE NATIVE VEGETABLE GROWTH. SURFICIAL SOILS SHALL NOT BE STOCKPILED IN EXCESS OF TWO WEEKS. FURTHER, ALL ASPECTS OF BACKFILLING, GRADING AND MULCHING SHALL BE COMPLETE WITHIN 30 DAYS OF INITIAL WETLAND IMPACT FOR EACH JURISDICTIONAL AREA.
3. TEMPORARY STOCKPILES SHALL NOT BE LOCATED ADJACENT TO WETLANDS WHERE SEDIMENTATION FROM STOCKPILES MAY CAUSE DAMAGE TO WETLAND. ADDITIONALLY, SILT BARRIERS AND FENCING SHALL CONTINUOUSLY AND FULLY ENCIRCLE ALL STOCKPILES WHICH WILL REMAIN FOR LONGER THAN 24 HOURS TO CONTAIN MATERIALS WITHIN A REASONABLY CONFINED AREA.
4. BANKS SHALL BE PROTECTED FROM EROSION OR COLLAPSE DURING CONSTRUCTION. BANK PROTECTION MATERIAL SHALL BE CAREFULLY PLACED FROM THE BANK AND NOT DUMPED FROM ABOVE IN AN UNCONTROLLED MANNER. SANDBAGS SHALL BE USED FOR PROTECTING THE BANKS. UPON COMPLETION OF CONSTRUCTION, BANKS AND WATERWAYS SHALL BE RESTORED TO THEIR PRE-CONSTRUCTION CONFIGURATION AND PROTECTED FROM EROSION.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ON SITE DUST CONTROL. THE USE OF MOTOR OILS AND OTHER PETROLEUM BASED OR TOXIC LIQUIDS FOR DUST SUPPRESSION OPERATIONS IS PROHIBITED.
6. DISTURBED PORTIONS OF THE SITE WHERE CONSTRUCTION ACTIVITY HAS PERMANENTLY STOPPED SHALL BE PERMANENTLY SEEDED UNLESS CALLED OUT TO BE SODDED. THESE AREAS SHALL BE SEEDED NO LATER THAN 7 DAYS AFTER THE LAST CONSTRUCTION ACTIVITY OCCURRED IN THESE AREAS.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING SEDIMENT IN THE DETENTION/RETENTION POND AND ANY SEDIMENT THAT MAY HAVE COLLECTED IN THE STORM DRAINS IN CONJUNCTION WITH THE STABILIZATION OF THE SITE.
8. ALL CONTROL STRUCTURE AND OUTFALL CULVERT INSTALLATIONS SHALL BE PROTECTED WITH SEDIMENT BARRIERS AT A MINIMUM.

ASBUILT NOTES

1. SUBMITTAL OF AS-BUILT SITE SURVEY, INCLUDING BENCHMARKS, IS REQUIRED PRIOR TO SCHEDULING A FINAL INSPECTION FOR UF PDC AND THE WATER MANAGEMENT DISTRICT.
2. AS-BUILT DRAWINGS SHALL BE PREPARED IN AUTOCAD FORMAT BY A FLORIDA REGISTERED LAND SURVEYOR. AN ELECTRONIC FILE OF THE PROJECT SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL. SIGNED AND SEALED PRINTS SHALL BE PROVIDED TO THE ENGINEER AS REQUESTED. PROVIDE LOCATION, ELEVATION AND DESCRIPTION OF BENCHMARK(S).
3. PROVIDE BUILDING LOCATIONS, FINISH FLOOR ELEVATIONS, PAVEMENT GRADES AND ALL UNDERGROUND FACILITIES INCLUDED AS PART OF THE CONSTRUCTION DOCUMENTS.
4. PROVIDE PERIMETER DIMENSIONS AND AT TOP OF BANK AND BOTTOM OF POND.
5. PROVIDE ELEVATIONS AT TOP OF BANK, BOTTOM OF POND AND POND OUTFALL STRUCTURE(S).
6. PROVIDE SPECIAL DETAIL DRAWINGS WHERE INSTALLATIONS WERE NOT AS SHOWN ON CONSTRUCTION DRAWINGS DUE TO FIELD CONDITIONS OR WHERE REQUIRED FOR CLARITY.
7. LOCATE ALL PIPES AND PROVIDE SIZE, ELEVATION, INVERT ELEVATIONS, LENGTH AND TYPE.

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Project Information

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA HULL ROAD
GAINESVILLE, FLORIDA

Project Number (CHL)	200060
Project Number (ARCH)	1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

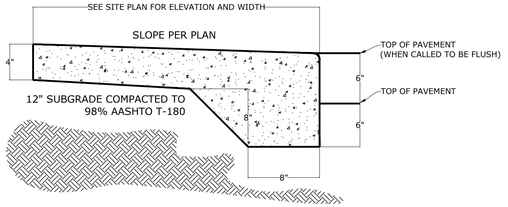
Revisions

No.	Description	Date

Sheet Information

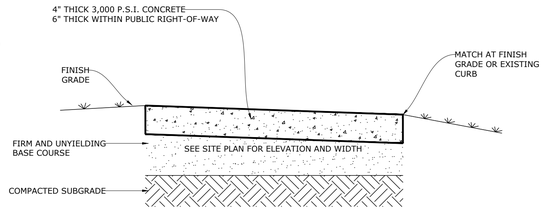
GENERAL NOTES

C100



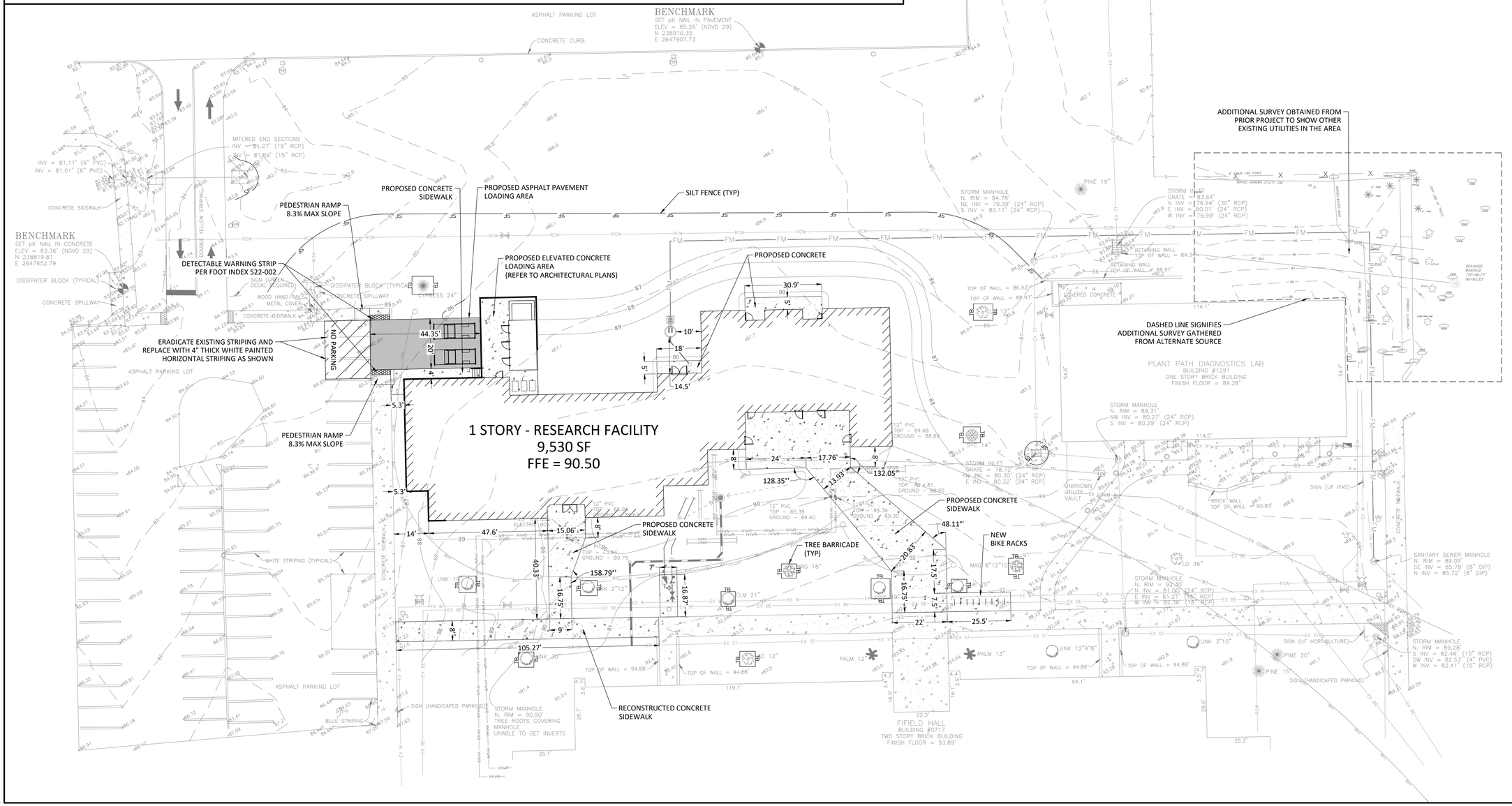
SIDEWALK DETAIL WITH THICKENED EDGE
(ADJACENT TO PARKING)

N.T.S.



TYPICAL SIDEWALK DETAIL

N.T.S.



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Project Number (CNL)	20-0060
Project Number (ARCH)	1918

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Revisions

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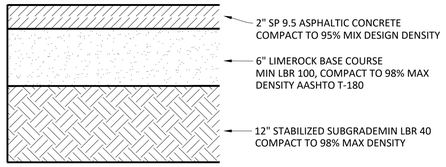
Sheet Information

SITE GEOMETRY AND MARKING PLAN

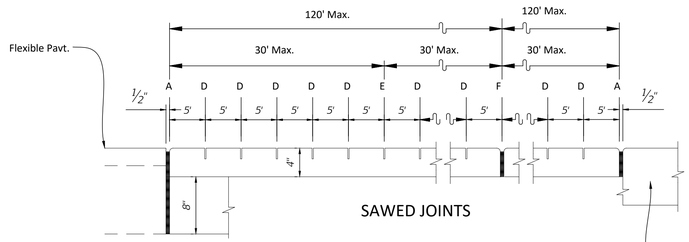
C200



TYPICAL ASPHALT PAVEMENT SECTION

N.T.S.

LONGITUDINAL SECTION



SAWED JOINTS

SIDEWALK JOINTS

N.T.S.

LEGEND:

A- ½" Expansion Joints (Preformed Joint Filler) between the sidewalk and; driveways, sidewalk-intersections, and all other fixed objects (e.g. drainage inlets and utility poles).

B- ⅛" Dummy Joints, Tooled

C- ⅛" Formed Open Joints

D- 3/16" Saw Cut Joints, 1½" Deep (within 96 hours) Max. 5' Centers

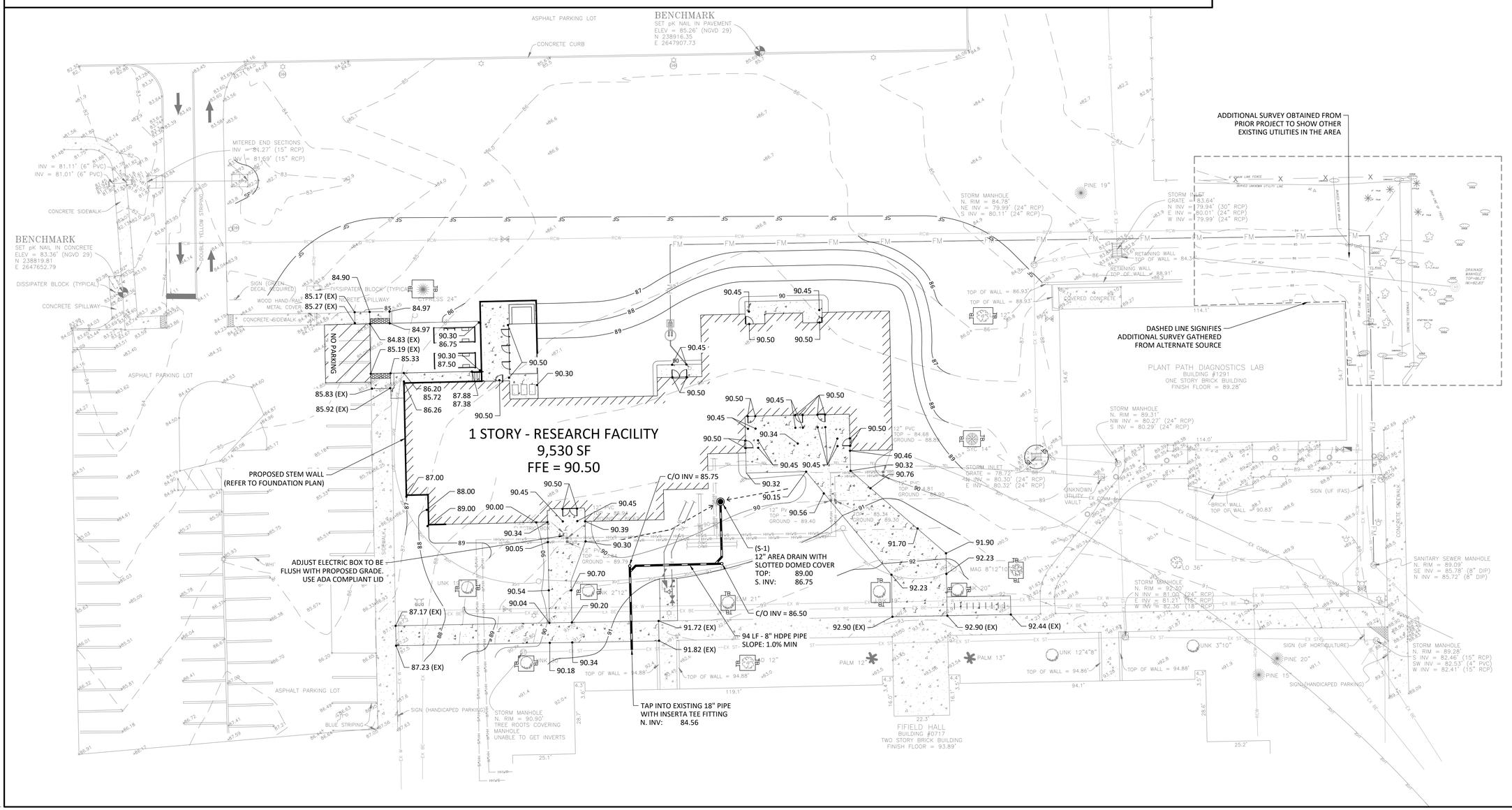
E- 3/16" Saw Cut Joints, 1½" Deep (within 12 hours) Max. 30' Centers Joint(s) Required When Length Exceeds 30'

F- ½" Expansion Joint When Run Of Sidewalk Exceeds 120'. Intermediate locations when called for in the plans or at locations as directed by the Engineer.

G- Cold Joint With Bond Breaker, Tooled

Rigid Structure; 6" Min. For Turnouts or Curb Ramps

0 20 40 Feet



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PAVING, GRADING, AND DRAINAGE PLAN

C300

0 20 40 Feet

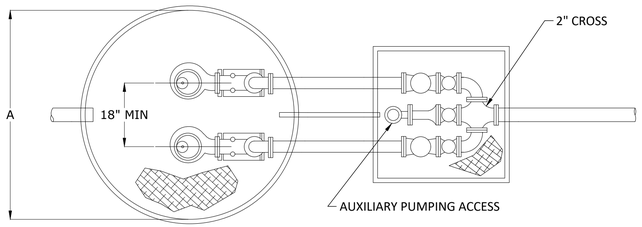
BENCHMARK
SET pK NAIL IN PAVEMENT
ELEV = 85.26' (NGVD 29)
N 238916.35
E 2647907.73

BENCHMARK
SET pK NAIL IN CONCRETE
ELEV = 83.36' (NGVD 29)
N 238819.81
E 2647652.79

ASPHALT PARKING LOT
CONCRETE CURB
CONCRETE SIDEWALK
DOUBLE YELLOW STRIPING
WHITE STRIPING (TYPICAL)
BLUE STRIPING
NO PARKING
SIGN (HANDICAPPED PARKING)
SIGN (GREEN DECAL REQUIRED)
DISSIPATER BLOCK (TYPICAL)
CONCRETE SPILLWAY
WOOD HAND RAIL METAL COVER
MITERED END SECTIONS
INV = 84.27' (15" RCP)
INV = 81.69' (15" RCP)
INV = 81.11' (6" PVC)
INV = 81.01' (6" PVC)
CYPRESS 24"
PINE 19"
PINE 20"
PINE 15"
PALM 12"
PALM 13"
UNK 30"
UNK 2"12"
UNK 12"4"8"
UNK 3"10"
STORM INLET
GRATE = 79.57'
S INV = 76.07' (30" RCP)
STORM MANHOLE
N. RIM = 84.78'
NE INV = 79.99' (24" RCP)
S INV = 80.11' (24" RCP)
STORM INLET
GRATE = 83.64'
N INV = 79.94' (30" RCP)
E INV = 80.01' (24" RCP)
W INV = 79.99' (24" RCP)
STORM MANHOLE
N. RIM = 89.31'
NW INV = 80.27' (24" RCP)
S INV = 80.29' (24" RCP)
STORM INLET
GRATE = 78.72'
SW INV = 80.30' (24" RCP)
E INV = 80.32' (24" RCP)
STORM MANHOLE
N. RIM = 92.40'
N INV = 81.00' (24" RCP)
E INV = 81.21' (24" RCP)
W INV = 82.36' (18" RCP)
STORM MANHOLE
N. RIM = 90.90'
TREE ROOTS COVERING MANHOLE
UNABLE TO GET INVERTS
SANITARY SEWER MANHOLE
N. RIM = 89.09'
SE INV = 85.78' (8" DIP)
N INV = 85.72' (8" DIP)
STORM MANHOLE
N. RIM = 89.28'
S INV = 82.46' (15" RCP)
SW INV = 82.53' (4" PVC)
W INV = 82.41' (15" RCP)
RETAINING WALL
TOP OF WALL = 84.34'
TOP OF WALL = 88.91'
TOP OF WALL = 86.93'
TOP OF WALL = 88.93'
TOP OF WALL = 94.88'
TOP OF WALL = 94.86'
TOP OF WALL = 94.88'
TOP OF WALL = 90.83'
COVERED CONCRETE
BRICK WALL
PLANT PATH DIAGNOSTICS LAB
BUILDING #1291
ONE STORY BRICK BUILDING
FINISH FLOOR = 89.28'
FIFIELD HALL
BUILDING #0717
TWO STORY BRICK BUILDING
FINISH FLOOR = 93.89'
UNKNOWN UTILITY - EX COMM VAULT
SIGN (UF IFAS)
SIGN (UF HORTICULTURE)
SIGN (HANDICAPPED PARKING)
DRAINAGE RAMP TOP=86.71 IN=80.87
CONCRETE SIDEWALK
EX ST
EX W
EX BF
EX SAN
EX COMM
RCW
FM
SS
TEL
HRVS
6" WATER LINE
BURIED UNKNOWN UTILITY LINE
E WATER LINE FENCE
OHP
OHP OF TREES
CONC. SIDEWALK
BRICK WALL
BRICK PAVER
CONCRETE CURB
CONCRETE SIDEWALK
RETAINING WALL
DRIP LINE OF TREES
DRIP LINE OF TREES
DRIP LINE OF TREES

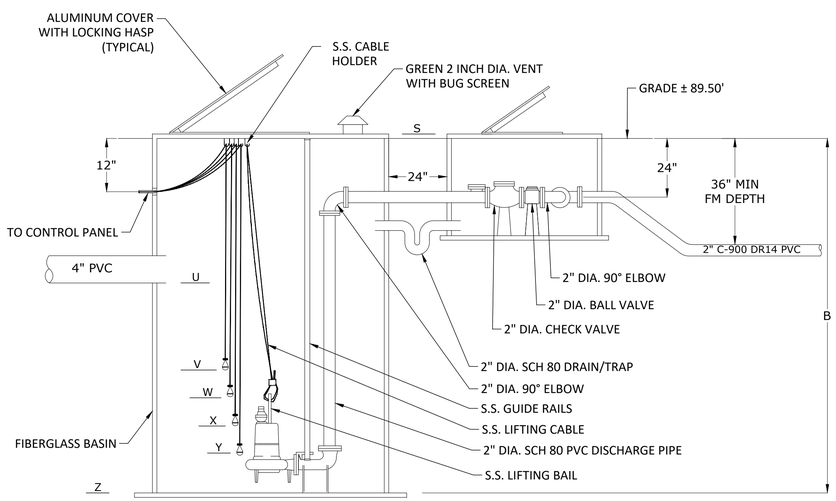
NOTES:

1. CONTRACTOR TO SUBMIT SHOP DWGS OF ALL MATERIALS FOR REVIEW PRIOR TO COMMENCEMENT OF WORK.
2. ALL COMPONENTS TO MEET OR EXCEED FDEP AND LOCAL PLUMBING CODE REQUIREMENTS.
3. ELECTRICAL COMPONENTS (INCLUDING CONTROL PANEL AND SWITCHES) TO BE DESIGNED BY OTHERS MEETING REQUIREMENTS SHOWN AND THE REQUIREMENTS OF FDEP AND LOCAL PLUMBING CODE .
4. PUMP SHOWN FOR SPECIFICATIONS. ALTERNATIVE PUMPS MEETING REQUIREMENTS MAY BE SUBMITTED FOR APPROVAL.
5. PUMPS ARE TO ALTERNATE IN USE.
6. POST WEATHER RESISTANT SIGN WITH UNIVERSITY OF FLORIDA FACILITY MANAGER CONTACT PHONE NUMBER IN CASE OF EMERGENCY.
7. CONTRACTOR TO PERFORM LEAKAGE TESTS ON FORCE MAIN AND MEET THE CRITERIA LISTED IN THE SPECIFICATIONS.
8. FORCEMAIN PIPING SHALL BE INSTALLED W/ MIN COVER OF 36". CONTRACTOR TO INSTALL LOCATING TAPE 12" FROM GRADE DIRECTLY ABOVE FORCEMAIN.
9. BACKFILL AROUND STRUCTURES IN 12" LIFTS COMPACTING EACH LIFT TO 95% OF THE MODIFIED PROCTOR DENSITY (AASHTO T-180).
10. INSTALL PUMP BASES, GUIDE RAILS, AND DISCHARGE PIPING PLUMB, LEVEL, AND SQUARE.
11. CONTROL PANEL SHALL BE FITTED WITH A LIGHTNING ARRESTOR.
12. EACH PUMP SHALL HAVE AN INDIVIDUAL ELAPSED TIME METER LOCATED WITHIN THE CONTROL PANEL AREA.
13. CONTRACTOR SHALL INSTALL HOSE BIB WITH FREE STANDING BACKFLOW VALVE WITHIN LIFT STATION YARD OR AFFIXED TO A NEARBY STRUCTURE.



LIFT STATION PLAN VIEW

N.T.S.



LIFT STATION SECTION

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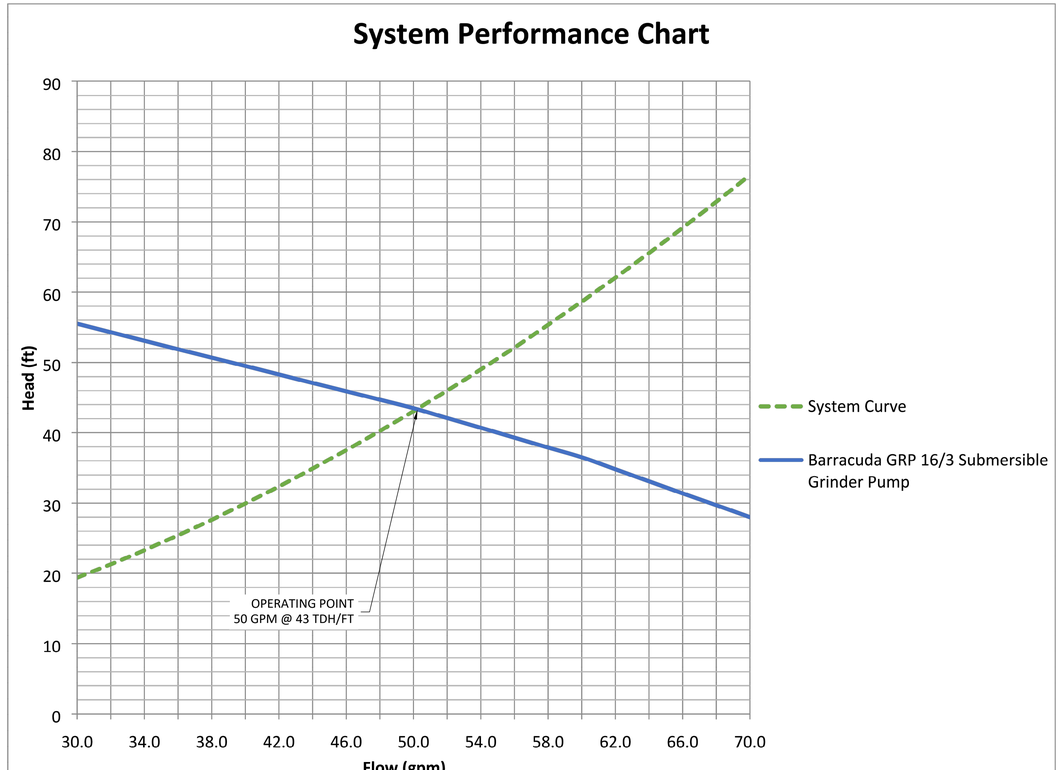
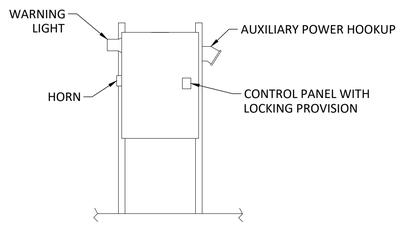


PUMP SPECIFICATIONS	
PUMPS REQUIRED	2
MANUFACTURER	BARRACUDA
MODEL NUMBER	GRP 16/3
CAPACITY EACH (GPM)	50
TOTAL HEAD (FEET)	43
IMPELLER DIAMETER	5.0394"
MOTOR HP REQUIRED	1.5
SPEED (RPM)	3450
ELECTRICAL	230/460V - 3 PHASE

WETWELL SPECIFICATIONS		
A	DIA	4.00'
B	DEPTH	9.00'
S	TOP	89.60'
U	INV IN	85.80'
V	ALARM	85.30'
W	LAG ON	84.80'
X	LEAD ON	84.30'
Y	BOTH OFF	81.60'
Z	INSIDE BOTTOM	80.60'



CONTROL PANEL DETAIL

N.T.S.

SYSTEM CURVE CALCULATIONS

DESIGN FLOW DETERMINATION

FLOW SOURCE:	9.5 KSF RESEARCH FACILITY
FIXTURE UNITS:	78
AVERAGE DAILY FLOW (GPD):	21,600
AVERAGE DAILY FLOW (GPM):	15.00
PEAKING FACTOR:	3.00
PEAK HOUR DEMAND (GPM):	45.00

WETWELL SIZING

PEAK DESIGN INFLUENT (GPM)	45.00
AVERAGE DESIGN INFLUENT (GPM)	15.00
DESIGN EFFLUENT (GPM)	51.00
WETWELL OPERATING VOLUME (GAL)	254 (BETWEEN PUMP OFF & PUMP ON)
ACTUAL RUN TIME AT 0 INFLOW (MIN)	5.08
MAX DETENTION TIME AT AVG. FLOW (MIN):	16.92
MAX PUMP MOTOR CYCLE RATE (START/HR):	2.72
CYCLE PERIOD AT MAX CYCLING RATE (MIN):	22.00

DESIGN HEAD

ALL PUMPS OFF IN WETWELL (FT-NGVD)	81.60
PIPE CENTERLINE AT DISCHARGE (FT-NGVD)	86.00
TOTAL STATIC HEAD (FT)	4.40
PRESSURE HEAD AT POINT OF CONNECTION (FT)	0.00
TOTAL FRICTION HEAD LOSS (FT)	38.73
TOTAL DESIGN HEAD (FT)	43.13

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Project Information

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA HULL ROAD GAINESVILLE, FLORIDA

Project Number (CIN) 200060
Project Number (ARCH) 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

Revisions

No.	Description	Date

Sheet Information

LIFT STATION DETAILS

C401

MECHANICAL LEGEND

(UNABRIDGED)

2408CDX	CEILING DIFFUSER: "X" = TYPE AS NOTED IN SPECS "24" = FACE SIZE, "08" = NECK DIAMETER 4-WAY THROW OR AS SHOWN ON PLANS
24X24RGX	CEILING RETURN: SIZE AND TYPE SHOWN "X" = TYPE AS NOTED IN SPECS PROVIDE ADAPTOR AS REQUIRED
24X24EGX	CEILING EXHAUST: SIZE AND TYPE SHOWN "X" = TYPE AS NOTED IN SPECS PROVIDE ADAPTOR AS REQUIRED
D	DUCT-MOUNTED SMOKE DETECTOR W/ ACCESS PANEL
TAG-XXX	UNIT SYMBOL WITH UNIT NUMBER
	EXISTING DUCTWORK/PIPING TO REMAIN
	EXISTING DUCTWORK/PIPING TO REMAIN
	EXISTING DUCTWORK/PIPING TO BE REMOVED
	BALANCING DAMPER
MD	MOTORIZED DAMPER
G	GRAVITY DAMPER
F	FIRE DAMPER
FS	FIRE & SMOKE DAMPER
S	SMOKE DAMPER
AFMS	AIRFLOW MEASURING STATION
	AIRTROL FITTING
	AUTOMATIC AIR VENT WITH VALVE, HONEYWELL EA79
	AUTOMATIC BALANCING VALVE
	BACKFLOW PREVENTER
	VALVE. SEE SPECIFICATIONS FOR TYPE.
	CALIBRATED BALANCING VALVE
	CHECK VALVE
	CONCENTRIC REDUCER
	CONNECT TO EXISTING
	DOOR GRILLE
	ECCENTRIC REDUCER
	FILL VALVE
	FLEXIBLE PIPE CONNECTION
	PRESSURE GAUGE
	PRESSURE OR TEMPERATURE TEST PORT
	INLINE STRAINER
	INLINE STRAINER WITH BLOWDOWN VALVE WITH THREADED CONNECTION AND CAP
	PIPE DOWN
	PIPE UP
	PLUG VALVE
	PRESSURE REDUCING VALVE
	RELIEF VALVE
S	SPEED CONTROLLER
SP	STATIC PRESSURE SENSOR
M	TWO-WAY CONTROL VALVE
M	THREE-WAY CONTROL VALVE
	THERMOMETER
	THERMOMETER WELL
H	ROOM HUMIDISTAT
T	ROOM THERMOSTAT
	UNION; DIELECTRIC WATERWAY (SEE SPECIFICATIONS)
	VENTURI FLOW METER
FM	FLOW METER

MECHANICAL ABBREVIATIONS

A	AMPS; AREA
AAV	AUTOMATIC AIR VENT
ABV CLG	ABOVE FINISHED CEILING
AC	AIR CONDITIONING UNIT
ACH	AIR CHANGE PER HOUR
AFF	ABOVE FINISHED FLOOR
AHU	AIR HANDLING UNIT
AM	AIRFLOW MONITOR
AMS	AIRFLOW MEASURING STATION
AL	ALUMINUM
AP	ACCESS PANEL
AH	ATOMIZING HUMIDIFIER
AS	AIR SEPARATOR
BD	BALANCING DAMPER
BFF	BELOW FINISHED FLOOR
BFP	BACKFLOW PREVENTER
BTU	BRITISH THERMAL UNITS
BTUH	BTU PER HOUR
B	BOILER
C	CONDENSATE
CAC	CONTROL AIR COMPRESSOR
CB	CHILLED BEAM
CD	CEILING DIFFUSER
CF	CUBIC FEET
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUITE
CBWP	CHILLED BEAM WATER PUMP
CBWS	CHILLED BEAM WATER SUPPLY
CBWR	CHILLED BEAM WATER RETURN
CH	CHILLER
CHW	CHILLED WATER
CHWP	CHILLED WATER PUMP
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CO	CLEAMOUT
CR	CONDENSATE RETURN (STEAM)
CSR	CURRENT SENSING RELAY
CS	CURRENT SENSING (AMPS)
CT	COOLING TOWER; COMPRESSION TANK
CU	CONDENSING UNIT; COPPER
CV	COEFFICIENT OF VALVE
DB	DRY BULB
DC	DUST COLLECTOR
DDC	DIRECT DIGITAL CONTROLS
DEFL	DEFLECTION
DG	DOOR GRILLE
DIA	DIAMETER
DS	DUCT SILENCER
DTW	DUAL TEMPER WATER
DTWR	DUAL TEMPER WATER RETURN
DTWS	DUAL TEMPER WATER SUPPLY
EA	EACH
EAT	ENTERING AIR TEMPERATURE
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
EG	EXHAUST GRILLE
EH	EXHAUST HOOD
ENT	ENTERING
ER	EXHAUST REGISTER
ESP	EXTERNAL STATIC PRESSURE
EV	EXHAUST VALVE
EWT	ENTERING WATER TEMPERATURE
EXST.X, EX	EXISTING
EXH	EXHAUST
°F	DEGREES FAHRENHEIT
FBC	FLORIDA BUILDING CODE
FCU	FAN COIL UNIT
FD	FIRE DAMPER, FLOOR DRAIN
FET	FUME EXHAUST TERMINAL
FG	FILTER GRILLE
FH	FUME HOOD
FMS	FLOW MEASURING STATION
FO	FLAT OVAL
FPM	FEET PER MINUTE
FRP	FIBERGLASS REINFORCED PLASTIC
FSC	FAN SPEED CONTROLLER
FT	FEET
FT WG	FEET OF WATER, GAUGE
FTU	FAN TERMINAL UNIT
GA	GAUGE
GAL	GALLONS
GALV	GALVANIZED
GET	GENERAL EXHAUST TERMINAL
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUITE
HG	HOT GAS
HHW	HEATING HOT WATER
HHP	HEATING HOT WATER PUMP
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HP	HEAT PUMP; HORSEPOWER
HPS	HEAT PRESSURE SYSTEM
HR	HOUR
HX	HEAT EXCHANGER
ID	INSIDE DIAMTER
IN. WG	INCHES OF WATER, GAUGE
KW	KILOWATTS
KWH	KILOWATT HOUR
LAT	LEAVING AIR TEMPERATURE
LB	POUND
LD	LINEAR DIFFUSER
LPS	LOW PRESSURE STEAM
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MAX	MAXIMUM
MBH	THOUSANDS OF BTU'S
MCF	THOUSANDS OF CUBIC FEET
MD	MOTORIZED DAMPER
MIN	MINUTE; MINIMUM
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NTS	NOT TO SCALE
OA	OUTDOOR AIR
OAL	OUTDOOR AIR LOUVER
OC	ON CENTER
OD	OUTSIDE DIAMETER
P	PUMP
PCW	PROCESS COOLING WATER
PCWP	PROCESS COOLING WATER PUMP
PCWR	PROCESS COOLING WATER RETURN
PCWS	PROCESS COOLING WATER SUPPLY
PH	PHASE
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
PVC	POLYVINYL CHLORIDE
R	RADIUS
RA	RETURN AIR
RD	ROUND DIFFUSER
RAG	RETURN AIR GRILLE
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RL	REFRIGERANT LIQUID
RP	REDUCED PRESSURE
RPM	REVOLUTIONS PER MINUTE
RAR	RETURN AIR REGISTER
RS	REFRIGERANT SUCTION
RV	ROOF VENT
SA	SUPPLY AIR
SAR, SR	SUPPLY AIR REGISTER
SAT	SUPPLY AIR TERMINAL
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DAMPER
SF	SQUARE FEET, SUPPLY FAN
SG	SOFFIT GRILLE
SIM	SIMILAR
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SR	SIDEWALL REGISTER
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
STM	STEAM
SV	SUPPLY VALVE
TEMP	TEMPERATURE
TG	TRANSFER GRILLE; TEMPERATURE GAUGE
TSP	TOTAL STATIC PRESSURE
TYP	TYPICAL
UC	UNDERCUT DOOR - 3/4"
UG	UNDERGROUND
UH	UNIT HEATER
V	VOLTS
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
VFM	VENTURI FLOW METER
VLV	VALVE
VRF	VARIABLE REFRIGERANT FLOW
VRV	VARIABLE REFRIGERANT VOLUME
VVU	VARIABLE VOLUME UNIT
WB	WET BULB
WPD	WATER PRESSURE DROP

DIVISION 23 CODES & STANDARDS

GENERAL

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.

CODES

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. COMPLY WITH REGULATIONS AND CODES OF UTILITY SUPPLIERS.
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.
4. WHERE CODE CONFLICT EXISTS, GENERALLY THE MOST RESTRICTIVE REQUIREMENT APPLIES. COMPLY WITH CURRENT CODE EDITION, UNLESS NOTED.
5. ADDITIONAL CODES OR STANDARDS APPLYING TO A SPECIFIC PART OF THE WORK MAY BE INCLUDED IN THAT SECTION.
6. THE FOLLOWING CODES GOVERN THE WORK:
   A. FLORIDA BUILDING CODE - BUILDING - SEVENTH EDITION (2020).
   B. FLORIDA BUILDING CODE - MECHANICAL - SEVENTH EDITION (2020).
   C. FLORIDA BUILDING CODE - ENERGY CONSERVATION - SEVENTH EDITION (2020).
   D. FLORIDA BUILDING CODE - FUEL GAS - SEVENTH EDITION (2020).
   E. FLORIDA BUILDING CODE - TEST PROTOCOLS FOR HIGH VELOCITY HURRICANE ZONES - SEVENTH EDITION (2020).
   F. NATIONAL ELECTRIC CODE (NFPA 70) - 2014.
   G. INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS (NFPA 90A) - 2015.
   H. INSTALLATION OF SPRINKLER SYSTEMS (NFPA 13) - 2013.
   I. FLORIDA FIRE PREVENTION CODE - 2020
      a. FIRE CODE (NFPA 1) - 2018 FLORIDA EDITION
      b. LIFE SAFETY CODE (NFPA 101) - 2018 FLORIDA EDITION

STANDARDS

1. ALL DIVISION 23 MATERIALS, INSTALLATION AND SYSTEMS SHALL MEET THE REQUIREMENTS OF THE FOLLOWING STANDARDS, INCLUDING THE LATEST ADDENDA AND AMENDMENTS, TO THE EXTENT REFERENCED:
   A. UNDERWRITERS' LABORATORIES (UL)
   B. AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI)
   C. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
   D. NATIONAL FIRE PROTECTION (NFPA)
   E. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
   F. AIR CONDITIONING AND REFRIGERATION INSTITUTE (ARI)
   G. SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)
   H. AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE)
   I. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
   J. UF DESIGN AND CONSTRUCTION STANDARDS

MECHANICAL GENERAL NOTES

THE FOLLOWING NOTES ARE TO DEMONSTRATE MINIMUM MECHANICAL CODE COMPLIANCE ONLY. CONTRACTOR IS RESPONSIBLE FOR THE FULL WRITTEN SPECIFICATIONS. IF ANY INCONSISTENCIES ARE PRESENT, THE FULL WRITTEN SPECIFICATIONS PREVAIL.

AIR DISTRIBUTION:

1. VERIFY COLLAR SIZES ON ALL EQUIPMENT INLETS AND OUTLETS. TRANSITION DUCTWORK AS NECESSARY. EXTERNALLY INSULATE TRANSITIONS AT EQUIPMENT CONNECTIONS.
2. PROVIDE DUCT FLEX CONNECTIONS FOR ALL UNITS. EXTERNALLY INSULATE FLEXIBLE CONNECTIONS.
3. ALL EXHAUST DUCTWORK RUNOUTS SHALL BE RIGID DUCT.
4. DUCT SIZES ARE SHEET METAL SIZES. NO DUCTWORK SHALL RUN PARALLEL WITH AND OVER WALLS.
5. CONTRACTOR SHALL VERIFY CLEARANCE SPACE AVAILABLE, OFFSETS REQUIRED, STRUCTURAL OPENINGS, AND WORK BY OTHER TRADES PRIOR TO FABRICATION OF DUCTWORK. SUBMIT SHOP DRAWINGS ON DUCTWORK LAYOUT. COORDINATE WITH ROOF TRUSSES/STRUCTURE. PRESSURE TEST ALL DUCTWORK FOR LEAKS. SEE SPECIFICATIONS. RETURN AND EXHAUST DUCT SHALL BE TESTED UNDER NEGATIVE PRESSURE.

EQUIPMENT:

1. PROVIDE FULL SIZE HARD-DRAWN COPPER CONDENSATE DRAINS FROM ALL UNITS TO DISPOSAL POINT INDICATED ON THE DRAWINGS.
2. PROVIDE A TRAP ON ALL CONDENSATE DRAIN OUTLETS. SLOPE ALL CONDENSATE DRAIN PIPING -1/8" INCH PER FOOT.
3. CONTRACTOR SHALL INSTALL ALL EQUIPMENT, PIPING, AND DUCTWORK SUCH THAT MANUFACTURER'S RECOMMENDED CLEARANCES ARE MET FOR ALL ACCESS PANELS, MOTORS, FANS, BELTS, FILTERS AND AIR INTAKES.
4. PROVIDE VIBRATION ISOLATORS FOR ALL UNITS. SEE SPECIFICATIONS AND DETAILS.
5. PROVIDE ACCESS PANELS IN ALL NON-ACCESSIBLE CONSTRUCTIONS (INCLUDING CEILING, WALLS, ETC) SIZED AND LOCATED AS REQUIRED TO PROVIDE PROPER SERVICE ACCESS IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATION FOR ALL HVAC EQUIPMENT INCLUDING DAMPERS AND VALVES.
6. ALL HVAC EQUIPMENT TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND UNDER SUPERVISION OF MANUFACTURERS REPRESENTATIVE.

CONTROLS:

1. MAINTAIN A MINIMUM OF 3'-6" SEPARATION FROM THE HVAC CONTROL WIRING AND OTHER DATA, TV, OR PHONE WIRING TO PREVENT ANY INTERFERENCE.
2. ALL LOW VOLTAGE CONTROL WIRING SHALL COMPLY WITH SPEC AND IN ACCORDANCE WITH ELECTRICAL SPEC REQUIREMENTS.
3. PROVIDE ALL SOFTWARE, PROGRAMMING, GRAPHICS, AND RELATED INTERFACE TO MONITOR THE HVAC SYSTEM VIA INTERNET LOGIN.

GENERAL:

1. PRIOR TO COMMENCING ANY WORK, THE CONTRACTOR SHALL SATISFY HER/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, S/HE SHALL IMMEDIATELY NOTIFY THE ARCHITECT/ENGINEER IN ORDER THAT PROPER ADJUSTMENTS CAN BE ANTICIPATED AND ORDERED.
2. COMMENCEMENT BY THE CONTRACTOR OF ANY WORK SHALL BE HELD AS AN ACCEPTANCE OF THE DATA BY HER/HIM AFTER WHICH TIME THE CONTRACTOR HAS NO CLAIM AGAINST THE OWNER RESULTING FROM ALLEGED ERRORS, OMISSIONS, OR INACCURACIES OF THE SAID DATA.
3. 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.
4. IT IS THE CONTRACTOR'S RESPONSIBILITY TO SEE THAT ALL EQUIPMENT AND DEVICES THAT MAY REQUIRE MAINTENANCE AND OPERATION ARE MADE EASILY ACCESSIBLE, REGARDLESS OF THE DIAGRAMMATIC LOCATION SHOWN ON THE DRAWINGS.
5. THE CONTRACTOR SHALL PROTECT EQUIPMENT AND MATERIAL AT ALL TIMES. HE SHALL REPLACE ALL EQUIPMENT AND MATERIAL WHICH ARE DAMAGED AS A RESULT OF INADEQUATE PROTECTION.
6. THOROUGHLY CLEAN ALL EXPOSED PARTS OF APPARATUS AND EQUIPMENT 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.
7. DURING THE PROGRESS OF THE WORK, THE CONTRACTOR SHALL RECORD ON THEIR FIELD SET OF DRAWINGS (AS-BUILTS) THE EXACT LOCATION, AS INSTALLED, OF ALL PIPING, DUCTWORK, EQUIPMENT, AND OTHER SYSTEMS WHICH ARE NOT INSTALLED EXACTLY AS SHOWN ON THE CONTRACT DOCUMENTS.

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Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

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Revisions

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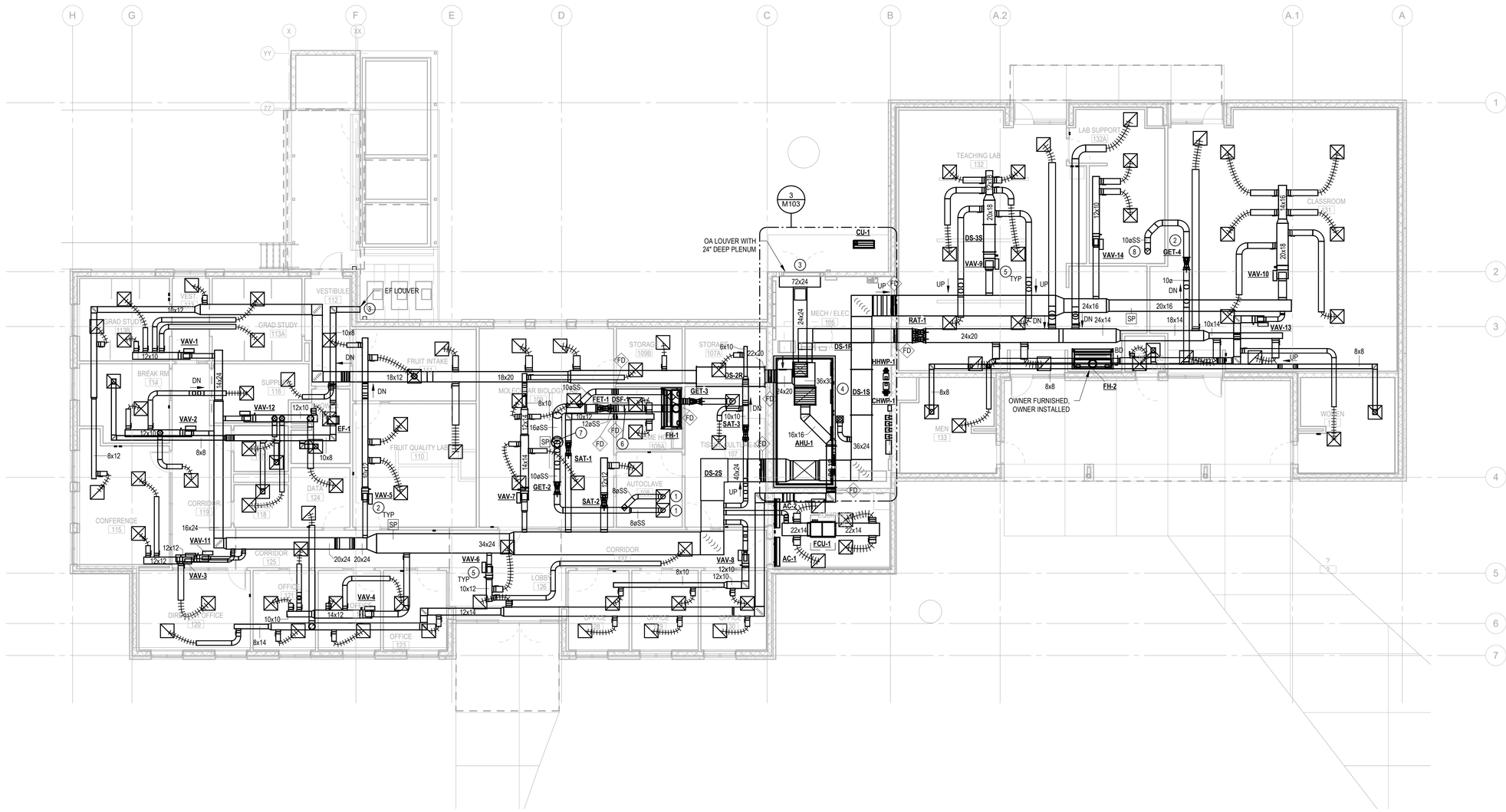
Sheet Information

LEGEND, ABBREVIATIONS, CODES AND STANDARDS

M001



1 FIRST FLOOR PLAN DUCTWORK
SCALE: 1/8" = 1'-0"

SHEET NOTES: (#)

1. COORDINATE VINYL EXHAUST GRILL LOCATION WITH AUTOCLAVE.
2. SEE CONTROLS DRAWINGS FOR ROOM TEMPERATURE SENSOR LOCATION AND ASSOCIATED TERMINAL.
3. SEE ARCHITECTURAL DRAWINGS FOR LOUVER SPECIFICATIONS. PROVIDE DRAIN. SEE DETAIL.
4. PROVIDE MINIMUM 4" HOUSE KEEPING PAD. COORDINATE PAD DEPTH AND BASE RAIL HEIGHT TO ENSURE PROPER CONDENSATE TRAP DEPTH.
5. COORDINATE TERMINAL LOCATION WITH RCP FOR SERVICE ACCESS. COORDINATE REQUIRED SERVICE ACCESS WITH OTHER ABOVE CEILING ITEMS. TYPICAL OF ALL TERMINAL UNITS.
6. PROVIDE DUCT SILENCER PER AIR TERMINAL SCHEDULE
7. 20"øSS EXHAUST DUCT UP TO EF-3 ON ROOF
8. 10"øSS EXHAUST DUCT UP TO EF-2 ON ROOF

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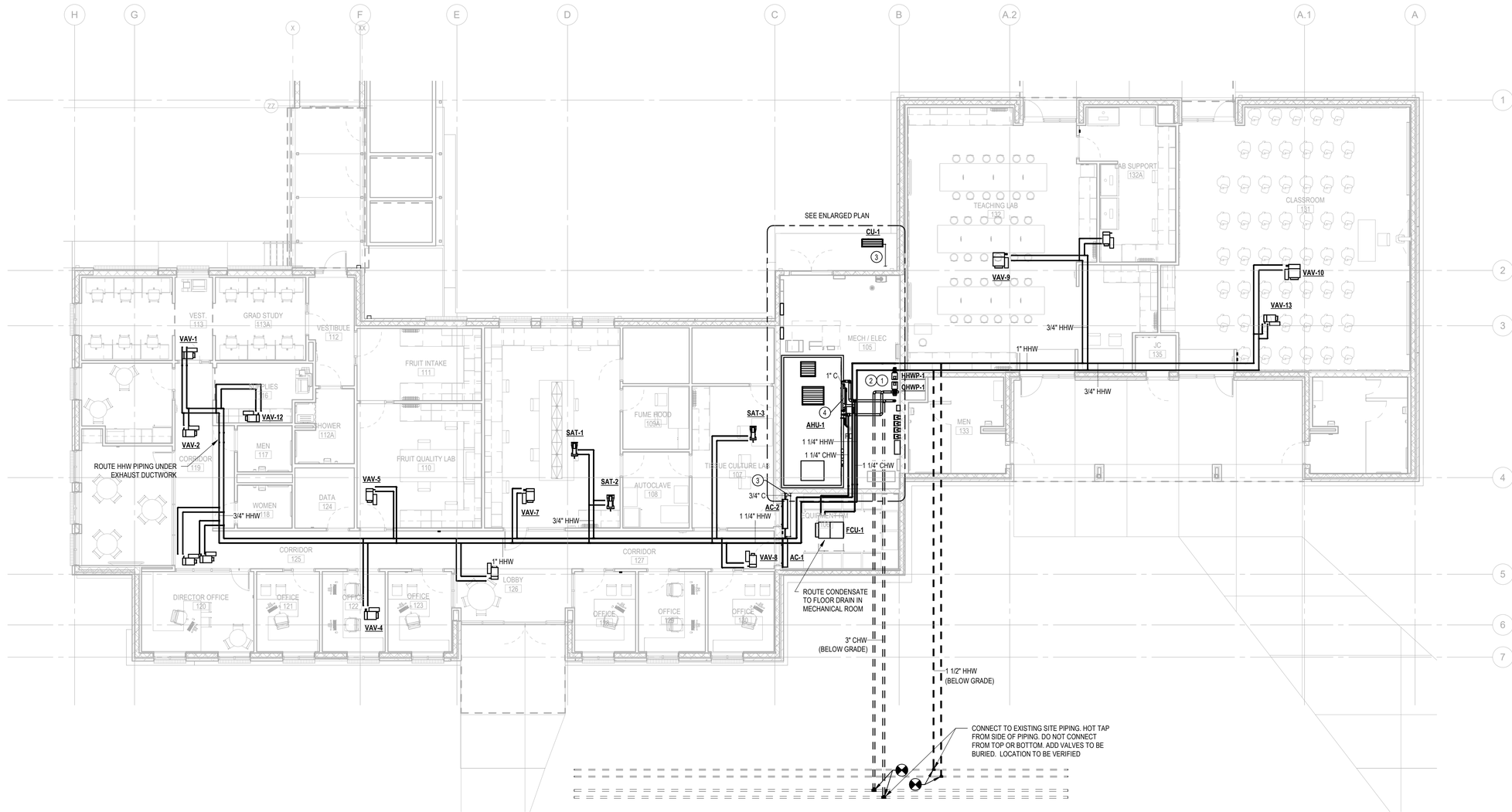
Sheet Information

DUCTWORK FLOOR PLAN

M101



1 FIRST FLOOR PLAN PIPING
SCALE: 1/8" = 1'-0"

SHEET NOTES: (#)

1. PROVIDE ISOLATION VALVES FOR CHWS&R AND HHWS&R AT MECHANICAL ROOM WITH OPERATORS AS REQUIRED FOR ACCESS. PROVIDE FLOW METERS ON HHW AND CHW.
2. VERTICAL HHW AND CHW PUMPS. SEE STRUCTURAL DRAWINGS FOR MOUNTING.
3. AC-1/CU-1 REFRIGERANT PIPING IN CONDUIT.
4. CHW PIPING BYPASS. LINE SIZE. SEE DETAILS.

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Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

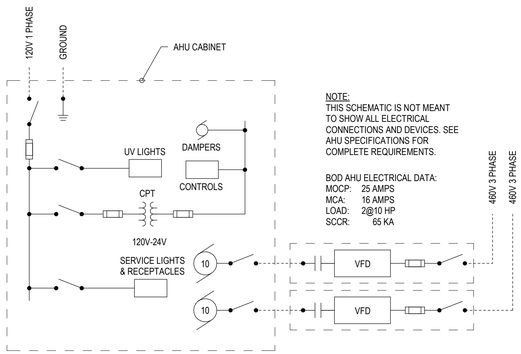
Revisions

No.	Description	Date

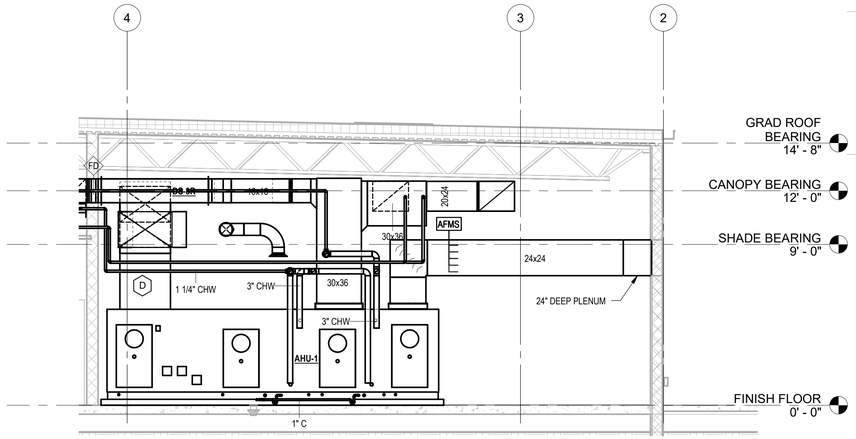
Sheet Information

PIPING FLOOR PLAN

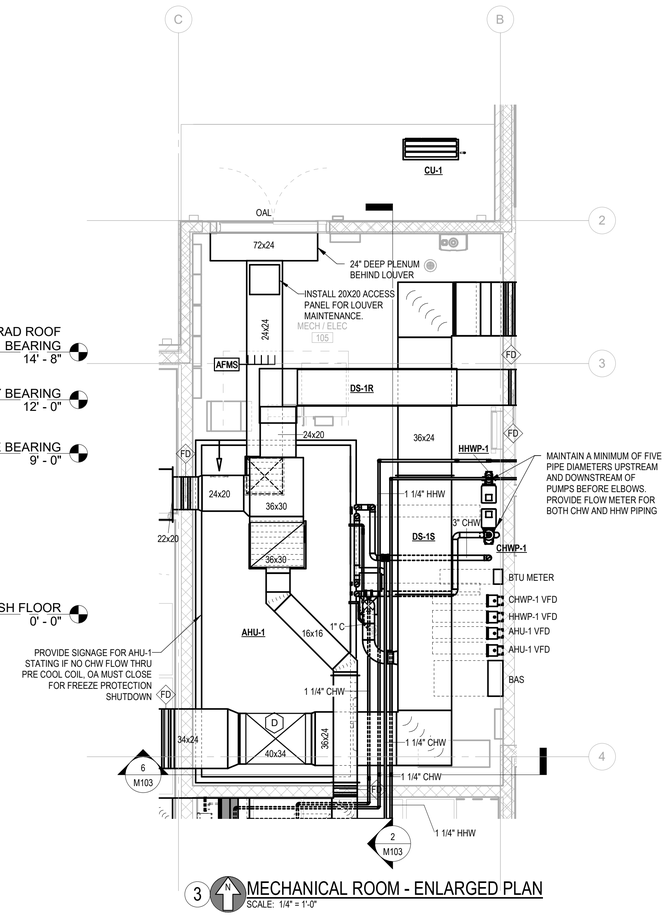
M102



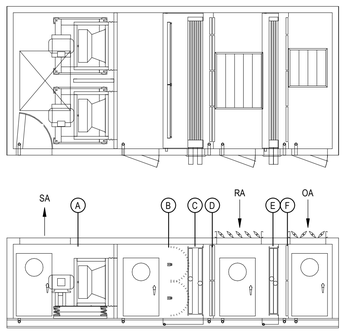
1 LINE VOLTAGE ELECTRICAL AHU SCHEMATIC
NOT TO SCALE



2 MECHANICAL ROOM 106 SECTION
SCALE: 1/4" = 1'-0"

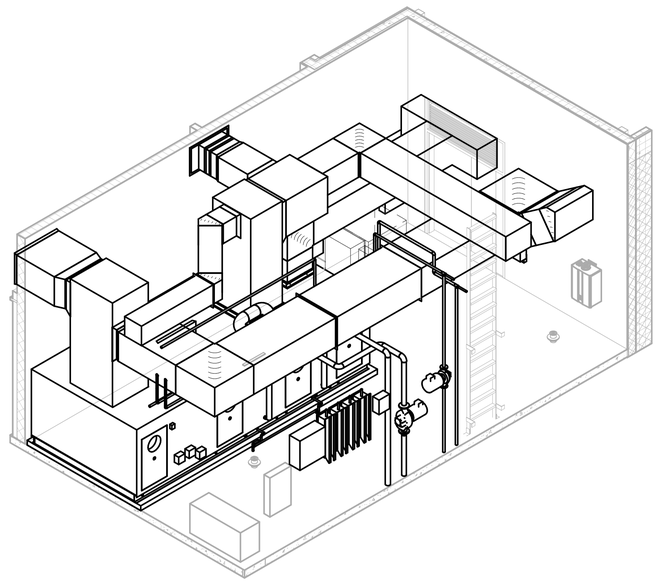


3 MECHANICAL ROOM - ENLARGED PLAN
SCALE: 1/4" = 1'-0"



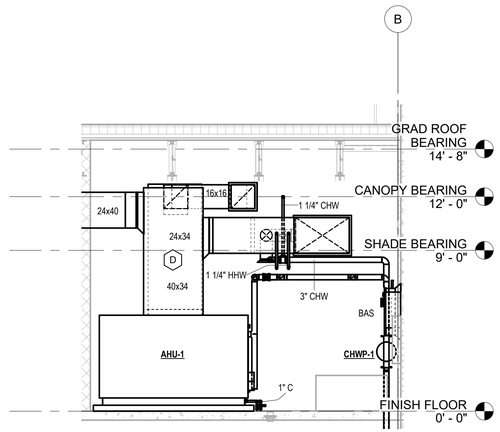
LEGEND
- (A) FAN SECTION
- (B) UV LIGHTS
- (C) COOLING COIL
- (D) FINAL FILTER
- (E) PRE-COOLING COIL
- (F) PRE FILTER

4 AHU CONFIGURATION
NOT TO SCALE



5 MECHANICAL ROOM ISOMETRIC VIEW
NOT TO SCALE

FOR REFERENCE ONLY



6 MECHANICAL ROOM 106 SECTION
SCALE: 1/4" = 1'-0"

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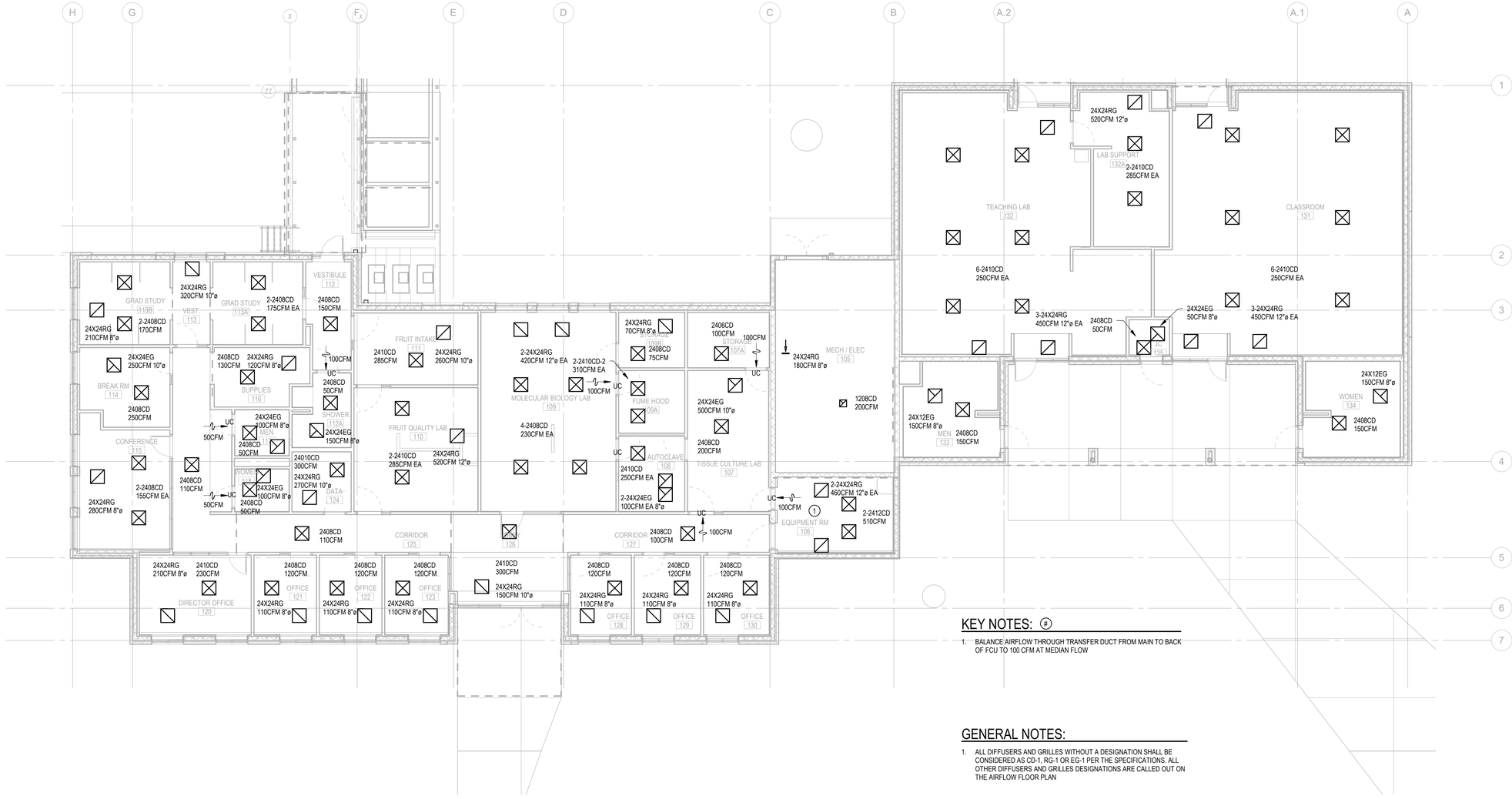
Sheet Information

ENLARGED PLANS AND ELEVATION VIEWS

M103



KEY NOTES: (#)

1. BALANCE AIRFLOW THROUGH TRANSFER DUCT FROM MAIN TO BACK OF FCU TO 100 CFM AT MEDIAN FLOW

GENERAL NOTES:

1. ALL DIFFUSERS AND GRILLES WITHOUT A DESIGNATION SHALL BE CONSIDERED AS CD-1, RG-1 OR EG-1 PER THE SPECIFICATIONS. ALL OTHER DIFFUSERS AND GRILLES DESIGNATIONS ARE CALLED OUT ON THE AIRFLOW FLOOR PLAN

1 FIRST FLOOR PLAN AIRFLOW
SCALE: 1/8" = 1'-0"

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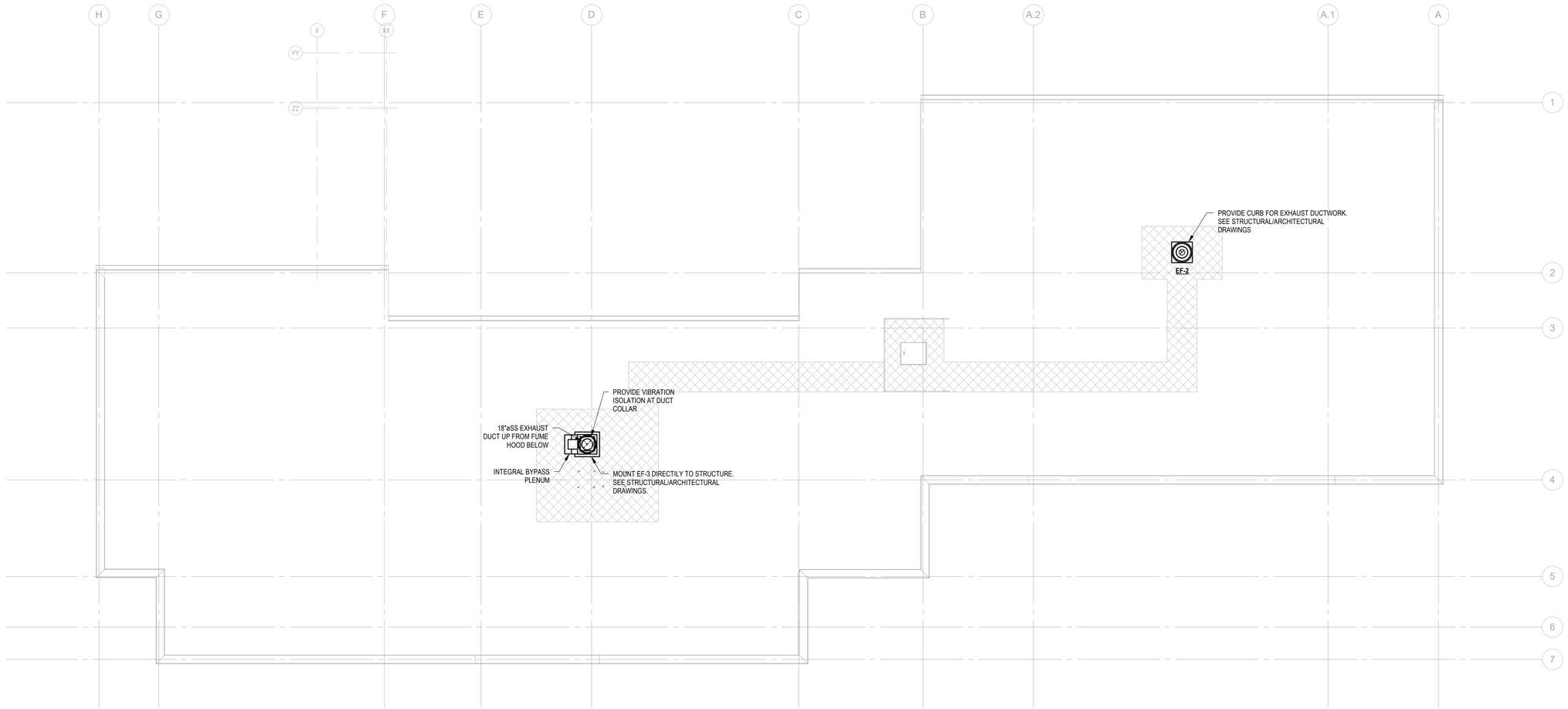
Sheet Information

AIRFLOW PLAN

M104



1 MECHANICAL ROOF PLAN
SCALE: 1/8" = 1'-0"

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ROOF PLAN

M110

EXHAUST FAN SCHEDULE

MARK	EF-1	EF-2	EF-3
LOCATION/SPACE SERVED	ABV 112A CEILING/TOILETS, SHOWER, BREAK	ROOF/TOILETS, JANITOR CLOSET	ROOF/FUME HOOD, AUTOCLAVE
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK
MODEL	SP-A1300	CUE-099HP-A	VK-H-18-9
TYPE	ABOVE CEILING	CENTRIFUGAL UPBLAST	UTILITY SET
DRIVE	DIRECT	DIRECT	BELT
AIRFLOW (CFM)	600	350	1420
TSP (IN WG)	1.0	1.0	2.15
MOTOR SECTION			
VOLTS-PHASE	120-1	120-1	460-3
BHP/HP	0.4/0.5	0.25/0.75	1.8/2.0
DRIVE TYPE	STD	ECM	STD
MOTOR SPEED (RPM)	1725	1725	1725
SOUND DATA (DB)			
63 HZ	71	78	89
125 HZ	74	72	83
250 HZ	69	70	83
500 HZ	68	64	80
1000 HZ	67	60	76
2000 HZ	62	61	73
4000 HZ	58	58	68
8000 HZ	51	50	61
SONES	8.0	8.7	19.2
SCHEDULE NOTES	(3) (5)	(2) (3) (4) (5)	(1) (6) (7) (8)

SCHEDULE NOTES
(1) PROVIDE DISCONNECT
(2) PROVIDE BIRD SCREEN
(3) PROVIDE BACKDRAFT DAMPER
(4) PROVIDE ROOF CURB
(5) PROVIDE THERMAL OVERLOAD
(6) STACK AND INLET LOSSES ARE INCLUDED IN FAN INTERNAL PRESSURE LOSS
(7) BYPASS PLENUM
(8) PROVIDE SURE-AIRE FLOW MONITORING

SPLIT SYSTEM AIR CONDITIONING UNIT SCHEDULE

UNIT TYPE	**MULTIZONE**	
MANUFACTURER	MITSUBISHI	
CONDENSING UNIT MARK	CU-1	
CONDENSING UNIT MODEL	TUMYP0481AK43NA	
AIR HANDLING UNIT MARK	AC-1	AC-2
AIR HANDLING UNIT MODEL	TPKFYP024KM142A	TPKFYP024KM142A
AIR HANDLING UNIT TYPE	SINGLE ZONE	SINGLE ZONE
SEER	18.8	18.8
DESIGN CONDITIONS		
WINTER OUTDOOR (°F)	20	20
WINTER INDOOR (°F)	70	70
SUMMER OUTDOOR DB/WB (°F)	96/80	96/80
SUMMER INDOOR DB/WB (°F)	75/63	75/63
FAN SECTION (1)		
SUPPLY AIR (CFM)	920	920
OUTDOOR AIR (CFM)	0	0
EXTERNAL STATIC PRESSURE (IN WG)	0.0	0.0
FAN MOTOR (HP)	FRAC	FRAC
VOLTS-PHASE	208-1	208-1
EVAPORATOR SECTION		
SENSIBLE COOLING CAPACITY (BTUH)	24,000	24,000
TOTAL COOLING CAPACITY (BTUH)	18,500	18,500
AIR ENTERING COOLING DB/WB (°F)	76/63.5	76/63.5
AIR ENTERING HEATING (°F)	-	-
CONDENSING SECTION		
COMPRESSOR (AMPS)	29	29
VOLTS-PHASE	208-1	208-1
SUCTION LINE SIZE (IN)	(2)	(2)
LIQUID LINE SIZE (IN)	(2)	(2)
SCHEDULE NOTES	(1) (3)	(1) (3)

SCHEDULE NOTES
(1) SINGLE POINT ELECTRICAL CONNECTION
(2) REFRIGERANT PIPE SIZING PER MANUFACTURER'S RECOMMENDATIONS
(3) PROVIDE ONE WALL MOUNTED REMOTE THERMOSTAT TO CONTROL BOTH AC UNITS

AIR HANDLING UNIT SCHEDULE

MARK		AHU-1
BASIS OF DESIGN		HAAKON
MODEL		CUSTOM
TYPE		HORIZONTAL
LOCATION		INDOOR
BASE RAIL (IN)		6
FAN SECTION	(7)	
FAN TYPE		PLENUM
FAN QUANTITY		2
DRIVE TYPE		DIRECT
FAN CFM		6,250
TOTAL CFM	(1)	12,500
TSP (IN WG)		6.25
ESP (IN WG)		3
MOTOR SECTION		
EACH MOTOR BHP		7.8
EACH MOTOR HP		10
MOTOR SPEED (RPM)		1750
VOLT-PHASE		460-3
DRIVE	(2)	VFD
PRE FILTER SECTION		
TYPE		MERV 14
EFFICIENCY (%)		95
DIRTY PD (IN WG)		1.2
AFTER FILTER SECTION		
TYPE	(3)	MERV 14
EFFICIENCY (%)		95
DIRTY PD (IN WG)		1.2
SOUND DATA (DB)		
63 HZ		85
125 HZ		85
250 HZ		96
AHU EQUIPMENT		
PREHEAT COIL		NO
PRECOOLING COIL	(4)	YES
COOLING COIL	(4)	YES
REHEAT COIL		NO
TRAP DIMENSIONS (A/B - IN)		(5)
SCHEDULE NOTES		(6)

SCHEDULE NOTES
(1) WHERE SUM OF FAN CFM DOES NOT EQUAL TOTAL CFM, ONE FAN IS REDUNDANT
(2) PROVIDE SEPARATE VFD FOR EACH FAN. NORMAL OPERATION ALL FANS RUN.
(3) NOT USED
(4) REFER TO AHU COIL SCHEDULE
(5) REFER TO CONDENSATE DRAIN TRAP DETAIL
(6) PROVIDE KNOCKDOWN CONSTRUCTION
(7) PROVIDE AIR FLOW MONITORING STATION

AIR HANDLING UNIT COOLING COIL SCHEDULE

MARK		PC1 (PRECOOL COIL)	CC1 (COOLING COIL)
LOCATION		AHU-1	AHU-1
TYPE		CHW	CHW
EWT (°F)		59.6	45
LWT (°F)		65.1	59.6
TRAP DEPTH (IN)		(2)	(2)
DESIGN CONDITIONS	(3)		
SUPPLY AIR CFM		2,850	12,500
OUTDOOR AIR CFM		2,850	2,850
EAT DB/WB (°F)		96/80	73.4/63.4
LAT DB/WB (°F)		66.3/65.1	52.8/52.5
FACE VELOCITY (FPM)		115	500
SENSIBLE CAPACITY (BTUH)		92,520	281,180
TOTAL CAPACITY (BTUH)		171,820	398,510
CHW FLOW (GPM)		54.6	54.2
MAX WATER PD (FT HD)		9	19.5
MAX AIR PD (IN WG)		0.03	0.8
MIN ROW/MAX FPI		3/10	6/12
PART LOAD (25%) CONDITIONS	(3)		
SUPPLY AIR CFM		715	3,125
OUTDOOR AIR CFM		715	715
EAT DB/WB (°F)		96/80	73.4
LAT DB/WB (°F)		61.9/61.6	63.4
SENSIBLE CAPACITY (BTUH)		26,580	77,960
TOTAL CAPACITY (BTUH)		51,130	115,230
CHW FLOW (GPM)		13.7	13.6
CONTROL			
TYPE		2 Way	2 Way
SIZE (IN)	(4)	0.75	0.75
CV	(4)	6.3	6.3
SCHEDULE NOTES			

SCHEDULE NOTES
(1) NOT USED
(2) REFER TO CONDENSATE TRAP DETAIL
(3) EACH COIL
(4) VALVE SELECTED FOR TOTAL FLOW OF ALL COILS SERVED

FBC ROOFTOP UNIT CLEARANCE REQUIREMENTS

WIDTH OF MECHANICAL UNIT (IN)	MINIMUM CLEARANCE ABOVE SURFACES (IN)
< 24	14
24 < 36	18
36 < 48	24
48 < 60	30
> 60	48

DUCT SILENCER SCHEDULE

MARK	**DS-1S**	**DS-2S**	**DS-3S**	**DS-1R**	**DS-2R**	**DS-3R**
SERVICE	AHU-1 SA	AHU-1 SA	AHU-1 SA	AHU-1 RA	AHU-1 RA	AHU-1 RA
PRICE MODEL NO.	RM80/3D	ERM80/4A	RL36/4F	ERM144/6A	RMX120/3F	RH72/2D
CFM	4,220	5,600	1,650	3,220	2,855	1,070
P.D. (IN WG)	0.17	0.14	0.14	0.13	0.2	0.05
DUCT SIZE	36X16	40X20	24X20	24X20	22X20	16X16
CONFIGURATION	STRAIGHT	ELBOW	STRAIGHT	ELBOW	STRAIGHT	STRAIGHT
CENTERLINE LENGTH (FT)	6'-8"	6'-8"	4'-0"	12'-0"	10'-0"	6'-0"
CASING SIZE (INxIN)	36X16	40X20	20X18	24X20	34X20	16X16
MATERIAL	GALV STL	GALV STL	GALV STL	GALV STL	GALV STL	GALV STL
INSERTION LOSS (DB)						
63 HZ	9	10	9	17	23	8
125 HZ	15	13	12	21	35	11
250 HZ	26	20	15	31	54	21
500 HZ	43	32	22	55	55	40
1000 HZ	45	36	17	55	55	42
2000 HZ	37	34	14	50	55	30
4000 HZ	25	29	11	41	44	22
8000 HZ	18	24	10	33	26	16
SCHEDULE NOTES	(1)(2)	(1)(2)	(1)(2)	(1)(2)	(1)(2)	(1)(2)

SCHEDULE NOTES
(1) FILM LINED SILENCER
(2) DUCT SILENCER SELECTION SHALL BE PERFORMED BY MFG TO LIMIT SOUND LEVELS IN SPACE TO NC 30 OR LESS BASED ON FINAL DUCT LAYOUT. PROVIDE CALCULATIONS AS PART OF SILENCER SUBMITTAL.

PUMP SCHEDULE

MARK	CHWP-1	HHWP-1
DUTY	CHILLED WATER PUMP	HEATING HOT WATER PUMP
MANUFACTURER	BELL AND GOSSETT	BELL AND GOSSETT
MODEL	E-80	E-80
SIZE	2X2X9.5C	1.5X1.5X7C
SPEED (RPM)	1800	1800
TYPE	INLINE	INLINE
CAPACITY (GPM)	75	20
TOTAL HEAD (FT HD)	50	50
MINIMUM EFFICIENCY (%)	56.6	39%
IMPELLER DIAMETER (IN)	8.125	6.875
MAX IMPELLER DIAMETER (IN)	9	7
MOTOR (HP)	3	1
VOLTS-PHASE	460-3	460-3
DRIVE TYPE	VFD	VFD
SCHEDULE NOTES		

FUME HOOD SCHEDULE

MARK	**FH-1**	**FH-2**
MANUFACTURER	LABCONCO	LABCONCO
MODEL	PROTECTOR PREMIER 100 60 0000	PROTECTOR ECHO
TYPE	SS	-
STYLE	BENCHTOP	-
SIZE (FT)	6	-
EXHAUST (CFM)	720	-
FACE VELOCITY AT 18" SASH HT (FPM)	100	-
ACID BASE CABINET SIZE (IN)	1@36	-
FLAMMABLE BASE CABINET SIZE (IN)	1@36	-
UTILITIES (QTY)		
120V DUPLEX	1	-
SCHEDULE NOTES	(1) (2) (3) (4) (5) (6)	(7)

SCHEDULE NOTES
(1) PROVIDE FACE VELOCITY CONTROLLER AND SASH POSITION SENSOR BY BAS SUPPLIER
(2) ALL WORK SURFACES ARE EPOXY RESIN AT 34" AFF
(3) COORDINATE WITH LAB CASEWORK ELEVATIONS
(4) REFER TO ARCHITECTURAL DRAWINGS FOR BASE CABINET MATERIAL
(5) PROVIDE ROUND EXHAUST COLLARS
(6) FUME HOOD LINERS SHALL BE FOR GENERAL CHEMICAL USE
(7) OWNER FURNISHED, OWNER INSTALLED

FAN COIL UNIT SCHEDULE

MARK	**FCU-1**
MANUFACTURER	VTS
MODEL	AVS012E-R-CV
TYPE	HORIZONTAL
FAN DATA	
MOTOR HP	1
VOLTS-PHASE	208-3
DRIVE TYPE	DIRECT
SUPPLY AIR (CFM)	1,025
OUTSIDE AIR (CFM)	-
TSP (IN WG)	1.6
ESP (IN WG)	0.5
COOLING COIL DATA	
TOTAL CAPACITY (BTUH)	36,600
SENSIBLE CAPACITY (BTUH)	28,200
MAXIMUM FACE VELOCITY (FPM)	415
EAT DB/WB (°F)	78/65
LAT DB/WB (°F)	53/53
EWT-LWT (°F)	50-58
CHW FLOW (GPM)	9.1
MAX WATER PD (FT HD)	2.6
PIPE RUNOUT SIZE (IN)	(2)
MAX AIR PD (IN WG)	0.55
MIN ROW	8
CONTROL VALVE TYPE & SIZE	2 WAY & 1/2
CONTROL VALVE CV	6.3
SCHEDULE NOTES	(1)

SCHEDULE NOTES
(1) PROVIDE THREE SPEED FAN CONTROLLER
(2) SIZE PER MANFUACTURER'S RECOMMENDATIONS

CANOPY HOOD SCHEDULE

MARK	**C-1**	**C-2**	**C-3**
MANUFACTURER	CAPTIVE AIR	CAPTIVE AIR	CAPTIVE AIR
MODEL	VH-1	VH-1	VH-1
MATERIAL	STAINLESS	STAINLESS	STAINLESS
SIZE (IN)	36x36	36x33	36x33
AIRFLOW (CFM)	415	450	415
SCHEDULE NOTES	(2)	(2)	(1) (2)

SCHEDULE NOTES
(1) MAX HEIGHT OF 21"
(2) COORDINATE WITH CEILING AND AUTOCLAVE HEIGHTS

VARIABLE VOLUME TERMINAL UNIT SCHEDULE

MARK (1)	SPACE SERVED	SIZE (2)	DUCT RUNOUT (IN)	NOMINAL CFM	MINIMUM CFM OCCUPIED	MINIMUM CFM UNOCCUPIED	BOX AIR PD (IN WG)	HOT WATER COIL								
								EAT (°F)	LAT (°F)	BTUH	EWT (°F)	LWT (°F)	GPM	ROWS	VALVE TYPE & SIZE (IN)	PIPE RUNOUT (IN)
VAV-1	GRAD STUDY	08	10"ø	690	275	140	0.35	55	90	10,600	120	100	1.1	2	3 WAY - 1/2	3/4
VAV-2	BREAK ROOM	08	10"ø	490	195	100	0.35	55	90	7,500	120	100	0.8	2	2 WAY - 1/2	3/4
VAV-3	CONFERENCE	06	8"ø	310	125	60	0.35	55	90	4,800	120	100	0.5	2	2 WAY - 1/2	3/4
VAV-4	OFFICE	08	10"ø	470	190	95	0.35	55	90	7,300	120	100	0.7	2	2 WAY - 1/2	3/4
VAV-5	FRUIT QUALITY	10	12"ø	1005	400	200	0.35	55	90	15,400	120	100	1.5	2	2 WAY - 1/2	3/4
VAV-6	LOBBY	06	8"ø	400	160	80	0.35	55	90	6,200	120	100	0.6	2	2 WAY - 1/2	3/4
VAV-7	MOLECULAR BIO LAB	10	12"ø	995	400	200	0.35	55	90	15,400	120	100	1.5	2	2 WAY - 1/2	3/4
VAV-8	OFFICE	08	10"ø	660	265	130	0.35	55	90	10,200	120	100	1.0	2	2 WAY - 1/2	3/4
VAV-9	TEACHING LAB	12	14"ø	1500	600	300	0.35	55	90	23,100	120	100	2.3	2	3 WAY - 1/2	3/4
VAV-10	CLASSROOM	12	14"ø	1500	600	300	0.35	55	90	23,100	120	100	2.3	2	3 WAY - 1/2	3/4
VAV-11	DIRECTOR OFFICE	06	8"ø	230	90	45	0.35	55	90	3,500	120	100	0.5	2	2 WAY - 1/2	3/4
VAV-12 (3)	TOILETS/SHOWER/BREAK	06	8"ø	450	180	90	0.35	55	90	6,900	120	100	0.7	2	3 WAY - 1/2	3/4
VAV-13 (3)	TOILETSJC	06	8"ø	350	140	70	0.35	55	90	5,400	120	100	0.5	2	3 WAY - 1/2	3/4
VAV-14	LAB SUPPORT	08	10"ø	570	230	115	0.35	55	90	8,900	120	100	0.9	2	3 WAY - 1/2	3/4
SCHEDULE NOTES																

SCHEDULE NOTES
(1) MARK WHERE X=AHU YY=BOX
(2) BASIS OF DESIGN: PRICE SDV WITH HOT WATER REHEAT
(3) CONSTANT VOLUME BOX
(4) ACCESS BEFORE AND AFTER EACH UNIT, MINIMUM OF 8"

AIR TERMINAL SCHEDULE

MARK	GENERAL								HOT WATER REHEAT COIL							CONTROL VALVE		
	ROOM(S) SERVED	SIZE (IN)	OCCUPIED MAX CFM	OCCUPIED MIN CFM	UNOCCUPIED MAX CFM	UNOCCUPIED MIN CFM	NOTES	MINIMUM INLET STATIC (IN WG)	ROOM OFFSET (CFM)	EAT (°F)	LAT (°F)	BTUH	EWT (°F)	LWT (°F)	GPM	MAX AIR PD (IN WG)	MAX WATER PD (FT HD)	TYPE & SIZE (IN)	PIPE RUNOUT (IN)	CV
SAT-1	109A	12	620	200	620	100		0.3	-100	53	90	24,775	120	100	2.5	0.2	5	2 WAY - 1/2	3/4	1.6
FET-1	109A	12	720	300	720	200	(1)	0.3	-100											
RAT-1	131,132,132A	2X12	2,070	400	400	200		0.3	NA											
SAT-2	108	12	870	200	870	200		0.3	0	53	90	34,765	120	100	3.5	0.2	5	2 WAY - 1/2	3/4	1.6
GET-2	108	10	200	200	200	200	(1)	0.3	0											
SAT-3	107	10	300	100	300	100		0.3	-300	53	90	11,988	120	100	1.2	0.2	5	2 WAY - 1/2	3/4	0.63
GET-3	107	12	500	300	500	300	(1)	0.3	-300											
GET-4	133,134,135	10	350	350	150	150		0.3	0											

SCHEDULE NOTES
(1) PROVIDE FACTORY SILENCER KIT (STAINLESS STEEL), PACKLESS
(2) NOT USED

AIR TERMINAL DUCT SILENCER SCHEDULE

MARK	MAX CFM	SIZE (IN)	LENGTH (IN)	CONFIGURATION	MAX UNIT PD (IN WG)	PRICE MODEL#
DSF-1	720	12	36	STRAIGHT	0.3	PCL

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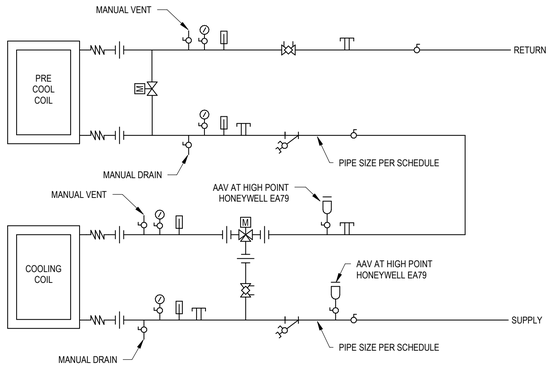
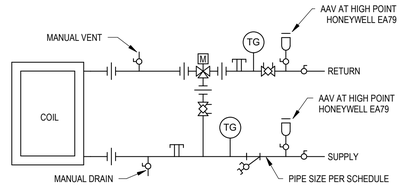
Sheet Information

SCHEDULES

M201

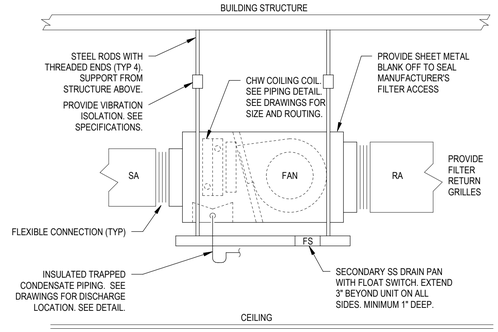


1 THREE WAY AHU COOLING COIL PIPING DIAGRAM
NOT TO SCALE

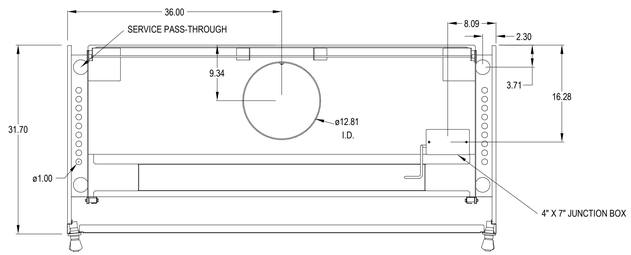


NOTE: FOR VAV-1, 9 AND 10 ONLY

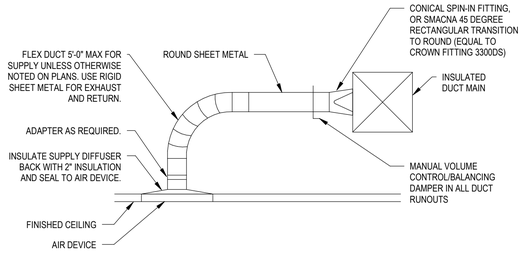
2 THREE WAY COIL PIPING DIAGRAM
NOT TO SCALE



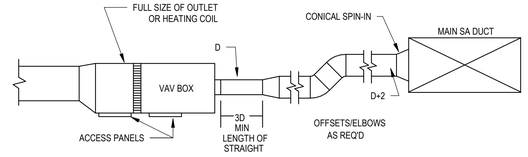
3 FAN COIL UNIT DETAIL
NOT TO SCALE



TOP VIEW

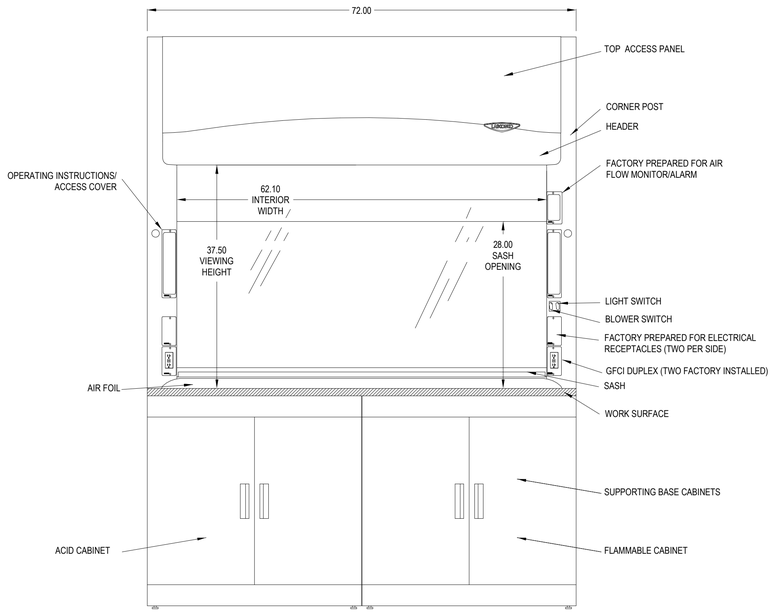


5 DUCT RUNOUT TO AIR INLETS AND OUTLETS
NOT TO SCALE



EXTERNALLY INSULATED ROUND DUCT RUNOUT 2" LARGER THAN NECK UNLESS OTHERWISE NOTED. MINIMUM STRAIGHT LENGTH TO BOX SHALL BE 3 DUCT DIAMETERS OR MANUFACTURER'S RECOMMENDATION, WHICHEVER IS GREATER. D=DUCT DIAMETER

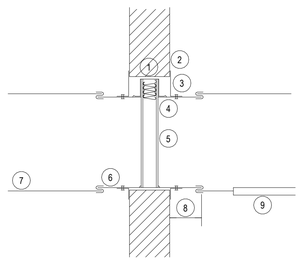
6 VAV BOX DUCT DETAIL
NOT TO SCALE



FRONT VIEW

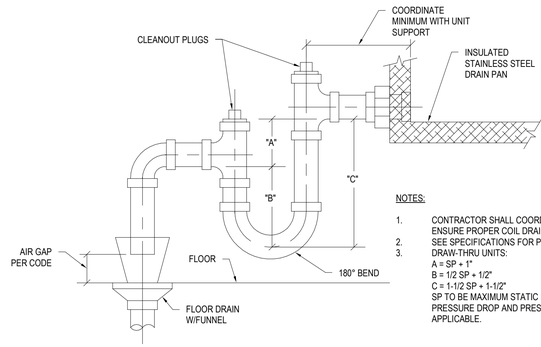
NOTE: ALL UNITS ARE IN INCHES

4 FUME HOOD DETAIL
NOT TO SCALE



1. 1/4" MINIMUM CLEARANCE
2. 1" MINIMUM OVERLAP (4 SIDES)
3. 1-1/2" x 1-1/2" x 14 GAUGE ANGLES MINIMUM WITH No.10 GALVANIZED SCREWS @ 12" OC (MIN. 2 PER SIDE) DO NOT ATTACH TO WALL
4. SCREW OR TACK WELD FIRE DAMPER TO SLEEVE. SAME SPACING AS ANGLES
5. UL-555, 1-1/2 HOUR SPRING ACTUATED FIRE DAMPER. HORIZONTAL INSTALLATION SIMILAR.
6. SLEEVE SHALL BE AT LEAST DUCT GAUGE PER SMACNA AND NFPA 90A
7. GALVANIZED STEEL DUCT
8. 6" MAXIMUM
9. ACCESS PANEL

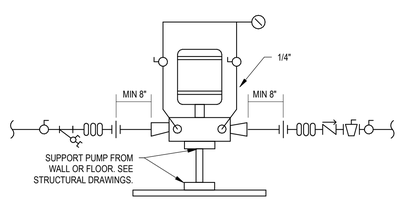
7 FIRE DAMPER DETAIL
NOT TO SCALE



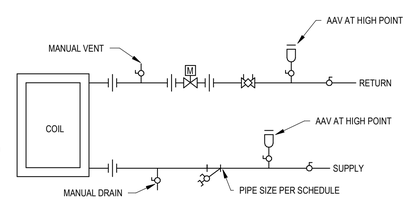
NOTES:

1. CONTRACTOR SHALL COORDINATE DRAIN DIMENSIONS EXISTING CONDITIONS TO ENSURE PROPER COIL DRAINAGE AND CLEARANCE FOR TRAP.
2. SEE SPECIFICATIONS FOR PIPE MATERIALS.
3. DRAW-THRU UNITS: A = SP + 1" B = 1/2 SP + 1/2" C = 1-1/2 SP + 1-1/2"
   BLOW-THRU UNITS: A = 1/2" B = SP + 1/2" C = SP + 1"
   SP TO BE MAXIMUM STATIC PRESSURE ON DRAIN PAN INCLUDING MAXIMUM FILTER PRESSURE DROP AND PRESSURE DROP OF FUTURE COMPONENTS OF UNIT IF APPLICABLE.

8 CONDENSATE P-TRAP DETAIL
NOT TO SCALE



9 INLINE PUMP DIAGRAM
NOT TO SCALE



10 TWO WAY COIL PIPING DIAGRAM
NOT TO SCALE

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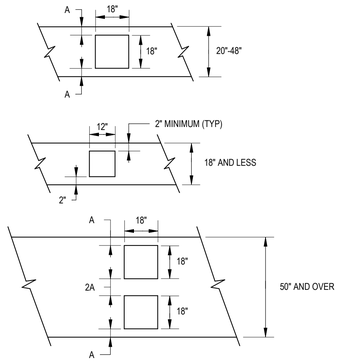
DETAILS

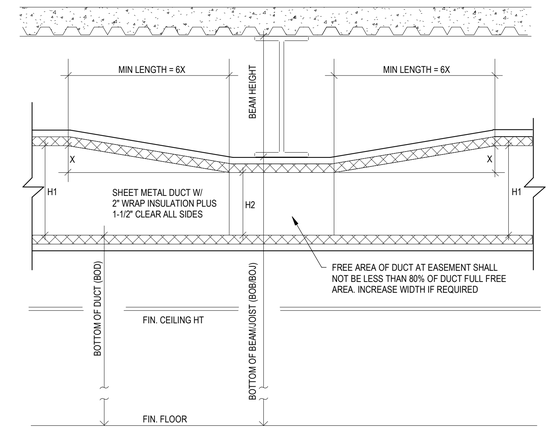
M301



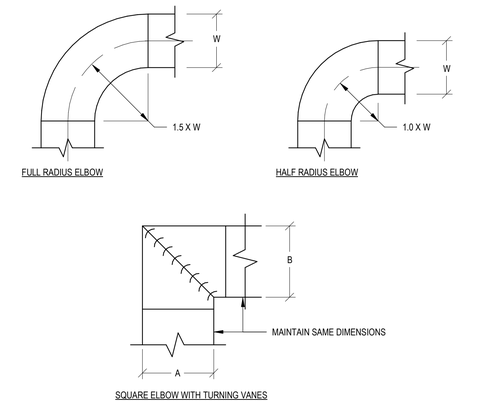
NOTES:

1. PROVIDE DUCT ACCESS DOORS AS PER SPECIFICATIONS AT CONTROL DEVICES (AUTOMATIC DAMPERS, THERMOSTATS, ETC.), FIRE DAMPERS, SMOKE DETECTORS, SMOKE DAMPERS, REHEAT COILS, HUMIDIFIERS, AIRFLOW SENSORS, AIR BOXES, AND WHERE REQUIRED FOR SERVICE ACCESS, AND AS SHOWN ON DRAWINGS.
2. LOCATE ACCESS DOORS IN DUCTWORK TO FACILITATE ACCESS TO DEVICES REQUIRING SERVICE AND INSPECTION.

1 DUCT ACCESS DOORS DETAIL
NOT TO SCALE



2 DUCT EASEMENT DETAIL
NOT TO SCALE

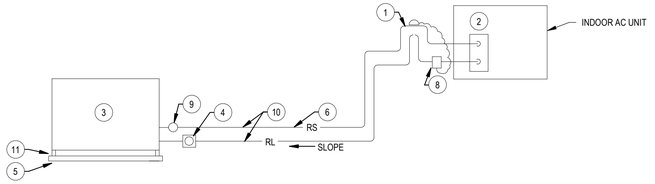


SQUARE ELBOW WITH TURNING VANES

NOTES:

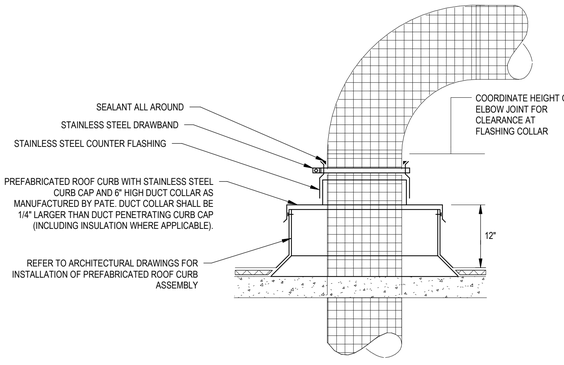
1. DIMENSIONS 'A' AND 'B' MUST BE EQUAL ON SQUARE ELBOWS, UNLESS OTHERWISE SHOWN ON DRAWINGS.
2. FULL RADIUS ELBOW SHALL BE USED AS THE STANDARD. HALF RADIUS ELBOWS SHALL ONLY BE PERMITTED WHERE FULL RADIUS ELBOWS WILL NOT FIT. MECHANICAL CONTRACTOR SHALL OBTAIN WRITTEN APPROVAL FROM ENGINEER PRIOR TO INSTALLATION OF HALF RADIUS ELBOWS.

3 DUCT ELBOW DETAIL
NOT TO SCALE



1. LOOP TO TOP OF COIL WITH BULB IN TOP OF COIL
2. EVAPORATOR COIL
3. CONDENSING UNIT
4. SIGHT GLASS
5. INSTALL ON NEW CONCRETE SLAB
6. INSULATE
7. NOT USED
8. THERMOSTATIC EXPANSION VALVE WITH CAPILLARY TUBE AND BULB
9. SUCTION LINE ACCUMULATOR
10. REFRIGERANT PIPING
11. VIBRATION ISOLATION PADS. TYPE EM-5 (SEE SPECS)

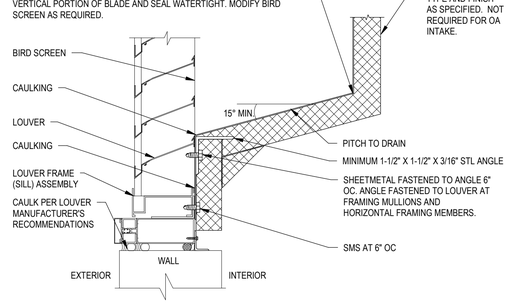
4 SPLIT-SYSTEM REFRIGERANT PIPING DIAGRAM
NOT TO SCALE



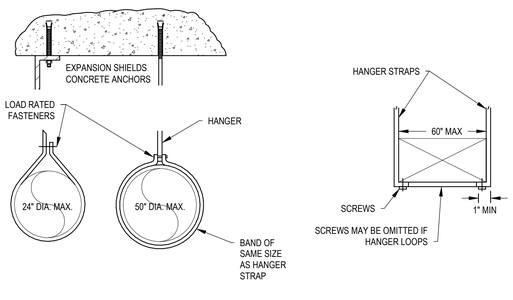
NOTES:

1. MECHANICAL CONTRACTOR SHALL SUBMIT DUCT PENETRATION ROOF CURB SHOP DRAWINGS.

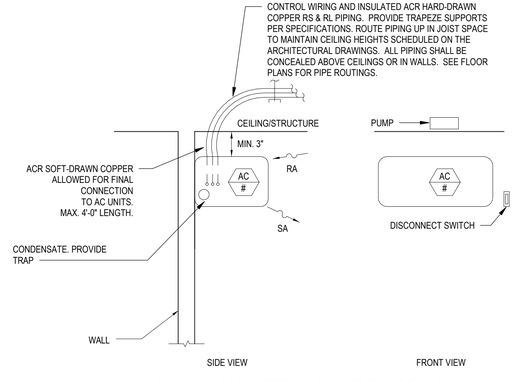
5 DUCT PENETRATION ROOF CURB DETAIL
NOT TO SCALE



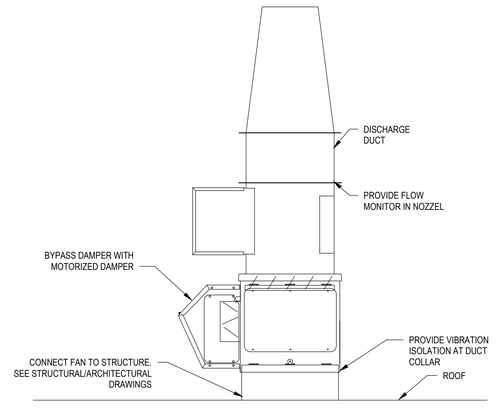
6 PLENUM CONNECTION AT LOUVER SILL DETAIL
NOT TO SCALE



7 DUCT HANGER DETAIL
NOT TO SCALE



8 WALL-MOUNTED AC UNIT DIAGRAM
NOT TO SCALE



9 FUME EXHAUST FAN DETAIL
NOT TO SCALE

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DETAILS

M302

CONTROLS ABBREVIATIONS

AHU	AIR HANDLING UNIT
AI	ANALOG INPUT
AO	ANALOG OUTPUT
BAS	BUILDING AUTOMATION SYSTEM
BLU	BUILDING LEVEL CONTROLLER
BTU	BRITISH THERMAL UNIT
CBWR	CHILLED BEAM WATER RETURN
CBWS	CHILLED BEAM WATER SUPPLY
CFM	CUBIC FEET PER MINUTE
CH	CHILLER
CHW	CHILLED WATER
CHWP	CHILLED WATER PUMP
CHWR	CHILLED WATER RETURN
CHWS	CHILLED WATER SUPPLY
CO	CLEANOUT
CO2	CARBON DIOXIDE
COMM	COMMUNICATION
COND	CONDENSATE
CSR	CURRENT SENSING RELAY
DDC	DIRECT DIGITAL CONTROLS
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT
DP	DIFFERENTIAL PRESSURE
EA	EACH
EBMS	ENTERPRISE BUILDING MANAGEMENT SYSTEM
EDH	ELECTRIC DUCT HEATER
EF	EXHAUST FAN
EH	ELECTRIC HEAT
ES	END SWITCH
EV	EXHAUST VALVE
EXH	EXHAUST
°F	DEGREES FAHRENHEIT
F/A	FIRE ALARM
FACP	FIRE ALARM CONTROL PANEL
FC	FAIL CLOSE UPON LOSS OF POWER SOURCE
FCU	FAN COIL UNIT
FEV	FUME EXHAUST VALVE
FM	FLOW METER
FMS	FLOW MEASURING STATION
FO	FAIL OPEN UPON LOSS OF POWER SOURCE
FS	FLOAT SWITCH
FT	FEET
FTL	FAIL TO LAST POSITION UPON LOSS OF POWER SOURCE
FTU	FAN TERMINAL UNIT
FZ	FREEZESTAT
GEV	GENERAL EXHAUST VALVE
GPM	GALLONS PER MINUTE
H	HUMIDISTAT
HHW	HEATING HOT WATER
HHWP	HEATING HOT WATER PUMP
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HS	HUMIDITY SENSOR
HX	HEAT EXCHANGER
IN.	INCHES
IN. WG	INCHES OF WATER, GAUGE
KW	KILOWATTS
KWH	KILOWATT HOUR
LL	LOW LIMIT
MD	MOTORIZED DAMPER
MIN	MINUTE; MINIMUM
NC	NORMALLY CLOSED UPON LOSS OF CONTROL SIGNAL
NO	NORMALLY OPEN UPON LOSS OF CONTROL SIGNAL
NTS	NOT TO SCALE
OA	OUTDOOR AIR
OS	OCCUPANCY SENSOR
P	PUMP
PCW	PROCESS COOLING WATER
PCWP	PROCESS COOLING WATER PUMP
PCWR	PROCESS COOLING WATER RETURN
PCWS	PROCESS COOLING WATER SUPPLY
PRV	PRESSURE REDUCING VALVE
PS	PRESSURE SENSOR
PSI	POUNDS PER SQUARE INCH
RA	RETURN AIR
RH	RELATIVE HUMIDITY
RHC	REHEAT COIL
RPM	REVOLUTIONS PER MINUTE
RR	RETURN AIR REGISTER
RV	ROOF VENT
SA	SUPPLY AIR
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DAMPER
SF	SQUARE FEET; SUPPLY FAN
SP	STATIC PRESSURE
SPST	SINGLE PULL SINGLE THROW
SV	SUPPLY VALVE
T	THERMOSTAT
TS	TEMPERATURE SENSOR
TX	TRANSFORMER
TYP	TYPICAL
UV	ULTRAVIOLET
VAV	VARIABLE AIR VOLUME
VFD	VARIABLE FREQUENCY DRIVE
WDS	WATER DETECTION SENSOR

CONTROLS LEGEND

- AMS — AIR MONITORING SENSOR
- AI — ANALOG INPUT
- AO — ANALOG OUTPUT
- DI — DIGITAL INPUT
- DO — DIGITAL OUTPUT
- PI — PRESSURE INDICATOR
- T — THERMOSTAT
- CSR — CURRENT SENSING RELAY
- COMM BAS — BAS COMMUNICATION LINK
- D — DUCT SMOKE DETECTOR (BY DIV 16)
- COND — CONDENSATION MONITOR
- CL — CONDENSATE LEVEL ALARM
- CO2 — CARBON DIOXIDE SENSOR
- C/H — COMBINATION CARBON DIOXIDE AND HUMIDITY SENSOR
- DP — DIFFERENTIAL PRESSURE TRANSMITTER / SWITCH
- ES — DAMPER END SWITCH
- FS — FLOAT SWITCH
- FM — FLUID FLOW METER
- HHL — HUMIDITY HIGH LIMIT
- HPL — HIGH PRESSURE LIMIT
- HS — HUMIDITY SENSOR
- LL — LOW LIMIT SAFETY (FREEZESTAT)
- LO — LOW PRESSURE SAFETY
- LPL — LOW PRESSURE LIMIT
- M — MOTORIZED ACTUATOR (ELECTRIC)
- O2 — OXYGEN SENSOR
- OS — OCCUPANCY SENSOR
- PS — PRESSURE SENSOR
- RH — REHEAT COIL
- RPM — REVOLUTION PER MINUTE
- SCR — SILICON CONTROLLED RECTIFIER
- SP — STATIC PRESSURE SENSOR
- TS — TEMPERATURE SENSOR
- T/H — THERMOSTAT WITH HUMIDITY SENSOR
- T/H/C — THERMOSTAT WITH HUMIDITY SENSOR AND CARBON DIOXIDE SENSOR
- WDS — WATER DETECTION SENSOR
- VFD — VARIABLE FREQUENCY DRIVE
- # — HARDWIRE INTERLOCK
- TS — TEMPERATURE SENSOR (AVERAGING)
- TS — TEMPERATURE SENSOR (POINT)
- M — MOTORIZED OPPOSED BLADE DAMPER

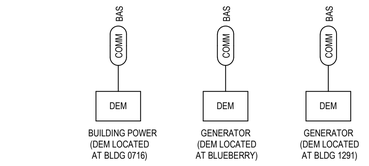
- COIL (C - COOLING; H - HEATING HOT WATER; EH - ELECTRIC HEATING)
- HEAT PIPE
- FILTER BANK
- DUCT HUMIDIFIER
- AIR FLOW MONITORING STATION
- AHU SINGLE FAN
- AHU FAN ARRAY - SEE AHU SCHEDULE FOR QUANTITY
- ULTRAVIOLET LIGHT
- STARTER
- TEST PORT
- CHECK VALVE
- LIGHT INDICATOR (X = BLUE/YELLOW/WHITE)
- THREE WAY CONTROL VALVE
- TWO WAY CONTROL VALVE
- MOTORIZED VOLUME CONTROL DAMPER
- MOTORIZED PARALLEL BLADE DAMPER
- PUMP
- BLADE TYPE AIR TERMINAL

GENERAL NOTES

1. THESE GENERAL NOTES APPLY TO ALL CONTROL DIAGRAMS AND SEQUENCES AS WELL AS WORK RELATED TO THE HVAC CONTROLS INDICATED ON OTHER DRAWINGS.
2. THE DIAGRAMS AND CONTROL SEQUENCES DESCRIBE THE REQUIRED SEQUENTIAL OPERATIONS OF SYSTEMS AND MAJOR COMPONENTS. THEY DO NOT DEFINE IN DETAIL THE OPERATION OF MINOR COMPONENTS, RELAYS, SWITCHES, OR OTHER SMALL DEVICES REQUIRED FOR THE PROPER FUNCTIONING OF THE CONTROL SYSTEM. INCORPORATE ALL SUCH ITEMS IN ORDER TO PROVIDE PROPER OPERATION OF CONTROL COMPONENTS AND EQUIPMENT TO SATISFY THE SEQUENCE OF OPERATION.
3. THE SEQUENCES OF OPERATION DESCRIBE CHANGES IN CONTROL FUNCTIONS AS OPERATING CONDITIONS VARY IN A PARTICULAR MANNER, SUCH AS RISING ROOM TEMPERATURE. UNLESS OTHERWISE STATED, THE SEQUENCES SHALL BE REVERSED WHEN THE OPERATING CONDITIONS REVERSE, SUCH AS WHEN THE RISING ROOM TEMPERATURE BEGINS TO FALL.
4. CONTROL DEVICE SETPOINTS SHALL BE MANUALLY ADJUSTABLE OVER THEIR ENTIRE CONTROL RANGE. SETPOINTS MAY BE FACTORY SET, BUT SHALL BE FIELD ADJUSTABLE. SPECIFIED SETPOINTS SHALL TAKE PRECEDENCE OVER FACTORY SETTINGS.
5. WHERE THE CONTROL SEQUENCES INDICATES AN AUTOMATIC RESET PROCEDURE, THE SETPOINT SHALL INDICATE THE NORMAL START-UP CONDITION AND MINIMUM / MAXIMUM SETTINGS.
6. TEMPERATURE, AIRFLOWS, PRESSURES, AND SIMILAR DATA SHOWN ON CONTROL DIAGRAMS ARE NOMINAL VALUES SO THAT TYPICAL DIAGRAMS MAY BE USED. SEE EQUIPMENT SCHEDULES FOR DATA DIRECTLY APPLICABLE TO INDIVIDUAL EQUIPMENT ITEMS. WHERE NOTED, VALUES SHALL BE FIELD MEASURED OR CALCULATED IN ACCORDANCE WITH THE PROCEDURE INDICATED.
7. HAND - OFF - AUTOMATIC SWITCHES (HOA) SHALL HAVE THEIR OPERATING POSITION MONITORED. SHOULD THE SWITCH BE MOVED TO THE HAND POSITION, AN ALARM SHALL BE INDICATED GIVING THE UNIT IDENTIFICATION, THE TIME, AND THE MESSAGE "IN THE MANUAL ON POSITION".
8. BAS SHALL PROVIDE TIME DELAYS ON RESTART ON EMERGENCY POWER AND RESTORATION OF NORMAL POWER SO THAT ALL MOTORS DO NOT ATTEMPT TO START AT THE SAME TIME.
9. LOCATE THERMOSTATS AND OTHER DEVICES REQUIRING OCCUPANCY MONITORING OR ADJUSTMENT AT AN ELEVATION 4'-0" ABOVE FINISHED FLOOR, IN ACCORDANCE WITH ADA REGULATIONS.
10. ALL WORK SHALL BE COORDINATED WITH ALL TRADES INVOLVED. INTERFACE EQUIPMENT AND WIRING SHALL BE PROVIDED AT NO ADDITIONAL COST TO THE OWNER.
11. CEILING ACCESS PANELS AND DUCT ACCESS PANELS SHALL BE PROVIDED, WHERE REQUIRED, TO SERVICE DAMPERS, HEATERS, VALVES, AND OTHER CONCEALED EQUIPMENT.
12. CONTROL SYSTEM SUPPLIER SHALL PROVIDE ALL WIRING AND CONDUIT REQUIRED FOR THE INSTALLATION OF THE CONTROL SYSTEM. WIRING, CONDUIT, AND RELATED EQUIPMENT SHALL COMPLY WITH THE PROVISIONS OF DIVISION 26, 27, AND 28. WORK SHALL INCLUDE ALL POWER AND CONTROL WIRING NEEDED FOR INTER-CONNECTIONS OF EQUIPMENT, REMOTE SENSORS AND DEVICES, INCLUDING SMOKE DAMPERS AND MOTOR OPERATED DAMPERS.
13. CONTROL SYSTEM SUPPLIER SHALL WIRE FROM POWER SOURCES INDICATED ON THE ELECTRICAL DRAWINGS. CIRCUITS PROVIDED FOR THE CONTROL SYSTEM SHALL BE DEDICATED 120 VOLT, 20 AMP, 60 HZ UNLESS OTHERWISE INDICATED. POWER CIRCUITS WILL BE PROVIDED BY DIVISION 26 TO THE TERMINAL POWER POINTS INDICATED. CIRCUITS WILL BE TERMINATED IN MECHANICAL EQUIPMENT ROOMS OR ELECTRICAL ROOMS UNLESS OTHERWISE INDICATED. COORDINATE FINAL CONNECTION POINT LOCATION WITH DIVISION 26.
14. SMOKE DETECTORS, REMOTE TEST, RESET, AND FIRE ALARM INDICATORS SHALL BE FURNISHED AND WIRED BY THE DIVISION 28 CONTRACTOR.
15. THE CONTROL SEQUENCE SHALL BE ACCOMPLISHED BY THE DIRECT DIGITAL CONTROL SYSTEM. ALL VALVE AND DAMPER OPERATORS SHALL BE ELECTRONIC TYPE UNDER DIRECT DIGITAL CONTROL.
16. VARIABLE FREQUENCY DRIVES SHALL INTERFACE WITH THE BAS AS SPECIFIED WITHIN THE SPECIFICATIONS AND INCLUDE THE REQUIRED INPUT, OUTPUT, AND ALARM DATA.
17. ALARM SETPOINTS ARE INDICATED IN THE CONTROL DRAWING POINTS LISTS. ALL ALARM SETPOINTS SHALL BE FULLY ADJUSTABLE BY THE BAS OPERATOR AND BE COORDINATED WITH THE OWNER.
18. ALL BAS CONDUIT RACEWAY SYSTEMS SHALL BE WHITE.
19. FOR ANY ADJUSTMENTS MADE TO THE BUILDING AUTOMATION SYSTEMS, THE CONTROLLER FACTORY DEFAULT VALUES SHALL MATCH THE FINAL FIELD ADJUSTED SETTINGS.
20. CONTROL WIRING AND POWER WIRING FEEDS TO VFDS SHALL NOT BE RAN IN THE SAME CONDUIT.
21. ALL INSTRUMENTATION ASSOCIATED WITH A SPECIFIC SYSTEM CONTROL SHALL BE CONNECTED TO ASSOCIATED CONTROLLER AND SHALL NOT BE CONNECTED TO REMOTE CONTROLLER. THIS IS TO ENSURE STANDALONE OPERATION.

CONTROLLER NOTES

1. USE LAB TEC CONTROLLER FOR ALL ZONE CONTROL (LABORATORY AND OFFICE).



DIGITAL ENERGY MONITORS (DEM) CONTROL DIAGRAM

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UNIVERSITY OF FLORIDA MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

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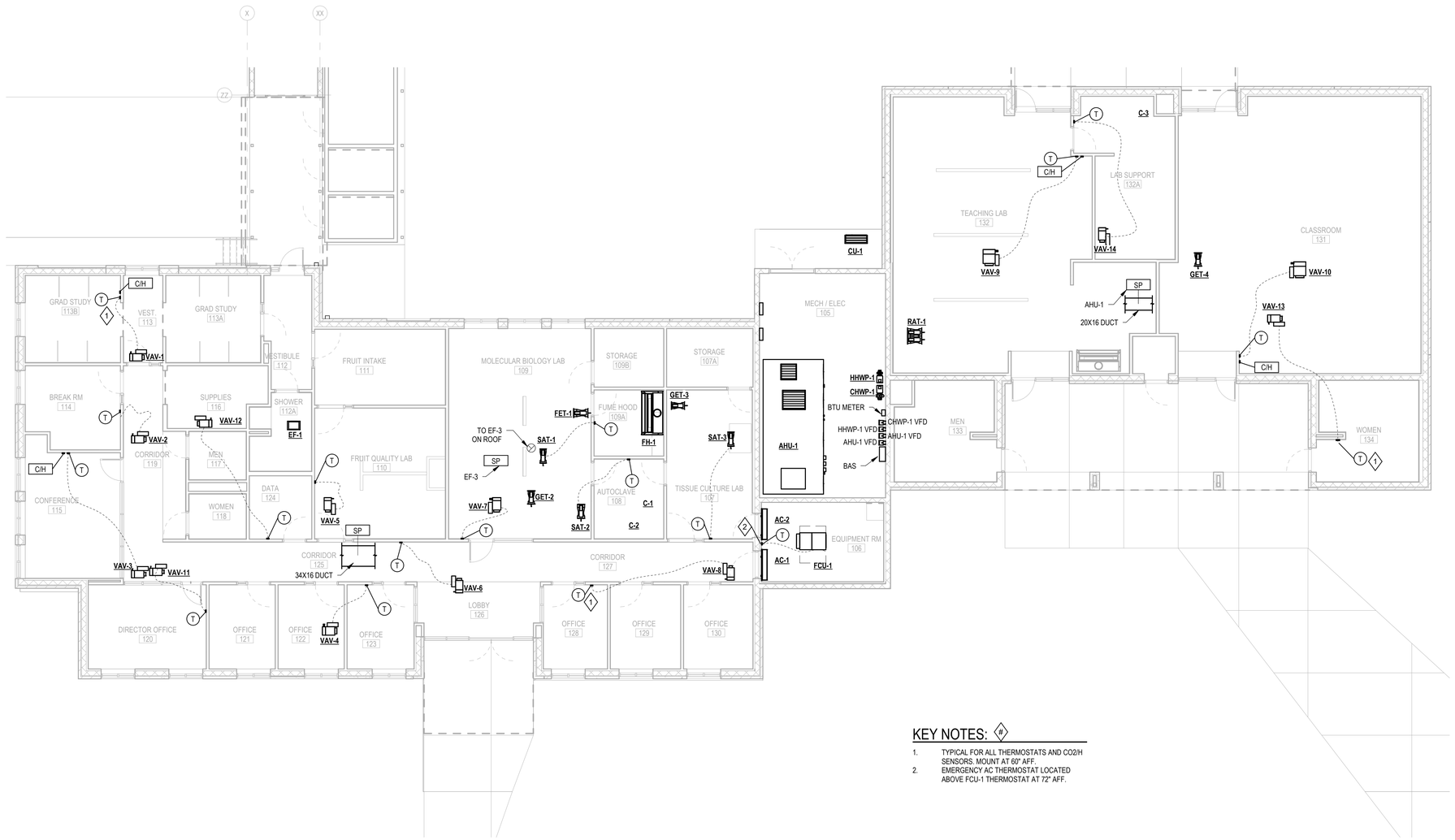
CONTROLS LEGEND AND ABBREVIATIONS

IC001



KEY NOTES: ⟨#⟩

1. TYPICAL FOR ALL THERMOSTATS AND CO2/H SENSORS. MOUNT AT 60" AFF.
2. EMERGENCY AC THERMOSTAT LOCATED ABOVE FCU-1 THERMOSTAT AT 72" AFF.

FIRST FLOOR PLAN - ENVIRONMENTAL CONTROLS

SCALE: 1/8" = 1'-0"

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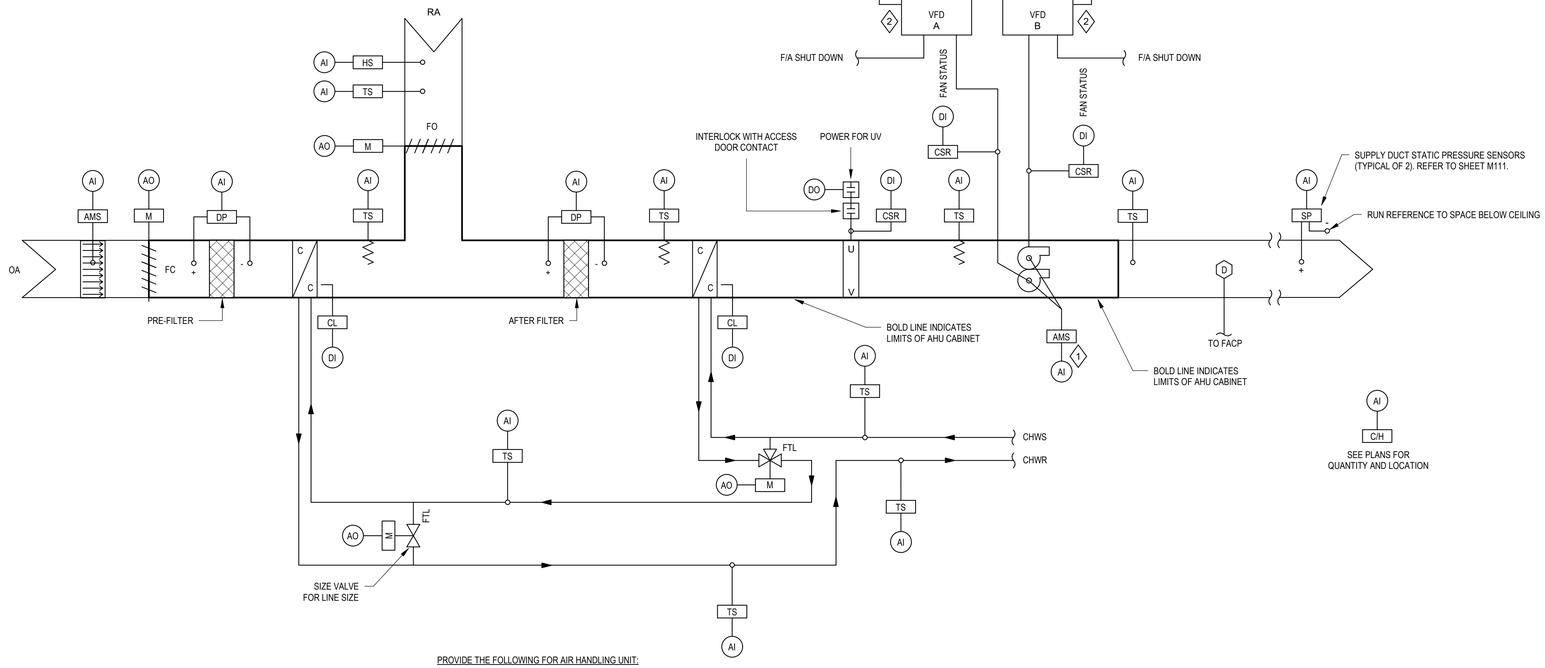
FIRST FLOOR PLAN - CONTROLS

IC101



PROVIDE THE FOLLOWING FOR AIR HANDLING UNIT:

1. COOLING COIL CONTROL.
2. MICRO VARIABLE FREQUENCY DRIVES WITH STATIC PRESSURE CONTROL.
3. OUTDOOR AIR/RETURN AIR DAMPER CONTROL.

SAFETY CONTROL SEQUENCES: PROVIDE THE FOLLOWING SAFETY FUNCTIONS. ALL SAFETIES SHALL BE OPERATIONAL REGARDLESS OF FAN MODE (HAND, OFF, AUTO, OR BYPASS)

1. SMOKE DETECTOR: SMOKE DETECTOR SHALL BE INSTALLED IN THE SUPPLY AIR DUCT WHERE SHOWN ON THE DRAWINGS TO STOP FAN AND SIGNAL SUPERVISORY TROUBLE AT FIRE ALARM.
2. CONDENSATE LEVEL ALARM: UPON INDICATION OF A HIGH LEVEL ALARM.

START-STOP SEQUENCES: PROVIDE THE FOLLOWING OPERATIONAL AND INTERLOCK FUNCTIONS WHEN THE AHU FAN HAS STARTED AND STOPPED. UNLESS OTHERWISE NOTED THESE SEQUENCES SHALL BE FUNCTIONAL FOR ANY REASON THE FAN STARTS OR STOPS IN ANY MODE OF OPERATION (ALL H-O-A MODES, ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

1. OUTDOOR AIR AND RETURN AIR DAMPERS: OPEN RETURN DAMPERS AND ENABLE OA AIRFLOW CONTROL UPON SIGNAL TO START. IF FAN FAILS TO START WITHIN 60 SECONDS AFTER DAMPERS ARE OPEN, CLOSE THE OUTSIDE AIR DAMPER, OPEN THE RETURN AIR DAMPER, AND SIGNAL FAN FAILURE ALARM. CLOSE OA DAMPER AND CYCLE (CLOSE FOR 30 SEC, THEN OPEN) RA DAMPER UPON PROOF OF FAN STOP.
2. COOLING COIL CONTROL VALVE: ENABLE COOLING COIL CONTROL VALVE UPON PROOF OF FAN START. CLOSE VALVE TO COIL UPON PROOF OF FAN STOP.
3. STATIC PRESSURE CONTROL LOOP: ENABLE STATIC PRESSURE CONTROL LOOP UPON PROOF OF FAN START. DISABLE STATIC PRESSURE CONTROL LOOP UPON PROOF OF FAN STOP.
4. UV LAMPS: ENABLE UV LAMPS ON SUPPLY FAN(S) START. PROVIDE INTERLOCK TO DISABLE UV LAMP WHEN AHU ACCESS DOOR IS OPEN. DISABLE UV LAMPS ON FAN STOP. INCLUDE THE ABILITY TO PROGRAM UV LIGHT TO OPERATE UNDER A USER DEFINED SCHEDULE (4AM TO 10 AM).

AHU START SHALL BE INITIATED BY BAS COMMAND. WHEN THE UNIT IS STARTED IN RESPONSE TO A BAS COMMAND, OPERATE THE UNIT AS FOLLOWS:

FAN SPEED CONTROL: PROVIDE STATIC PRESSURE SENSORS MOUNTED REMOTELY. CONTROL THE VARIABLE SPEED ARRAY TO MAINTAIN THE ESTABLISHED SUPPLY AIR STATIC PRESSURE SETPOINT (SET BY TAB).

CHILLED WATER COOLING COIL CONTROL: MODULATE THE CHILLED WATER CONTROL VALVE TO MAINTAIN THE COOLING COIL DISCHARGE TEMPERATURE AT 55 DEGF (ADJ) (AS SENSED IMMEDIATELY DOWNSTREAM OF COOLING COIL).

PRE-COOLING COIL CONTROL: PRE-COOLING COIL WILL BE OPERATIONAL WHEN CHILLED WATER COOLING COIL IS OPERATIONAL. WHEN THE OA IS LESS THAN 68°F (ADJ), MODULATE THE PRE-COOLING BYPASS VALVE OPEN TO MAINTAIN PRE-COOL DISCHARGE AIR TEMPERATURE (AS SENSED IMMEDIATELY DOWNSTREAM OF THE PRE-COOL COIL) OF 65°F (ADJ). WHEN THE OA TEMPERATURE IS LESS THAN 52°F (ADJ), MODULATE THE CHILLED WATER VALVE TO 80% OPEN AND THE PRE-COOLING BYPASS VALVE TO 100% CLOSE.

OUTDOOR AIR CONTROL: MODULATE THE OUTSIDE AIR DAMPER AND RETURN AIR DAMPER IN SEQUENCE TO MAINTAIN THE SCHEDULED OUTSIDE AIRFLOW SETPOINT REGARDLESS OF FAN SPEED OR FILTER LOADING. THE RETURN AND OUTSIDE AIR DAMPERS SHALL CONTROL AS FOLLOWS: STARTING WITH THE RETURN AIR DAMPER OPEN, MODULATE THE OUTSIDE AIR DAMPER OPEN/CLOSED AS REQUIRED TO MAINTAIN THE CALCULATED AIR FLOW SETPOINT. IN THE EVENT THE OUTSIDE AIR DAMPER IS FULLY OPEN (100%) AND THE OUTSIDE AIR VOLUME IS BELOW SET-POINT, BEGIN MODULATING THE RETURN AIR DAMPER TOWARDS ITS CLOSED POSITION BUT NOT LESS THAN 50% (ADJ).

SUPPLY AIR RESET:
THE BAS SHALL CONTINUALLY MONITOR ALL SUPPLY AIR TERMINALS TO DETERMINE THE COOLING AND HEATING REQUEST. A COOLING REQUEST SHALL BE TRIGGERED WHEN A ZONE IS OPERATING MORE THAN 1 DEGF (ADJ) ABOVE THE ESTABLISHED COOLING SETPOINT. A HEATING REQUEST SHALL BE TRIGGERED WHEN THE REHEAT VALVE IS OPERATING AT OR ABOVE 90% (ADJ). THE DISCHARGE AIR SETPOINT SHALL BE RESET UP BY 1 DEGF (ADJ) WHEN MORE THAN 25% OF THE ZONES REPORT A HEATING REQUEST. NO RESET SHALL BE ALLOWED IF THERE ARE ANY ACTIVE COOLING REQUESTS. THE BAS SHALL RE-EVALUATE ONCE EVERY 30 MINUTES (ADJ). LIMIT COOLING RESET TO BETWEEN 55 DEGF (ADJ) AND 58 DEGF (ADJ). THE BAS SHALL MONITOR ALL SPACE HUMIDITY SENSORS AND IN THE EVENT ANY SPACE HUMIDITY SENSOR REPORTS GREATER THAN 60% RH (ADJ), RESET DISCHARGE AIR SETPOINT BACK TO 55 DEGF. RELEASE SUPPLY AIR RESET WHEN THE HUMIDITY LEVELS RETURN TO 55%RH (ADJ) AND RESTART THE RESET SEQUENCE STARTING AT 55 DEGF SETPOINT.

STATIC PRESSURE RESET CONTROL:
THE BAS SHALL CONTINUOUSLY POLL THE DAMPER POSITION OF ALL AIR TERMINAL BOXES. IF ALL DAMPERS ARE BELOW 75% (ADJ) AS INDICATED BY COMMAND SIGNAL, THE BAS SHALL RESET THE STATIC PRESSURE SET-POINT DOWN AT A RATE OF -0.1 IN W.G. EVERY 15 MINUTES. IF ANY VAV BOX DAMPER COMMAND SIGNAL IS ABOVE 98% (ADJ), THE BAS SHALL RESET STATIC PRESSURE SET-POINT UP AT A RATE OF +0.25 IN W.G. EVERY 15 MINUTES.

DEMAND BASED VENTILATION: THE BAS SHALL POLL ALL CO2 SPACE SENSORS AND CALCULATE THE HIGHEST VALUE. THE OUTSIDE AIR CFM SETPOINT SHALL BE RESET BETWEEN SCHEDULED MINIMUM AND MAXIMUM SETPOINT IN ACCORDANCE WITH CO2 CHANGES. DISABLE DEMAND VENTILATION SEQUENCE, RETURNING OA CFM SETPOINT TO SCHEDULED MAXIMUM, WHEN OUTDOOR TEMPERATURES DROP BELOW 38 DEGF (ADJ) TO ALLOW FOR FREE COOLING.

AHU MIXED AIR VAV COOLING CONTROL DIAGRAM AND SEQUENCE

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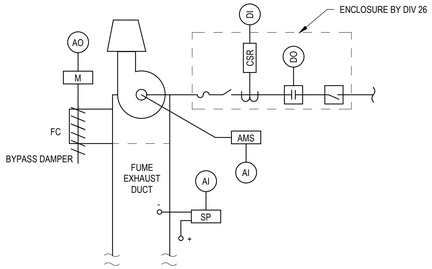
AHU MIXED AIR VAV COOLING CONTROLS

IC201



SEQUENCE OF OPERATION:

EXHAUST FAN WILL OPERATE TO MAINTAIN REMOTE STATIC PRESSURE SETPOINT OF _____ IN WC (ADJ) [AS DETERMINED BY TAB]. IN THE EVENT THE REMOTE STATIC PRESSURE INCREASES, MODULATE THE BYPASS DAMPER OPEN. CLOSE THE BYPASS DAMPER WHEN THE STATIC PRESSURE DECREASES.

FUME EXHAUST FAN (EF-3) CONTROL DIAGRAM AND SEQUENCE

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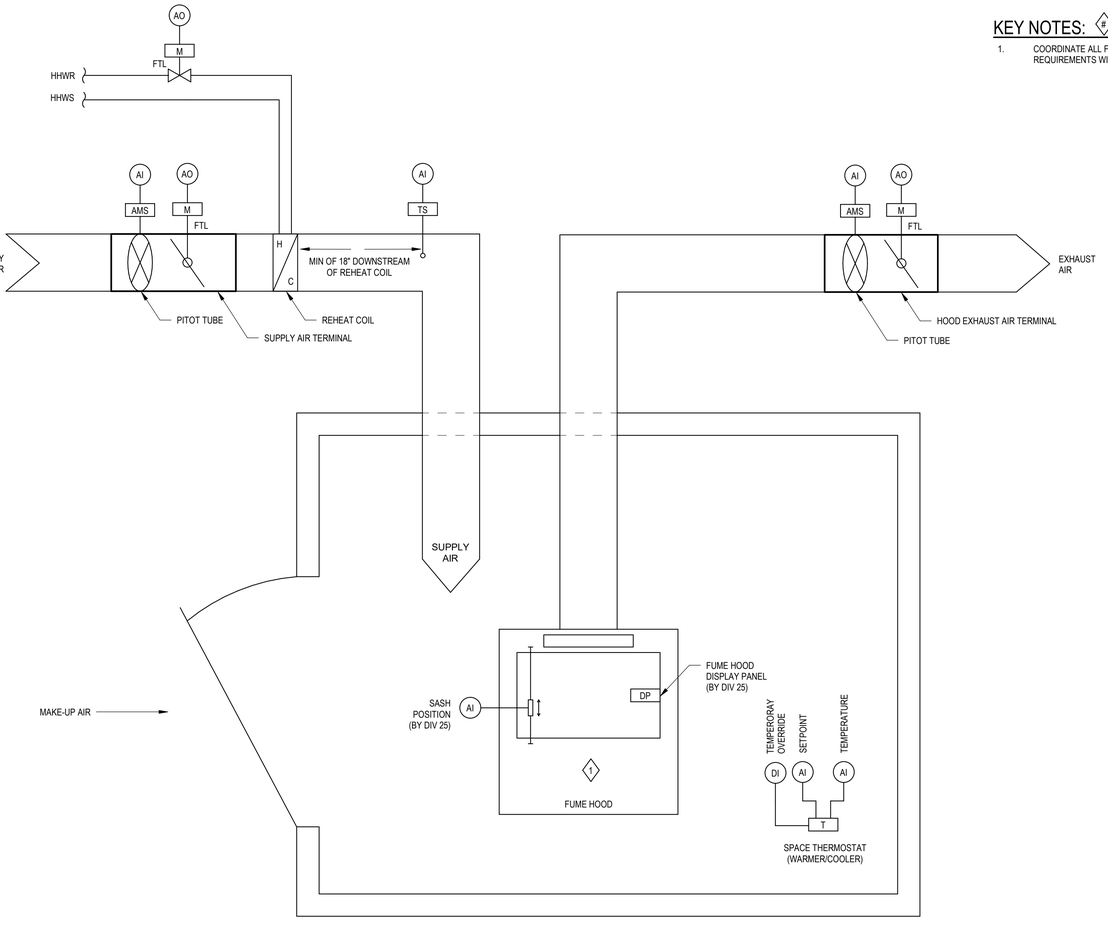

KEY NOTES: ◇#

1. COORDINATE ALL FUME HOOD REQUIREMENTS WITH FACILITY SERVICES.

PROVIDE THE FOLLOWING:

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT AND REMOTE COMMUNICATION PORT.
2. A SUPPLY TERMINAL UNIT WITH REHEAT COIL AND HOOD EXHAUST TERMINAL UNIT.
3. SUPPLY AIR TEMPERATURE SENSOR DOWNSTREAM OF THE SUPPLY TERMINAL REHEAT COIL FOR USE IN MONITORING OVERALL TERMINAL UNIT PERFORMANCE.
4. INCLUDE SUPPLY AIRFLOW SENSOR AND HOOD EXHAUST AIRFLOW SENSOR FOR THE LAB CONTROLLER TO MONITOR AND MAINTAIN A SCHEDULED AIRFLOW OFFSET.
5. INCLUDE HOOD AIR FLOW SENSOR TO ENSURE CORRECT AIRFLOW WITHIN HOOD.

ROOM VENTILATION CONTROL:

1. THE LAB CONTROLLER SHALL CALCULATE TOTAL ROOM SUPPLY CFM AS NEEDED TO SATISFY HOOD EXHAUST OFFSET AND MANAGE DESIGN PRESSURIZATION.
2. HOOD FLOW SHALL BE FACTORED INTO THE OVERALL OFFSET CALCULATION.
3. SUPPLY AIR TERMINAL SHALL BE MODULATED BETWEEN ITS ESTABLISHED MINIMUM AND MAXIMUM FLOWS TO MAINTAIN THE LAB OFFSET.

ROOM TEMPERATURE CONTROL:

1. THE HEATING VALVE SHALL BE MODULATED TO MAINTAIN THE SETPOINT.

HOOD CONTROL:

1. THE HOOD CONTROLLER SHALL MAINTAIN CONTINUOUS FLOW AT THE FACE OF THE HOOD (100 FPM) IN ACCORDANCE WITH HOOD REQUIREMENTS.

SETPOINTS:

70°F (+/- 3°F ADJUSTABLE RANGE)

1 LAB - SUPPLY/FUME EXHAUST TRACKING CONTROL DIAGRAM AND SEQUENCE (FUME HOOD 109A)

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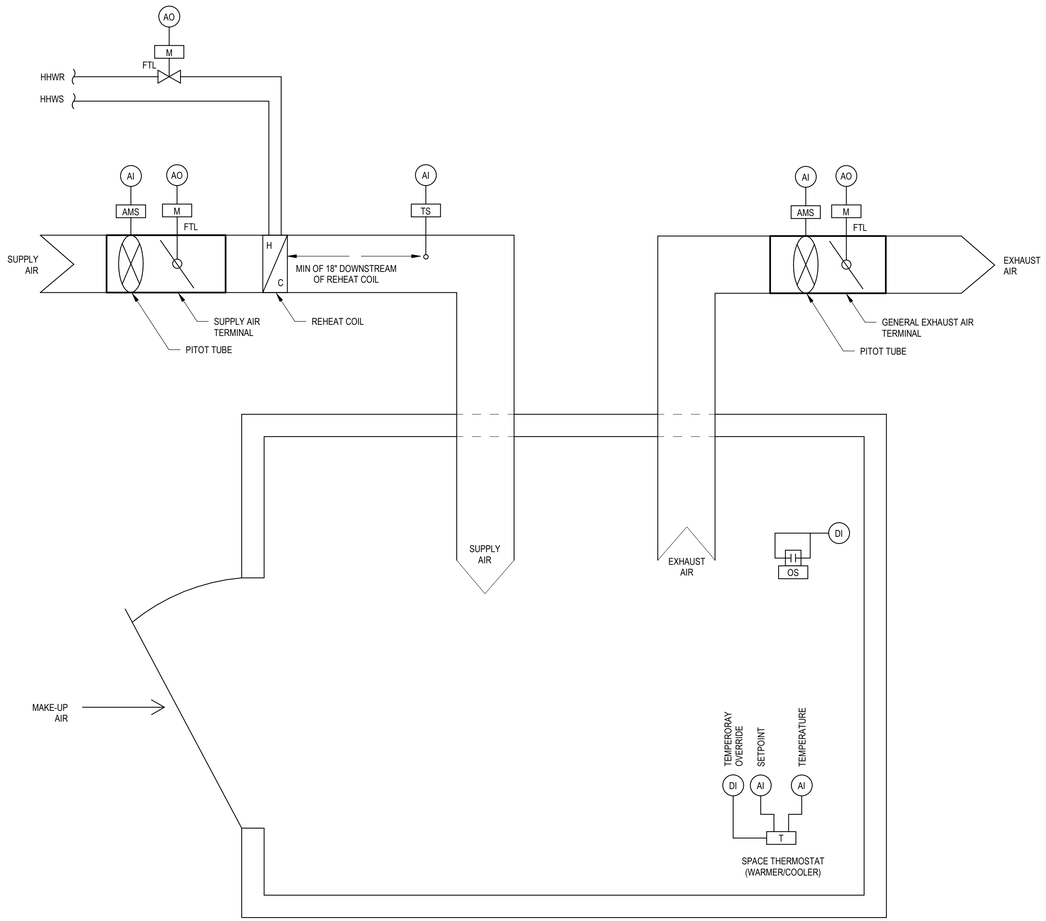
LAB SUPPLY/FUME EXHAUST TRACKING CONTROLS

IC202



PROVIDE THE FOLLOWING:

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT AND REMOTE COMMUNICATION PORT.
2. A SUPPLY TERMINAL UNIT WITH REHEAT COIL AND GENERAL EXHAUST TERMINAL UNIT.
3. SUPPLY AIR TEMPERATURE SENSOR DOWNSTREAM OF THE SUPPLY TERMINAL REHEAT COIL FOR USE IN MONITORING OVERALL TERMINAL UNIT PERFORMANCE.
4. INCLUDE SUPPLY AIRFLOW SENSOR AND GENERAL EXHAUST AIRFLOW SENSOR FOR THE LAB CONTROLLER TO MONITOR AND MAINTAIN A SCHEDULED AIRFLOW OFFSET.
5. OCCUPIED MODE AS DETERMINED BY SCHEDULE OR LOCAL OCCUPANCY SENSOR.

OCCUPIED MODE:

THE LAB CONTROLLER SHALL MAINTAIN OCCUPIED TEMPERATURE SETPOINTS AND SCHEDULED OFFSETS.

ROOM VENTILATION CONTROL:

1. THE LAB CONTROLLER SHALL CALCULATE TOTAL ROOM GENERAL EXHAUST CFM AS NEEDED TO SATISFY SUPPLY AIR OFFSET AND MANAGE DESIGN PRESSURIZATION.

ROOM TEMPERATURE CONTROL:

1. SUPPLY AIR TERMINAL SHALL BE MODULATED BETWEEN ITS ESTABLISHED MINIMUM AND MAXIMUM FLOWS TO MAINTAIN THE SPACE SETPOINT. CONTROL SHALL BE CONTINUOUS REGARDLESS OF OCCUPANCY STATUS.
2. THE HEATING VALVE SHALL BE MODULATED TO MAINTAIN THE HEATING SETPOINT WHEN SUPPLY AIR TERMINAL IS AT MINIMUM FLOW.

SETPOINTS:

HEATING SETPOINT	70°F	(+/- 3°F ADJUSTABLE RANGE)
COOLING SETPOINT	72°F	(+/- 3°F ADJUSTABLE RANGE)

LAB - SUPPLY/GENERAL EXHAUST TRACKING CONTROL DIAGRAM (TISSUE CULTURE LAB 107)

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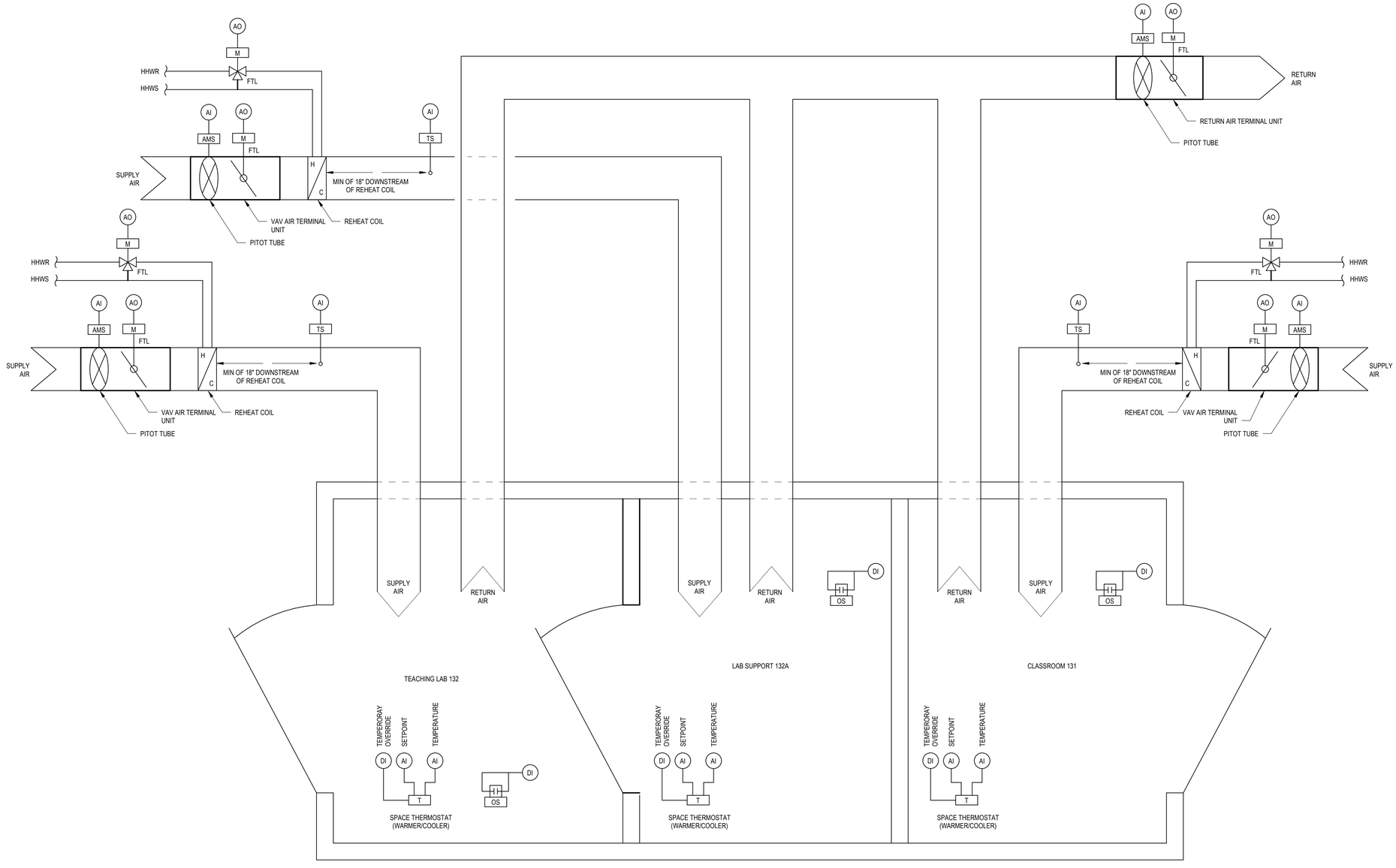
LAB SUPPLY/GENERAL EXHAUST TRACKING CONTROLS

IC203



PROVIDE THE FOLLOWING:

1. ROOM THERMOSTAT FOR EACH ROOM WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT AND REMOTE COMMUNICATION PORT.
2. A SUPPLY TERMINAL UNIT WITH REHEAT COIL FOR EACH ROOM AND COMMON RETURN AIR TERMINAL UNIT.
3. SUPPLY AIR TEMPERATURE SENSOR DOWNSTREAM OF THE SUPPLY TERMINAL REHEAT COIL FOR USE IN MONITORING OVERALL TERMINAL UNIT PERFORMANCE.
4. INCLUDE SUPPLY AIRFLOW SENSOR AND GENERAL EXHAUST AIRFLOW SENSOR FOR THE LAB CONTROLLER TO MONITOR AND MAINTAIN A SCHEDULED AIRFLOW OFFSET.
5. OCCUPIED MODE AS DETERMINED BY SCHEDULE OR LOCAL OCCUPANCY SENSOR.

OCCUPIED MODE:

THE ROOM CONTROLLER SHALL MAINTAIN OCCUPIED TEMPERATURE SETPOINTS AND SCHEDULED OFFSETS.

ROOM VENTILATION CONTROL:

1. THE ROOM CONTROLLER SHALL CALCULATE TOTAL RETURN CFM AS NEEDED TO MATCH THE TOTAL SUPPLY AIR CFM FOR THE THREE SPACES.

ROOM TEMPERATURE CONTROL:

1. SUPPLY AIR TERMINAL SHALL BE MODULATED BETWEEN ITS ESTABLISHED MINIMUM AND MAXIMUM FLOWS TO MAINTAIN THE SPACE SETPOINT. CONTROL SHALL BE CONTINUOUS REGARDLESS OF OCCUPANCY STATUS.
2. THE HEATING VALVE SHALL BE MODULATED TO MAINTAIN THE HEATING SETPOINT WHEN SUPPLY AIR TERMINAL IS AT MINIMUM FLOW.

SETPOINTS:

HEATING SETPOINT	70°F	(+/- 3°F ADJUSTABLE RANGE)
COOLING SETPOINT	72°F	(+/- 3°F ADJUSTABLE RANGE)

LAB - SUPPLY/RETURN TRACKING CONTROL DIAGRAM

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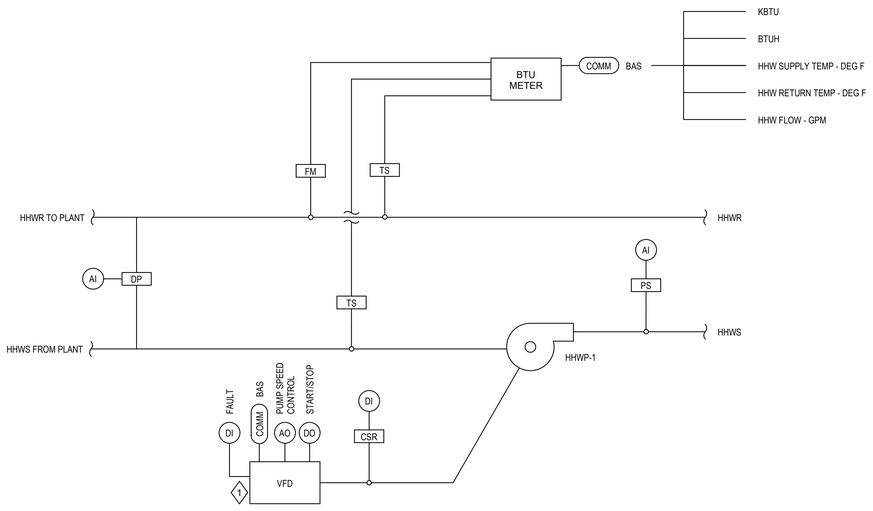
LAB SUPPLY/RETURN TRACKING CONTROLS

IC204



PROVIDE THE FOLLOWING:

1. APPROPRIATE TEMPERATURE, FLOW AND PRESSURE SENSORS.
2. HEATING HOT WATER BTU METER.
3. DIFFERENTIAL PRESSURE SENSORS FOR PUMP CONTROL.
4. SYSTEM ENABLE/DISABLE SHALL BE DETERMINED BY BUILDING OCCUPANCY SCHEDULE AND AHU STATUS.

START-STOP SEQUENCE: UPON STARTUP ENABLE PUMP CONTROL. UPON SHUTDOWN, DISABLE ALL PUMP CONTROL. THIS SEQUENCE SHALL BE FUNCTIONAL FOR ANY REASON THE PUMP STARTS-STOPS IN ANY MODE OF OPERATION (ALL H-O-A MODES, ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

HEATING HOT WATER DIFFERENTIAL PRESSURE RESET SEQUENCE BY OWNER.

PUMP CONTROL:

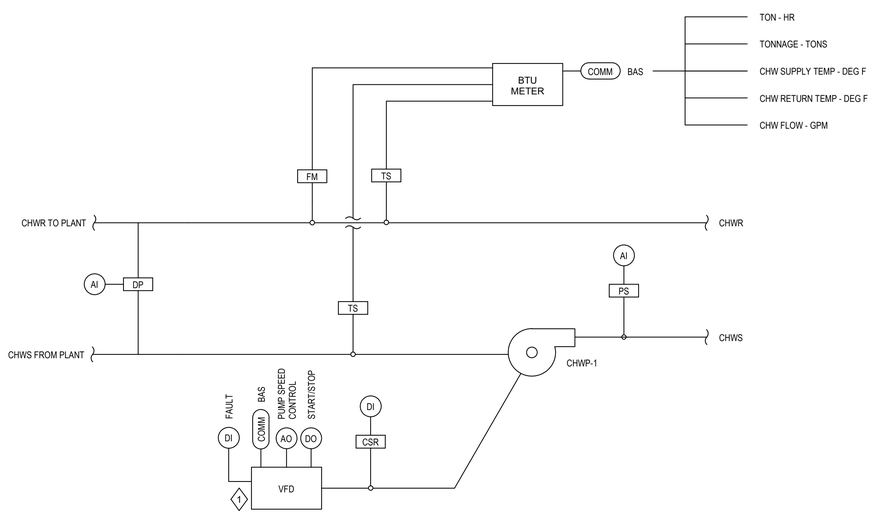
1. ONCE ENABLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL PRESSURE SETPOINT.
2. DIFFERENTIAL PRESSURE RESET CONTROL: THE BAS SHALL CONTINUOUSLY POLL THE VALVE POSITION OF ALL HEATING HOT WATER COILS. THE BAS SHALL RESET DIFFERENTIAL PRESSURE SET-POINT UP OR DOWN TO CONTINUALLY RESET THE SYSTEM DIFFERENTIAL PRESSURE SETPOINT FOR OPTIMUM PERFORMANCE.

2 HEATING HOT WATER BUILDING TERTIARY PUMPING CONTROL DIAGRAM AND SEQUENCE

NOT TO SCALE

KEY NOTES: ◇#

1. SEE DETAIL 4 ON SHEET IC207 FOR CONTORL WIRE SCHEME.



PROVIDE THE FOLLOWING:

1. APPROPRIATE TEMPERATURE, FLOW AND PRESSURE SENSORS.
2. CHILLED WATER BTU METER.
3. DIFFERENTIAL PRESSURE SENSORS FOR PUMP CONTROL.
4. SYSTEM ENABLE/DISABLE SHALL BE DETERMINED BY BUILDING OCCUPANCY SCHEDULE AND AHU STATUS.

START-STOP SEQUENCE: UPON STARTUP ENABLE PUMP CONTROL. UPON SHUTDOWN, DISABLE ALL PUMP CONTROL. THIS SEQUENCE SHALL BE FUNCTIONAL FOR ANY REASON THE PUMP STARTS-STOPS IN ANY MODE OF OPERATION (ALL H-O-A MODES, ALL VFD MODES, ALL AUTOMATIC AND SAFETY FUNCTIONS, AND LOCAL MANUAL START-STOP).

WHEN WHERE AHU COOLING COIL VALVE IS GREATER THAN 90% OPEN ACTIVATE THE CHILLED WATER PUMP. WHEN AHU COOLING COIL VALVE IS LESS THAN 60% OPEN, SHUTDOWN THE PUMP. WHEN THE PUMP IS ACTIVE, MODULATE THE SPEED TO ENSURE A 55°F DISCHARGE AIR TEMPERATURE (SENSED IMMEDIATELY DOWNSTREAM OF THE COOLING COIL AND UPSTREAM OF THE SUPPLY FAN). THE PUMP SHALL SHUT DOWN IN THE EVENT OF HIGH PRESSURE SET AT 65 PSI (ADJ).

PUMP CONTROL:

1. ONCE ENABLED THE PUMP SPEED SHALL BE MODULATED TO MAINTAIN THE CALCULATED DIFFERENTIAL PRESSURE SETPOINT.
2. DIFFERENTIAL PRESSURE RESET CONTROL: THE BAS SHALL CONTINUOUSLY POLL THE VALVE POSITION OF ALL CHILLED WATER COILS. THE BAS SHALL RESET DIFFERENTIAL PRESSURE SET-POINT UP OR DOWN TO CONTINUALLY RESET THE SYSTEM DIFFERENTIAL PRESSURE SETPOINT FOR OPTIMUM PERFORMANCE.

1 CHILLED WATER BUILDING TERTIARY PUMPING CONTROL DIAGRAM AND SEQUENCE

NOT TO SCALE

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MAIN CAMPUS

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03	100% CONSTRUCTION DOCUMENTS	2020-11-17
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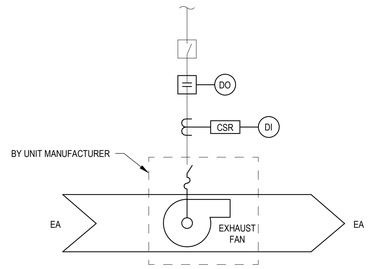
Sheet Information

TERTIARY PUMPING BUILDING CONTROLS

IC205

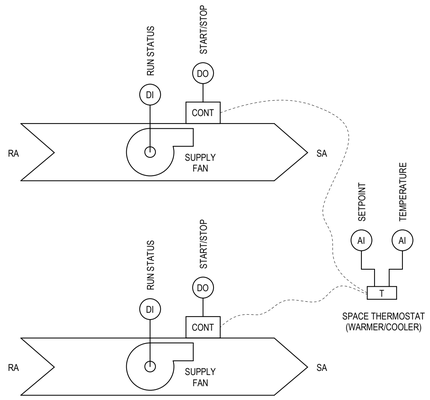


NOTES:
1. RELAY: PROVIDE LINE VOLTAGE RELAY CONTROLLED BY - 24VAC DO FROM BAS.
2. CSR: PROVIDE CSR WITH DI TO BAS.
3. EF: INCLUDES INTEGRAL O.L. AND DISCONNECT.

SEQUENCE OF OPERATION:

INTERLOCK EXHAUST FAN EF-1 AND EF-2 WITH AHU-1. ENABLE FANS WHEN AHU-1 IS ENABLED AND DISABLE FANS WHEN AHU-1 IS DISABLED.

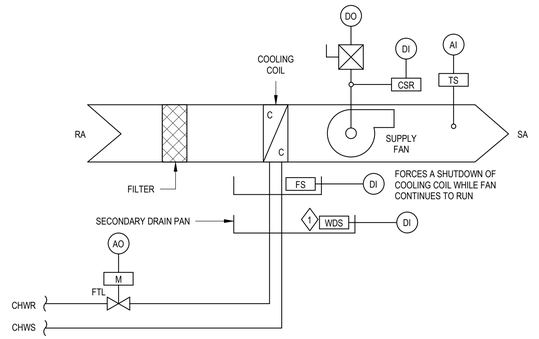
1 EXHAUST FAN (EF-1 AND EF-2)CONTROL DIAGRAM AND SEQUENCE
NOT TO SCALE



SEQUENCE OF OPERATION:

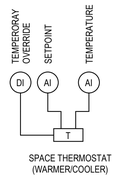
UNIT SHALL OPERATE IN PARALLEL WHEN THE SPACE TEMPERATURE INCREASES BEYOND ROOM TEMPERATURE SETPOINT OF 76°F. IN GENERAL, THE FANS AND THE COOLING MODE SHALL BE ENABLED BY THE REMOTE THERMOSTAT.

2 AC UNIT (AC-1) CONTROL DIAGRAM AND SEQUENCE
NOT TO SCALE



KEY NOTES: ◇#

1. WATER DETECTION SENSOR TO TRIGGER UPON SENSING ANY WATER IN SECONDARY DRAIN PAN. SIMILAR TO DWYER WDS-LP-D2-A.



PROVIDE THE FOLLOWING FOR FAN COIL UNIT:

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. DISCHARGE AIR TEMPERATURE SENSOR.
3. COOLING CONTROL.
4. FAN CONTROL.

SAFETY CONTROL SEQUENCES:

1. CONDENSATE OVERFLOW: UPON THE DETECTION OF WATER IN THE PRIMARY DRAIN PAN, FULLY CLOSE THE COOLING CONTROL VALVE, FAN REMAINS ACTIVE AND ALARM AT THE BAS.

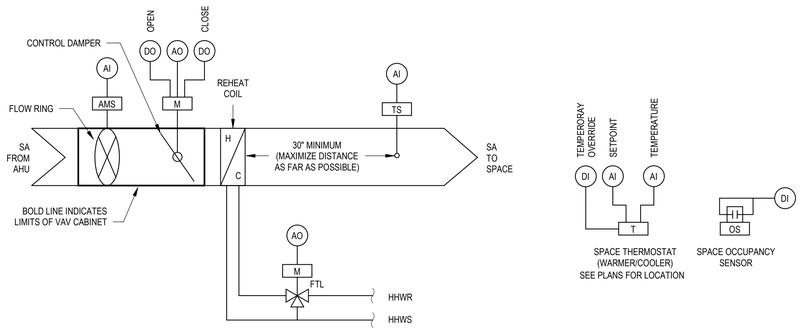
TEMPERATURE CONTROL:

1. START THE FCU FAN AND PROVE FAN ON PRIOR TO ACTIVATION OF TEMPERATURE CONTROL.
2. MODULATE COOLING COIL AS NEEDED TO MAINTAIN SPACE CONDITIONS.

SETPOINTS:

SETPOINT 74°F (+/- 3°F ADJUSTABLE RANGE)

3 FAN COIL UNIT W/ COOLING ONLY (FCU-1) CONTROL DIAGRAM AND SEQUENCE
NOT TO SCALE



PROVIDE THE FOLLOWING FOR ALL VAV TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. PRESSURE INDEPENDENT AIR VOLUME CONTROL WITH ADJ MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. OCCUPIED MODE SHALL BE DETERMINED BY BAS SCHEDULE OR LOCAL OCCUPANCY SENSOR. OCCUPANCY SENSOR SHALL TAKE PRECEDENT.

OCCUPIED MODE:

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING DEMAND.
2. ON A RISE IN ROOM TEMPERATURE, MODULATE THE CONTROL AIR DAMPER TOWARDS ITS MAXIMUM CFM SETPOINT UNTIL OCCUPIED COOLING SETPOINT HAS BEEN ACHIEVED.
3. ON A DROP IN ROOM TEMPERATURE, MODULATE THE CONTROL AIR DAMPER TOWARDS ITS MINIMUM CFM SETPOINT
4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW WHILE INCREASING THE HOT WATER OUTPUT TO MAINTAIN THE HEATING SETPOINT.

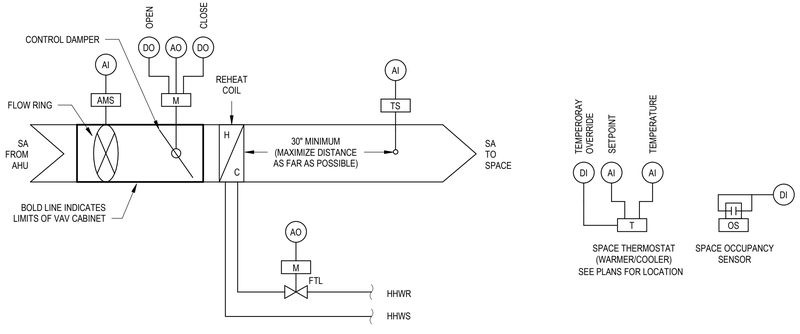
UNOCCUPIED MODE:

1. THE CONTROL AIR DAMPER SHALL BE ALLOWED TO MODULATE TO MINIMUM UNOCCUPIED AIR CFM SETPOINT ACCORDING TO SCHEDULE.
2. UNOCCUPIED STATUS TO BE DETERMINED BY LOCAL OCCUPANCY SENSOR.

SETPOINTS:

COOLING SETPOINT 74°F (+/- 3°F ADJUSTABLE RANGE)
HEATING SETPOINT 70°F (+/- 3°F ADJUSTABLE RANGE)

4 TYPICAL VAV W/ 3-WAY HHW REHEAT CONTROL DIAGRAM AND SEQUENCE (TYPICAL FOR VAV-1, VAV-9 AND VAV-10 ONLY)
NOT TO SCALE



PROVIDE THE FOLLOWING FOR ALL VAV TERMINAL UNIT BOXES.

1. ROOM THERMOSTAT WITH INTEGRAL TEMPERATURE SENSOR, INTEGRAL DISPLAY, SLIDING SCALE SETPOINT ADJUSTMENT, AND REMOTE COMMUNICATION PORT.
2. PRESSURE INDEPENDENT AIR VOLUME CONTROL WITH ADJ MAXIMUM AND MINIMUM AIRFLOW SETTINGS.
3. OCCUPIED MODE SHALL BE DETERMINED BY BAS SCHEDULE OR LOCAL OCCUPANCY SENSOR. OCCUPANCY SENSOR SHALL TAKE PRECEDENT.

OCCUPIED MODE:

1. THE CONTROLLER SHALL CONTINUE TO MONITOR ROOM TEMPERATURE AND RESET THE CFM SETPOINT UP OR DOWN IN RESPONSE TO COOLING DEMAND.
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4. ON A CONTINUED FALL IN ROOM TEMPERATURE, CONTINUE DELIVERING THE SCHEDULED MINIMUM AIR FLOW WHILE INCREASING THE HOT WATER OUTPUT TO MAINTAIN THE HEATING SETPOINT.

UNOCCUPIED MODE:

1. THE CONTROL AIR DAMPER SHALL BE ALLOWED TO MODULATE TO MINIMUM UNOCCUPIED AIR CFM SETPOINT ACCORDING TO SCHEDULE.
2. UNOCCUPIED STATUS TO BE DETERMINED BY LOCAL OCCUPANCY SENSOR.

SETPOINTS:

COOLING SETPOINT 74°F (+/- 3°F ADJUSTABLE RANGE)
HEATING SETPOINT 70°F (+/- 3°F ADJUSTABLE RANGE)

PROVIDE THE FOLLOWING FOR VAV-12 AND VAV-13 TERMINAL UNIT BOXES:
CONFIGURE THE TEMRINAL UNIT BOX TO FUNCTION AS A CONSTANT VOLUME AIR TERMINAL UNIT. THE REHETA COIL WILL MODULATE TO MAINTAIN TEMPERATURE ONLY.

5 TYPICAL VAV W/ 2-WAY HHW REHEAT CONTROL DIAGRAM AND SEQUENCE
NOT TO SCALE

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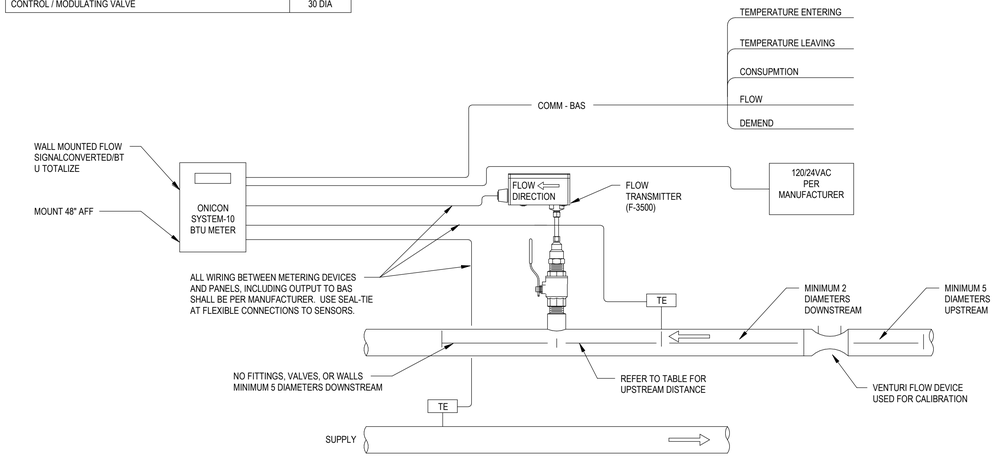
Sheet Information

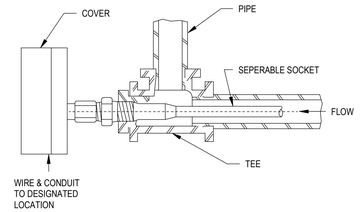
MISCELLANEOUS HVAC CONTROLS

IC206

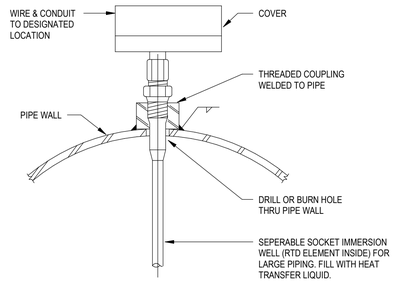
MINIMUM UPSTREAM STRAIGHT RUN REQUIRED	
OBSTRUCTION	UPSTREAM
SINGLE BEND PRECEDED BY ≥ 9 DIAMETERS OF STRAIGHT PIPE RUN	10 DIA
PIPE SIZE REDUCTION / EXPANSION IN STRAIGHT RUN	10 DIA
SINGLE BEND PRECEDED BY ≤ 9 DIAMETERS OF STRAIGHT PIPE RUN	15 DIA
OUTFLOWING TEE / PUMP OUTFLOW	20 DIA
MULTIPLE BENDS OUT OF PLANE	30 DIA
INFLOWING TEE	30 DIA
CONTROL / MODULATING VALVE	30 DIA



1 UTILTY METER - ONICON (TYPICAL FOR HHW AND CHW PIPING)
NO SCALE

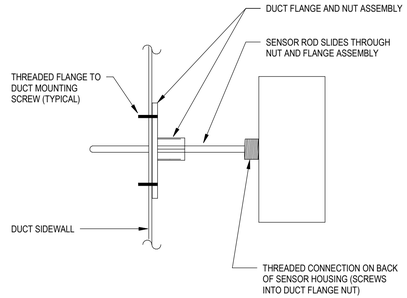


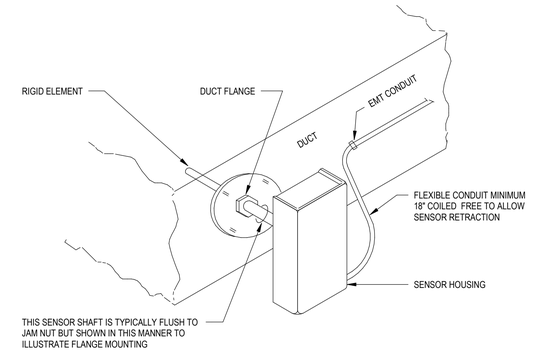
SMALL PIPING - 3" OR LESS



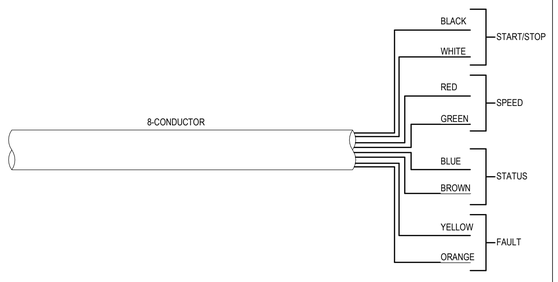
LARGE PIPING - GREATER THAN 3"

2 TEMPERATURE SENSOR INSTALLED IN PIPE INSTALLATION DETAIL
NO SCALE

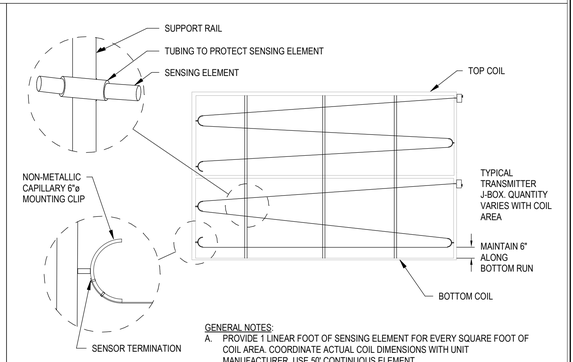




3 TYPICAL DUCT MOUNTED TEMPERATURE OR HUMIDITY SENSOR INSTALLATION DETAIL
NO SCALE



4 VFD WIRING DIAGRAM
NO SCALE



GENERAL NOTES:
A. PROVIDE 1 LINEAR FOOT OF SENSING ELEMENT FOR EVERY SQUARE FOOT OF COIL AREA. COORDINATE ACTUAL COIL DIMENSIONS WITH UNIT MANUFACTURER. USE 50' CONTINUOUS ELEMENT.

5 AVERAGING TEMPERATURE SENSOR DETAIL
NO SCALE

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CONTROLS DETAILS

IC207

PLUMBING LEGEND

PIPE FITTINGS:

	SANITARY ELBOW
	SANITARY LONG SWEEP ELBOW
	SANITARY CAP
	SANITARY TRANSITION
	SANITARY DOUBLE TEE
	SANITARY LONG SWEEP DOUBLE TEE
	SANITARY TEE
	SANITARY TEE WITH 8TH BEND
	SANITARY TEE WITH 8TH DOUBLE BEND
	SANITARY P-TRAP
	COPPER ELBOW
	COPPER TEE
	COPPER CROSS
	COPPER TRANSITION
	COPPER COUPLING/CAP
	STEEL THREADED ELBOW
	STEEL THREADED TEE
	STEEL THREADED CROSS
	STEEL THREADED TRANSITION
	STEEL THREADED CAP

PLUMBING VALVES

	BALL VALVE
	BALANCING VALVE
	CHECK VALVE
	GATE VALVE
	BACKFLOW PREVENTER

PLUMBING FIXTURES

	FLOOR DRAIN
	CLOSET FLANGE

ANNOTATIONS

1 / P1.11	SHEET REFERENCE CALL OUT
	ELEVATION
	CONNECT TO EXISTING
1 / P1.11	SECTION CALL OUT
1	SHEET NOTE CALL OUT
1	DEMOLITION NOTE CALL OUT
1	REVISION LABEL
M	GAS METER
R	GAS REGULATOR

PIPE TYPES

	DEMOLITION PIPING
	EXISTING PIPING
	NEW PIPING

ABBREVIATIONS

ABV	CLG ABOVE FINISHED CEILING
AD	AREA DRAIN
AFF	ABOVE FINISHED FLOOR
AP	ACCESS PANEL
AV	ACID VENT
AW	ACID WASTE
BFP	BACKFLOW PREVENTER
BTU	BRITISH THERMAL UNITS
BTUH	BTU PER HOUR
B	BOILER
CA	COMPRESSED AIR
CB	CATCH BASIN
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CI	CAST IRON
CO	CLEANOUT
CTG	CLEANOUT TO GRADE
CWV	COMBINATION WASTE VENT
D	INDIRECT DRAIN
DCR	DOMESTIC COLD WATER RETURN
DCS	DOMESTIC COLD WATER SUPPLY
DCW	DOMESTIC COLD WATER
DHR	DOMESTIC HOT WATER RETURN
DHS	DOMESTIC HOT WATER SUPPLY
DHW	DOMESTIC HOT WATER
DI	DEIONIZED
DIA, Ø	DIAMETER
DIR	DEIONIZED RETURN
DIS	DEIONIZED SUPPLY
DM	DEMINERALIZED
EA	EACH
ELEV	ELEVATION
ES	EMERGENCY SHOWER
EWC	ELECTRIC WATER COOLER
EX	EXISTING TO REMAIN
°F	DEGREES FARENHEIT
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FFE	FINISHED FLOOR ELEVATION
FH	FUME HOOD
FT	FEET
FT WG	FEET OF WATER, GAUGE
GA	GAUGE
GAL	GALLONS
GALV	GALVANIZED
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HB	HOSE BIBB
HP	HORSEPOWER
HPW	HIGH PURITY WATER
HR	HOUR
HW	HEADWALL
ID	INSIDE DIAMTER
IN	INCHES
IN. WG	INCHES OF WATER, GAUGE
INV	INVERT
KW	KILOWATTS
KWH	KILOWATT HOUR
LAV, L	LAVATORY
LA	LABORATORY AIR
LV	LABORATORY VENT
LW	LABORATORY WASTE
LVAC	LABORATORY VACUUM
MAX	MAXIMUM
MBH	THOUSANDS OF BTU'S
MCF	THOUSANDS OF CUBIC FEET
MH	MANHOLE
MIN	MINUTE; MINIMUM
MR	MOP RECEPTOR
MV	MEDICAL VACUUM
N2	NITROGEN
N20	NITROUS OXIDE
NC	NORMALLY CLOSED
NG	NATURAL GAS
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NTS	NOT TO SCALE
02	OXYGEN
OC	ON CENTER
OD	OUTSIDE DIAMETER
P	PUMP
PH, Ø	PHASE
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYLCHLORIDE
RD	ROOF DRAIN
RL	RAIN LEADER
RPBFP	REDUCED PRESSURE BACKFLOW PREVENTER
RPM	REVOLUTIONS PER MINUTE
RW	RAINWATER
SAN	SANITARY
SF	SQUARE FEET
SIM	SIMILAR
SK	SINK
SPEC	SPECIFICATION
SS	SANITARY SEWER, STAINLESS STEEL
SSD	SITE STORM DRAIN
STD	STANDARD
ST	STORM
STL	STEEL
SW	SOFT WATER
TEMP	TEMPERATURE
TP	TRAP PRIMER
TS	TEMPERED WATER
TYP	TYPICAL
UG	UNDERGROUND
UR	URINAL
V	VENT
VFD	VARIABLE FREQUENCY DRIVE
VFM	VENTURI FLOW METER
VIYB	VALVE-IN-YARD-BOX
VLV	VALVE
W	WASTE OR SOIL
WC	WATER CLOSET
WCO	WALL CLEANOUT
WH	WALL HYDRANT
WHA'X'	WATER HAMMER ARRESTOR, 'X' - PDI SIZE
X	EXISTING TO BE REMOVED

DIVISION 22 CODES & STANDARDS

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.

2. CODES
   2.1. ALL WORK UNDER DIVISION 22 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 GOVERN THE WORK:
      2.6.1. FLORIDA BUILDING CODE - BUILDING - SEVENTH EDITION (2020).
      2.6.2. FLORIDA BUILDING CODE - PLUMBING - SEVENTH EDITION (2020).
      2.6.3. FLORIDA BUILDING CODE - MECHANICAL - SEVENTH EDITION (2020).
      2.6.4. FLORIDA BUILDING CODE - FUEL GAS - SEVENTH EDITION (2020).
      2.6.5. FLORIDA BUILDING CODE - TEST PROTOCOLS FOR HIGH VELOCITY HURRICANE ZONES - SEVENTH EDITION (2020).
      2.6.6. FLORIDA FIRE PREVENTION CODE - 2020
         A. FIRE CODE (NFPA 1) - 2018 FLORIDA EDITION
         B. LIFE SAFETY CODE (NFPA 101) - 2018 FLORIDA EDITION
      2.6.7. NATIONAL ELECTRIC CODE (NFPA 70) - 2017.
      2.6.8. INSTALLATION OF AIR CONDITIONING AND VENTILATION SYSTEMS (NFPA 90A) - 2015.
      2.6.9. INSTALLATION OF SPRINKLER SYSTEMS (NFPA 13) - 2016.

3. STANDARDS
   3.1. ALL DIVISION 22 MATERIALS, INSTALLATION AND SYSTEMS SHALL MEET THE REQUIREMENTS OF THE FOLLOWING STANDARDS, INCLUDING THE LATEST ADDENDA AND AMMENDMENTS, TO THE EXTENT REFERENCED:
      3.1.1. UNDERWRITERS' LABORATORIES (UL)
      3.1.2. AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI)
      3.1.3. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
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      3.1.8. AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE)
      3.1.9. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
      3.1.10. STANDARDS OF THE HYDRONIC INSTITUTE (IBR)

RECIRCULATION PUMP SCHEDULE

MARK	RP-1 (1)(2)
MANUFACTURER	B&G
MODEL NUMBER	ECOCIRC XL 36-45
SIZE RPM	1750
TYPE	CENTRIFUGAL INLINE
CAPACITY (GPM)	5
TOTAL HEAD (FT. H20)	20
MOTOR (HP)	1/6 HP
ELECTRICAL CHAR. (V-Ø)	120V 1Ø

(1) SET POINT - 105°F, VARIABLE SPEED
(2) WIRELESS CONTROLLER CARD

COLD WATER DEMAND

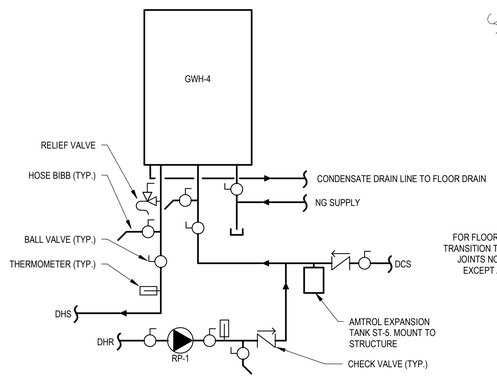
FIXTURE TYPE	WSFU PER FIXTURE				TOTAL WSFU		
	COLD	HOT	TOTAL	COUNT	COLD	HOT	TOTAL
ELECTRIC WATER COOLER	0.25	0	0.25	2	0.5	0	0.5
SINK (PRIVATE)	1	1	1.4	2	2	2	2.8
LAVATORY (PUBLIC)	1.5	1.5	2	7	10.5	10.5	14
MOP RECEPTOR	2.25	2.25	3	1	2.25	2.25	3
WATER CLOSET (PUBLIC / FLUSH VALVE)	10	0	10	5	50	0	50
URINAL (FLUSH VALVE)	5	0	5	1	5	0	5
LAB SINKS	1.5	1.5	2	8	12	12	16
SHOWER HEAD (PUBLIC)	3	3	4	1	3	3	4
				TOTALS	85.25	29.75	95.3
TOTAL DEMAND (GPM)							65
COLD WATER MAIN SIZE (IN)							2 1/2
LOAD VALUES IN WATER SUPPLY FIXTURE UNITS (WSFU)							95

WATER PRESSURE REQUIREMENT CALCULATION

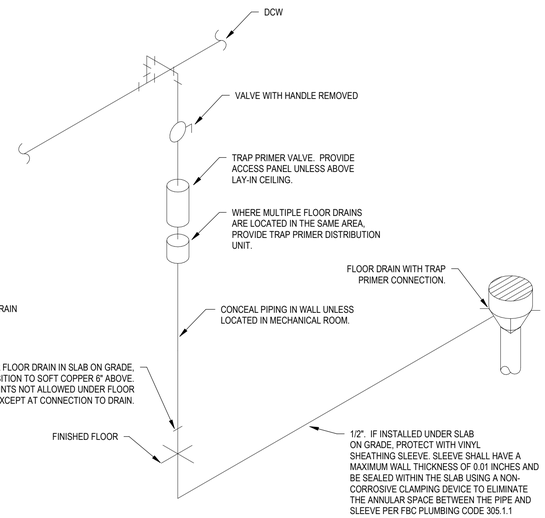
PRESSURE REQUIREMENT AT REMOTE FIXTURE (PSI)		30
FRICTION LOSS THROUGH PIPE (PRESSURE DROP THROUGH PIPE 2 PSI/100 FT)		
	LENGTH OF PIPE TO REMOTE FIXTURE (FT)	195
	EQUIVALENT LENGTH (LENGTH OF PIPE X 1.5) (FT)	292.5
	FRICTION LOSS THROUGH PIPE (PSI)	5.85
PRESSURE LOSS FROM STATIC ELEVATION:		
	ELEVATION CHANGE FROM WATER SUPPLY TO REMOTE FIXTURE (FT)	15
	PRESSURE LOSS FROM ELEVATION (ELEVATION X 0.43) (PSI)	6.45
PRESSURE LOSS THROUGH BACKFLOW PREVENTER (PSI)		12
MISCELLANEOUS LOSS (PSI)		5
TOTAL PRESSURE REQUIRED AT CONNECTION TO WATER SYSTEM (PSI)		59.3

PLUMBING FIXTURE SCHEDULE

TYPE MARK	DCW	DHW	SAN	VENT	ELECTRICAL	GPM/GPF	FAUCET/FLUSH VALVE	REMARKS
WC-1	1 1/2"	-	4"	2"	-	1.28 GPF	BATTERY OPERATED AUTOMATIC FLUSH VALVE	
WC-2	1 1/2"	-	4"	2"	-	1.28 GPF	BATTERY OPERATED AUTOMATIC FLUSH VALVE	
UR-6	1"	-	2"	2"	-	0.125 GPF	BATTERY OPERATED AUTOMATIC FLUSH VALVE	
L-18	1/2"	1/2"	2"	2"	-	0.35 GPM	BATTERY OPERATED AUTOMATIC FAUCET	PROVIDE WATER HAMMER ARRESTER TYPE "A" ON HOT AND COLD WATER PIPES
DF-3	1/2"	-	2"	2"	-	-	-	
EWC-6	1/2"	-	2"	2"	120V 1Ø	-	-	PROVIDE WATER HAMMER ARRESTER TYPE "A"
MR-1	3/4"	3/4"	2"	2"	-	-	-	
SK-1	1/2"	1/2"	2"	2"	-	1.5 GPM	-	
SH-2	1/2"	1/2"	2"	-	-	1.5 GPM	-	
ES-2	1 1/4"	-	2"	-	-	-	-	
LS-1	1/2"	1/2"	2"	2"	-	1.5 GPM	-	
IM-1	1/2"	-	-	-	-	-		PROVIDE WATER HAMMER ARRESTER TYPE "A"
IK-1	1/2"	-	-	-	-	-		PROVIDE WATER HAMMER ARRESTER TYPE "A"
GWH-4	1 1/2	1 1/2	-	-		-	-	
FS-1	-	-	4"	2"	-	-	-	
LC-3	-	-	-	-	-	-	-	DECK MOUNTED LAB GAS COCK - DOUBLE OUTLET, 5CFH



2 GAS WATER HEATER DIAGRAM
NOT TO SCALE



1 TRAP PRIMER DIAGRAM
NOT TO SCALE

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SRIKANTH SUNKARI
PE - 0056039

Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

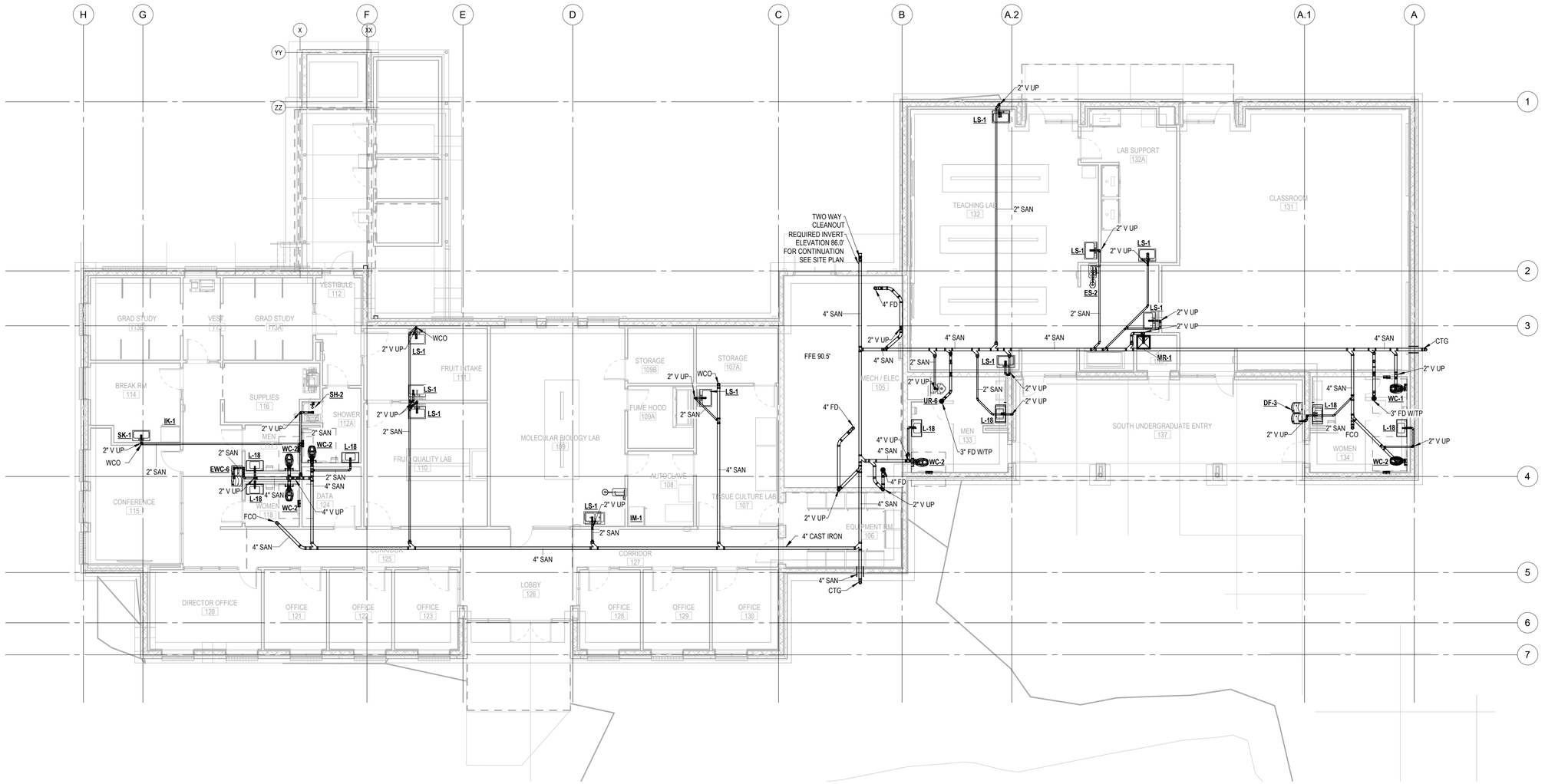
Revisions

No.	Description	Date

Sheet Information

LEGEND, ABBREVIATIONS, NOTES, CODES, STANDARDS, DETAILS, AND SCHEDULES

P001



UNDERFLOOR PLAN - SANITARY
SCALE: 1/8" = 1'-0"

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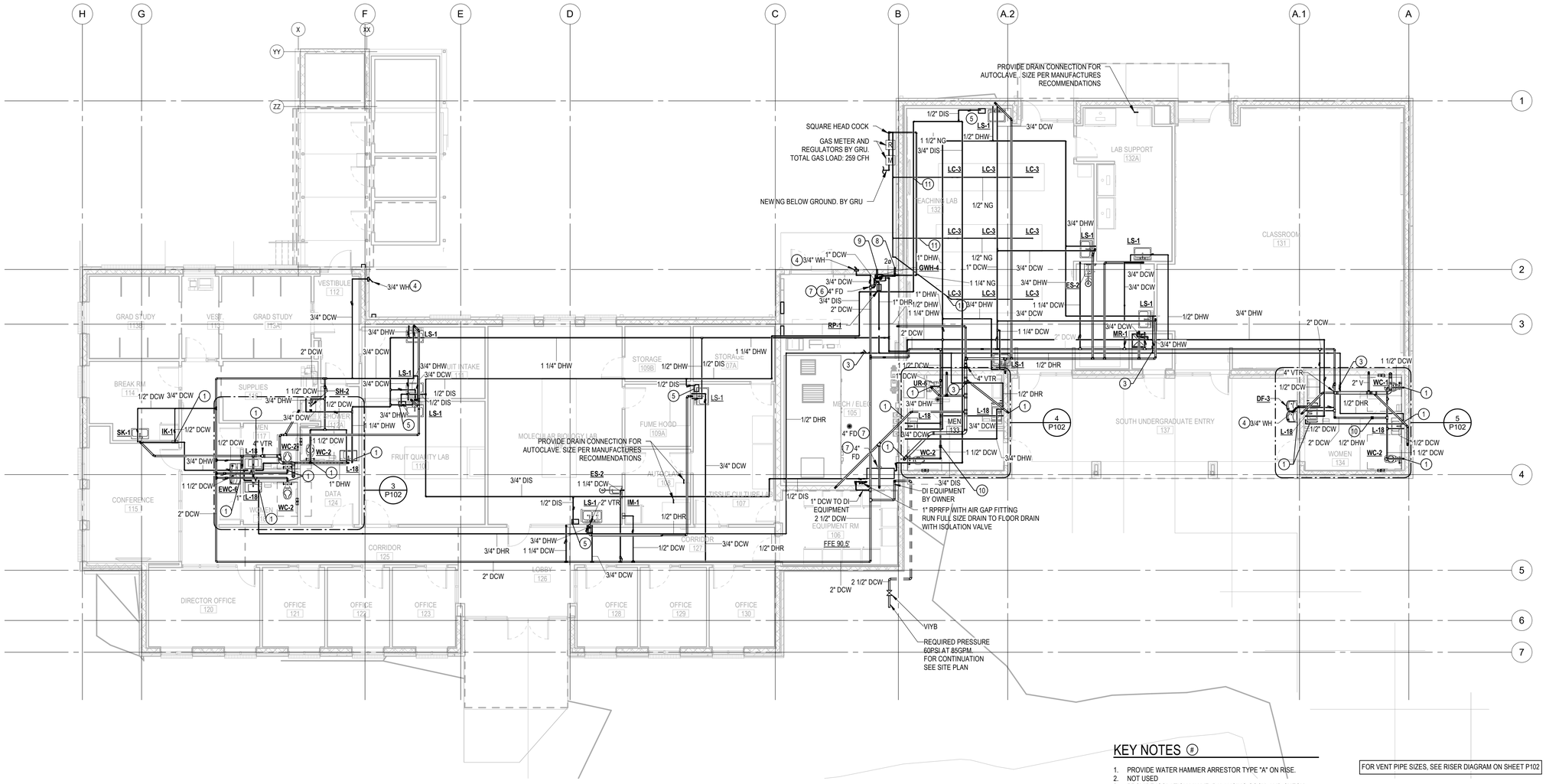
UNDERFLOOR PLAN - SANITARY

P100



FLOOR PLAN
SCALE: 1/8" = 1'-0"

KEY NOTES (#)

1. PROVIDE WATER HAMMER ARRESTOR TYPE "A" ON RISE.
2. NOT USED
3. PROVIDE ISOLATION VALVE, BALANCING COCK, AND CHECK VALVE
4. INSTALL WALL HYDRANT 18" ABOVE GRADE. COORDINATE EXACT LOCATION WITH ARCHITECTURAL DRAWINGS.
5. PROVIDE DI WATER WITH BALL VALVE AT MINIMUM OF 72" AFF FOR POLISHER.OWNER PROVIDED DI POLISHER. CONTRACTOR SHALL INSTALL AND MAKE IT OPERATIONAL. COORDINATE LOCATION WITH DRYING RACKS.
6. ROUTE DRAIN PIPING FROM GAS WATER HEATER TO NEAREST FLOOR DRAIN.
7. PROVIDE BARRIER-FREE TRAP PRIMER SEAL PROTECTION DEVICE, PER FBC-PLUMBING CODE 2017 EDITION, PARAGRAPH 1002.4.1.4. ZURN 1072, OR APPROVED EQUAL.
8. PROVIDE UBBINK GAS VENT AND AIR INTAKE PIPING PER MANUFACTURER'S REQUIREMENTS. PROVIDE INTAKE AT A MINIMUM OF 12" FROM VENT.
9. PROVIDE GAS VENT A MINIMUM OF 10' FROM OA INTAKE LOUVER.
10. PROVIDE TRAP PRIMER VALVE WITH 1/2" COLD WATER DISCHARGE DOWN TO FLOOR DRAINS/FLOOR SINKS.
11. RUN 1/2" NG PIPE IN THE 2" PVC CONDUIT AND SEAL ONE END SEALED AND OTHER END TERMINATE OUTDOOR WITH INSECT SCREEN. PIPING SHALL BE INSTALLED PER FBC FUEL GAS ,6TH EDITION 404.8, 404.8.1

FOR VENT PIPE SIZES, SEE RISER DIAGRAM ON SHEET P102

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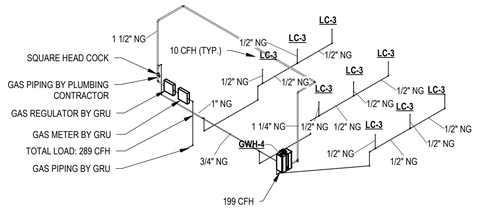
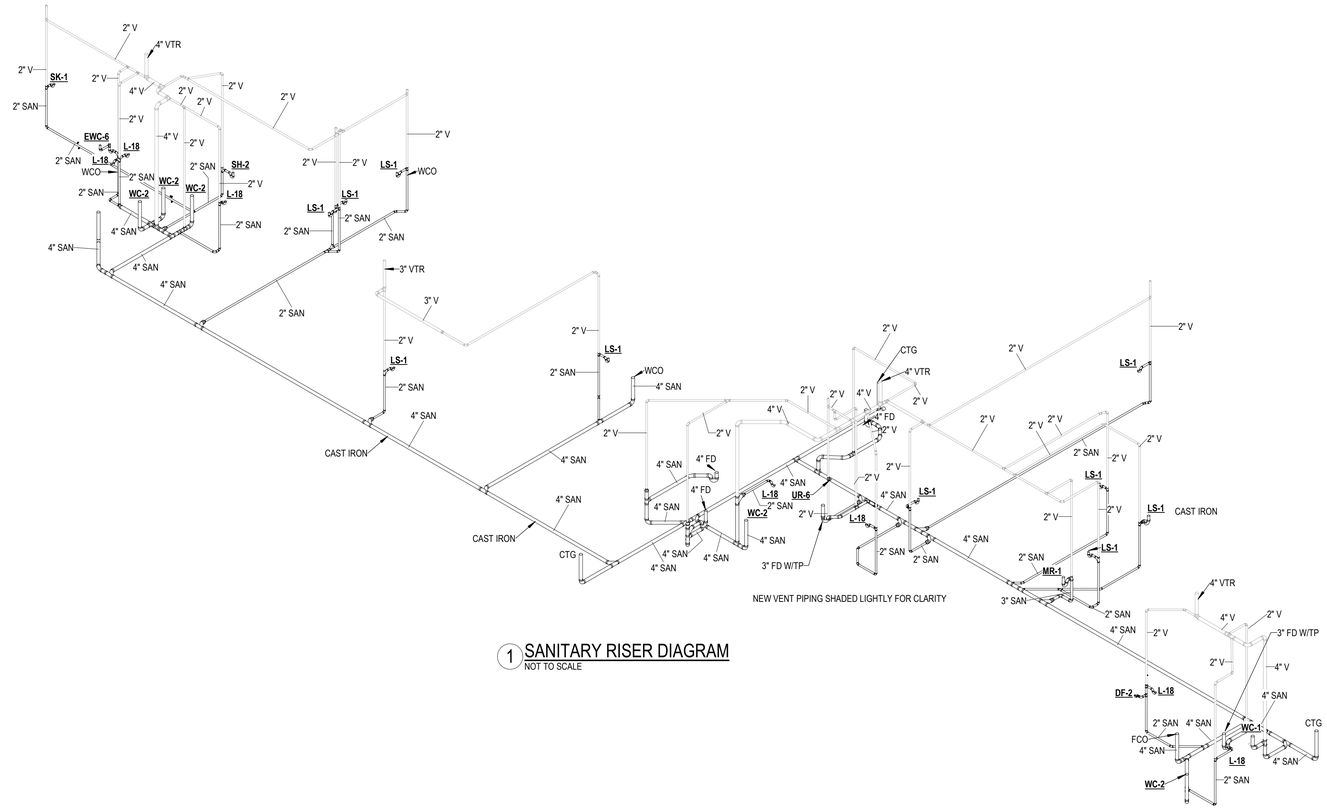
Sheet Information

FLOOR PLAN - WATER, GAS, AND VENT

P101

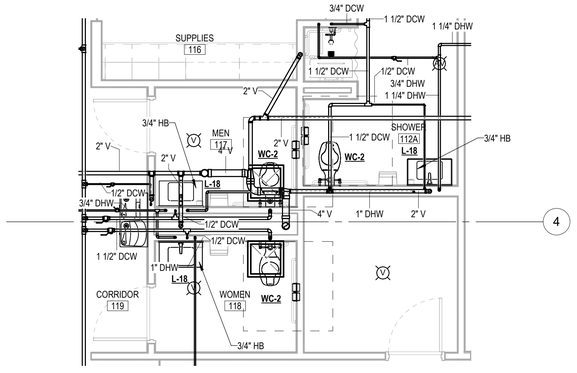


2 GAS RISER
NOT TO SCALE

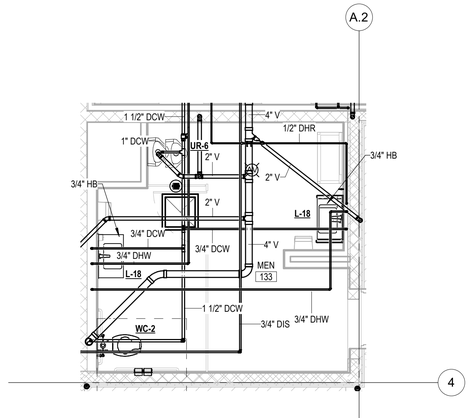


NEW VENT PIPING SHADED LIGHTLY FOR CLARITY

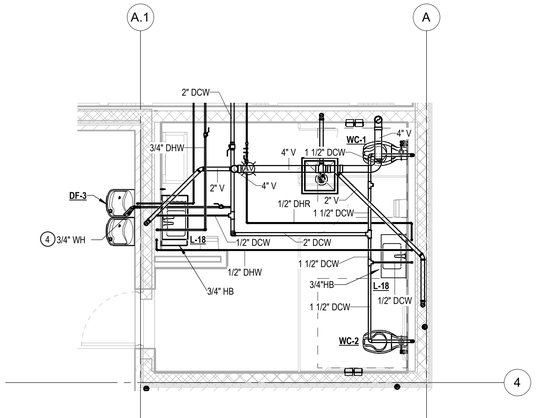
1 SANITARY RISER DIAGRAM
NOT TO SCALE



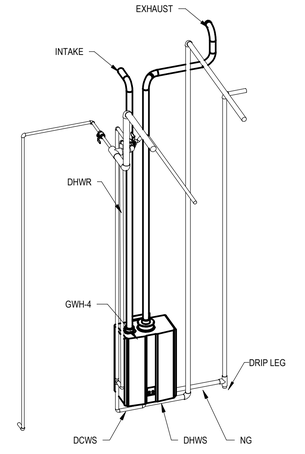
3 ENLARGED PLAN WEST TOILET ROOMS
SCALE: 1/4" = 1'-0"



4 ENLARGED PLAN MEN 133
SCALE: 1/4" = 1'-0"



5 ENLARGED PLAN WOMEN 134
SCALE: 1/4" = 1'-0"



6 WATER HEATER PIPING ISOMETRIC VIEW
NOT TO SCALE

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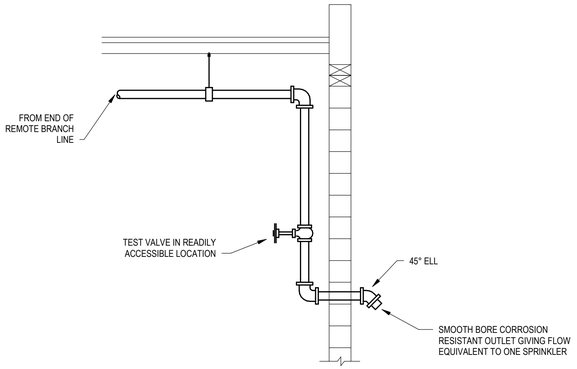
No.	Description	Date

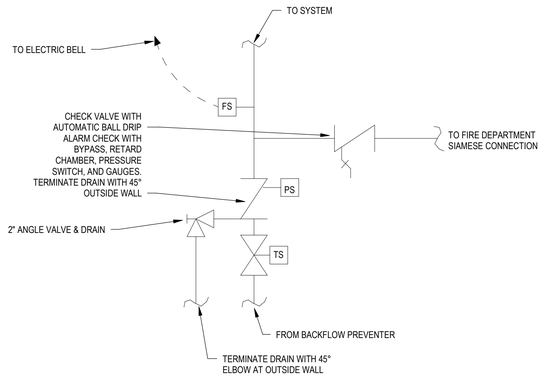
Sheet Information

RISERS AND ENLARGED PLANS

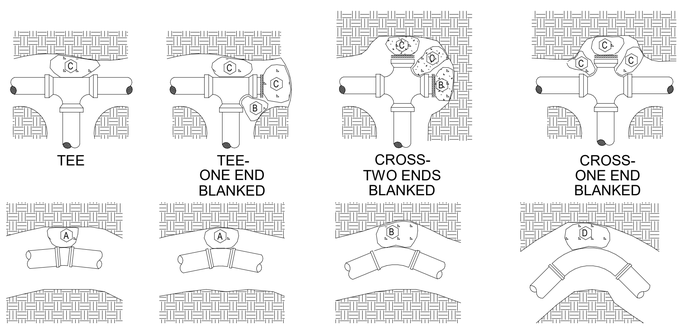
P102



1 INSPECTORS TEST CONNECTION DETAIL FOR WET-PIPE SYSTEM
NOT TO SCALE



2 FIRE SPRINKLER RISER DIAGRAM
NOT TO SCALE



PIPE SIZE	CUBIC FEET OF CONCRETE			
	A	B	C	D
<=4"	1.0	1.5	1.5	2.0
6"	1.5	2.5	3.0	4.0
8"	2.0	4.0	5.0	7.0
10"	3.0	5.5	7.0	10.0

NOTES:

1.) THE BEARING AREAS GIVEN ARE BASED ON A MINIMUM OF 2000 LBS. PER SQUARE FOOT SOIL BEARING AGAINST UNDISTURBED TRENCH WALL AND FOR 150 LBS. PER SQUARE INCH PRESSURE. THE FIGURES SHOWN REPRESENT THE MINIMUM VERTICAL PROJECTED AREA OF THE REACTION BLOCK.

2.) USE 2500 LBS. PER SQUARE INCH MINIMUM CONCRETE FOR ALL REACTION BLOCKS. PROVIDE VISQUEEN OR FELT BETWEEN THE CONCRETE AND THE PIPE.

3 THRUST BLOCK DETAIL
NOT TO SCALE

DIVISION 21 CODES & STANDARDS

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.

2. CODES

   2.1. ALL WORK UNDER DIVISION 21 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 GOVERN THE WORK:
   2.6.1. FLORIDA BUILDING CODE - BUILDING - SEVENTH EDITION (2020).
   2.6.2. FLORIDA BUILDING CODE - PLUMBING - SEVENTH EDITION (2020).
   2.6.3. FLORIDA BUILDING CODE - MECHANICAL - SEVENTH EDITION (2020).
   2.6.4. FLORIDA BUILDING CODE - FUEL GAS - SEVENTH EDITION (2020).
   2.6.5. FLORIDA BUILDING CODE - TEST PROTOCOLS FOR HIGH VELOCITY HURRICANE ZONES - SEVENTH EDITION (2020).
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   3.1.2. AMERICAN NATIONAL STANDARDS INSTITUTION (ANSI)
   3.1.3. AMERICAN SOCIETY OF TESTING MATERIALS (ASTM)
   3.1.4. NATIONAL FIRE PROTECTION (NFPA)
   3.1.5. NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
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   3.1.8. AMERICAN SOCIETY OF HEATING, REFRIGERATION, AND AIR CONDITIONING ENGINEERS (ASHRAE)
   3.1.9. AIR MOVEMENT AND CONTROL ASSOCIATION (AMCA)
   3.1.10. STANDARDS OF THE HYDRONIC INSTITUTE (IBR)

FIRE PROTECTION NOTES

1. THE SPRINKLER SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE 2016 EDITION OF NFPA 13 AND THE SPECIFICATIONS.
2. MAINTAIN THE INTEGRITY OF ALL FIRE RATED ASSEMBLIES AND ACOUSTICAL ASSEMBLIES.
3. COORDINATE ALL WORK WITH OTHER TRADES TO ALLOW FOR A MINIMUM OF INTERFERENCE.
4. PROVIDE 10 DAYS NOTICE BEFORE ALL OPERATIONAL TESTS. PROVIDE 2 DAYS NOTICE BEFORE ALL HYDROSTATIC TESTS. REFER TO SPECIFICATIONS.
5. THE DESIGN OF THE FIRE PROTECTION SYSTEM SHOWN ON THE DRAWINGS AND SPECIFICATIONS IS BY THE MOSES ENGINEERING ENGINEER-OF-RECORD. THE CONTRACTOR'S BID FOR THIS WORK IS TO PROVIDE A SYSTEM THAT MEETS THE INTENT OF THE DESIGN SHOWN. CONTRACTUAL REQUIREMENTS INCLUDE PREPARING WORKING (SHOP) DRAWINGS TO SHOW THE EXACT DETAILS OF THE INSTALLATION AND THE COORDINATION WITH OTHER TRADES, AS WELL AS FURNISHING AND INSTALLING THE MATERIAL SHOWN.
6. MODIFY/PROVIDE IDENTIFICATION TAGS AT FIRE DEPARTMENT CONNECTIONS (FDC) INDICATING THE BUILDING NUMBER(S) SERVED BY THAT FDC.
7. PROVIDE IDENTIFICATION TAGS AT EACH CONTROL VALVE.
8. LOCATE SPRINKLER HEADS IN THE CENTER OF CEILING TILES IN BOTH DIRECTIONS.
9. CONTRACTOR SHALL COORDINATE NEW WORK WITH OTHER TRADES.
10. A COPY OF THE REVIT DISKS OF THE SPRINKLER SYSTEM DESIGN WILL BE AVAILABLE TO THE SPRINKLER SUBCONTRACTOR TO ASSIST IN WORKING (SHOP) DRAWING PREPARATION IF DESIRED.
11. CONTRACTOR SHALL PROVIDE AN ADDITIONAL 5 HEADS IN THE BID FOR THE PROJECT. THESE HEADS WILL BE USED TO MEET ANY STATE FIRE MARSHAL REQUIRMENTS.

ABBREVIATIONS

ABV CLG	ABOVE FINISHED CEILING	KW	KILOWATTS
AFF	ABOVE FINISHED FLOOR	KWH	KILOWATT HOUR
AP	ACCESS PANEL	MAX	MAXIMUM
BFP	BACKFLOW PREVENTER	MIN	MINIMUM
DI	DUCTILE IRON	NIC	NOT IN CONTRACT
DIA, Ø	DIAMETER	NTS	NOT TO SCALE
EA	EACH	OC	ON CENTER
ELEV	ELEVATION	P	PUMP
EX	EXISTING TO REMAIN	PH,Ø	PHASE
°F	DEGREES FAHRENHEIT	PIV	POST-INDICATOR VALVE
FDC	FIRE DEPARTMENT CONNECTION	PRV	PRESSURE REDUCING VALVE
		PSI	POUNDS PER SQUARE INCH
FS	FLOW SWITCH	PVC	POLYVINYLCHLORIDE
FT	FEET	RPBFP	REDUCED PRESSURE BACKFLOW PREVENTOR
FT WG	FEET OF WATER, GAUGE		
GA	GAUGE	RPM	REVOLUTIONS PER MINUTE
GAL	GALLONS	SF	SQUARE FEET
GPH	GALLONS PER HOUR	SPEC	SPECIFICATION
GPM	GALLONS PER MINUTE	TS	TAMPER SWITCH
HP	HORSEPOWER	TYP	TYPICAL
HR	HOUR	UG	UNDERGROUND
IN	INCHES	VLV	VALVE
IN. WG	INCHES OF WATER, GAUGE	WS	WINDOW SPRINKLER
INV	INVERT	X	EXISTING TO BE REMOVED

GENERAL NOTE:

EXISTING PIPING HAS BEEN INCLUDED FROM EXISTING BUILDING DRAWINGS AND IS UNVERIFIED. CONTRACTOR TO VERIFY ALL POINTS OF CONNECTION BEFORE FABRICATION OF NEW PIPING.

HYDRAULIC DESIGN CRITERIA

LIGHT HAZARD - WET

DESIGN AREA OF WATER APPLICATION: (MAXIMUM CEILING HEIGHT IS 11'-4". DESIGN AREA IS REDUCED PER NFPA-13, 2013 EDITION, PARAGRAPH 11.2.3.2.3.1.)	1158 SQ FT
MINIMUM DENSITY OF APPLICATION:	0.1 GPM/SQ FT
AREA PER SPRINKLER:	196 SQ FT
ALLOWANCE FOR INSIDE HOSE STREAM:	0 GPM
ALLOWANCE FOR OUTSIDE HOSE STREAM:	100 GPM
TOTAL CALCULATED HYDRAULIC FLOW:	347.6 GPM

FIRE FLOW TEST DATA

STATIC PRESSURE (1):	76 PSI
RESIDUAL PRESSURE (1):	52 PSI
FLOW (2):	967 GPM
DATE:	07/21/2020
TIME:	10:05 AM
SIZE OF MAIN:	6 INCHES
TYPE OF MAIN:	CIRCULATING
SOURCE OF SUPPLY:	GAINESVILLE REGINAL UTILITIES
TEST PERFORMED BY:	PPD - UTILITIES

NOTES:
(1) MEASURED AT FIRE HYDRANT DESIGNATED "A" ON THE DRAWINGS. ELEVATION SHOWN ON THE DRAWINGS.
(2) MEASURED AT FIRE HYDRANT DESIGNATED "B" ON THE DRAWINGS.

FIRE PROTECTION DESIGN CRITERIA

OWNER:	UNIVERSITY OF FLORIDA
NAME OF FACILITY:	IFAS BLUEBERRY RESEARCH FACILITY
STREET ADDRESS:	UF 640 BUILDING - HULL ROAD
LOCATION:	GAINESVILLE
TYPE OF CONSTRUCTION:	2B
OCCUPANCY:	BUSINESS
AUTHORITY HAVING JURISDICTION:	STATE FIRE MARSHAL/EH&S
GENERAL BUILDING HAZARD:	LIGHT
MAXIMUM PROTECTION AREA PER HEAD:	196 SQ FT

FIRE PROTECTION LEGEND

FIRE PROTECTION SPRINKLERS

- QUICK RESPONSE PENDENT SPRINKLER
- QUICK RESPONSE UPRIGHT SPRINKLER

FIRE PROTECTION EQUIPMENT

- CHECK VALVE
- BUTTERFLY VALVE WITH TAMPER SWITCH
- TEST METER
- FLOW SWITCH
- CONTROL VALVE ASSEMBLY

ANNOTATIONS

- 1 / P1.11 — SHEET REFERENCE CALL OUT
- CONNECT TO EXISTING
- 1 / P1.11 — SECTION CALL OUT
- S1 — HYDRAULIC CALCULATION NODE
- 1 — SHEET NOTE CALL OUT
- 1 — DEMOLITION NOTE CALL OUT
- 1 — REVISION LABEL

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SRIKANTH SUNKARI
PE - 0056039

Project Information

Owner

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MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

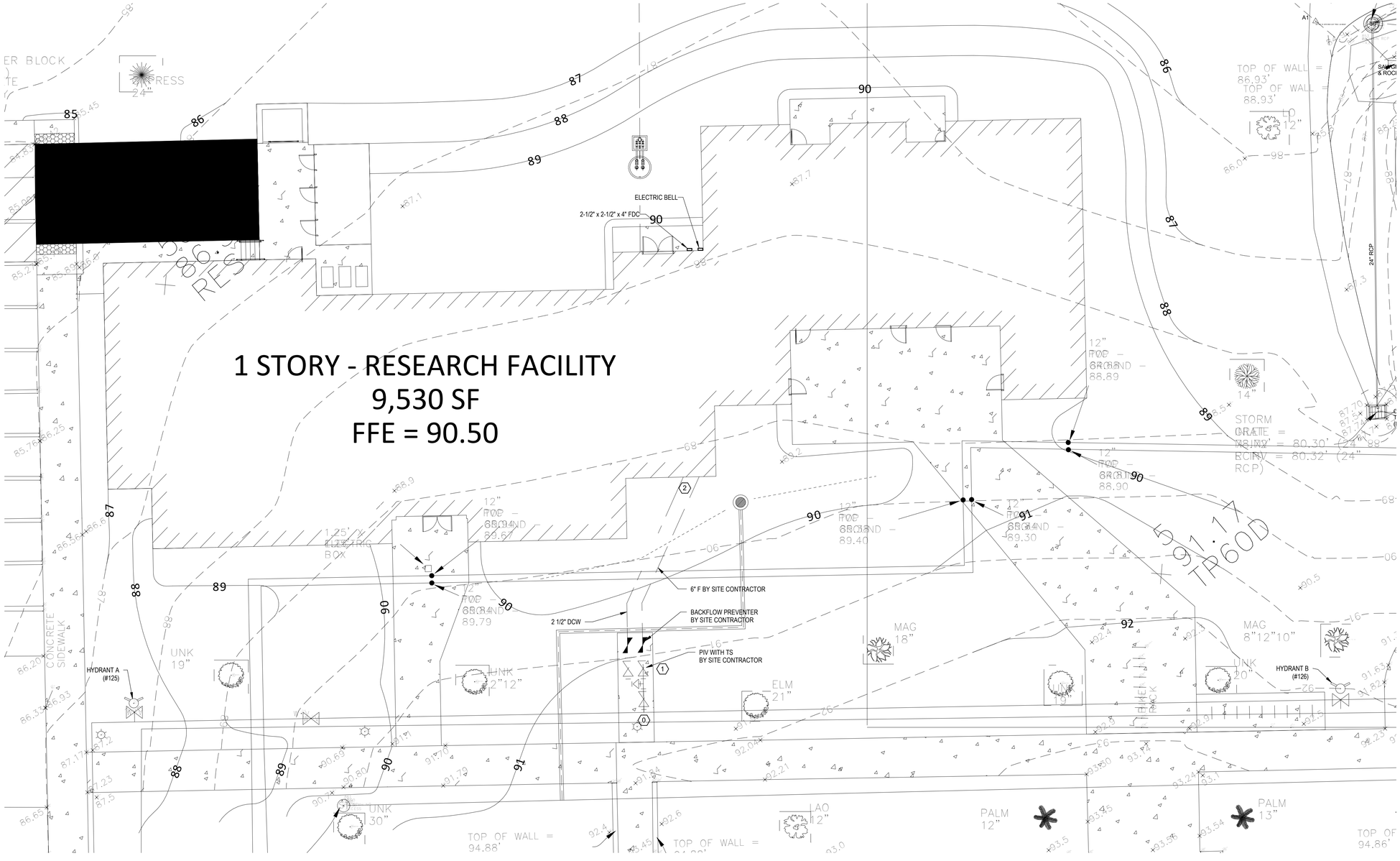
Revisions

No.	Description	Date

Sheet Information

LEGEND, NOTES AND DESIGN CRITERIA

F001



SITE PLAN
SCALE: 1" = 10'-0"

FOR REFERENCE ONLY
SEE CIVIL DRAWING C400

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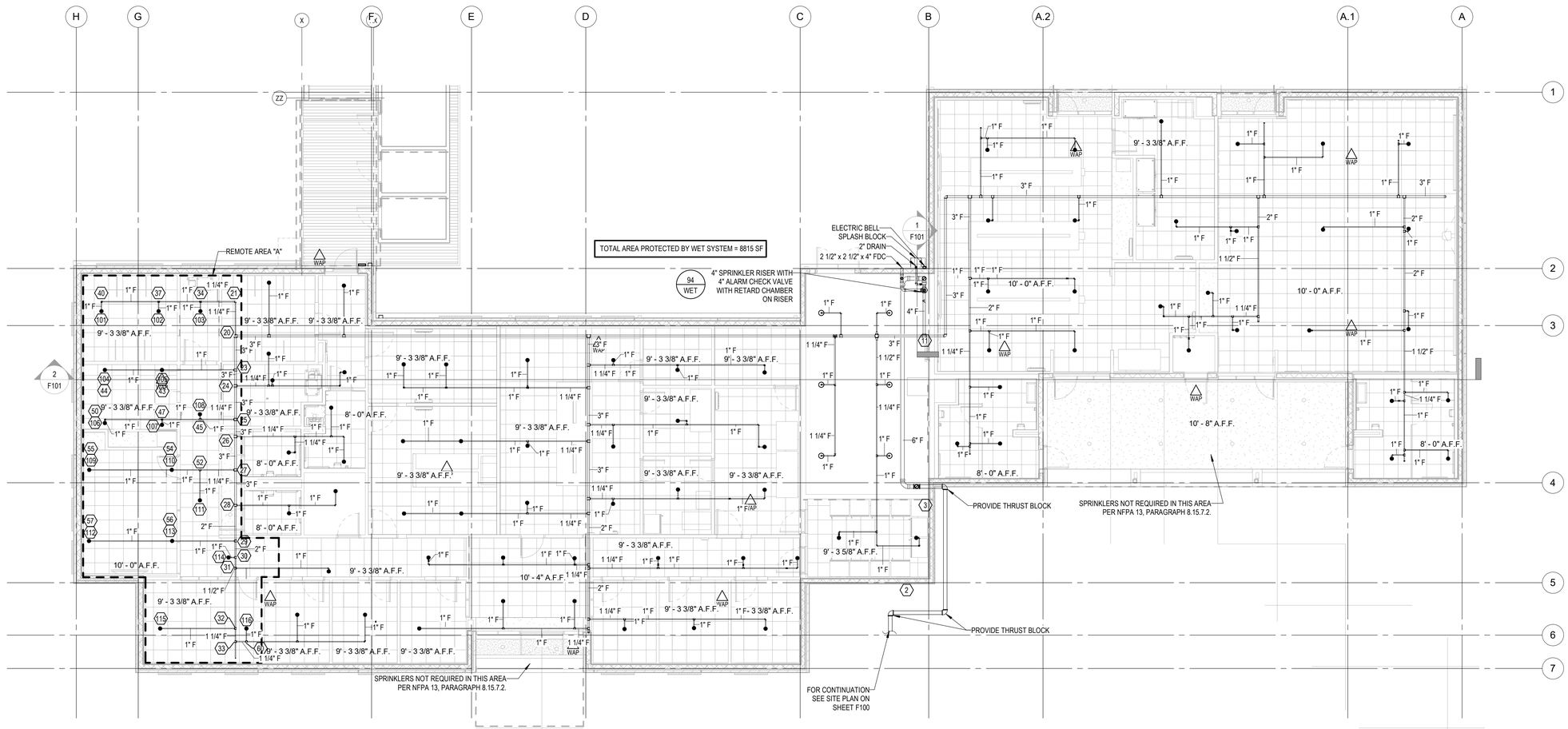
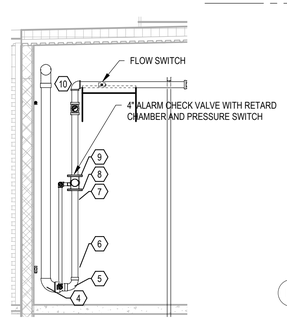
SITE PLAN

F100



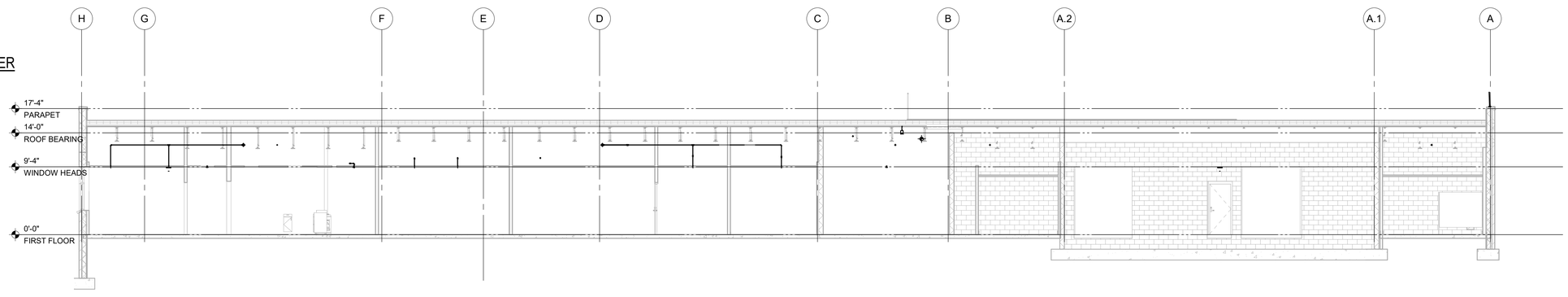
REFLECTED CEILING PLAN

SCALE: 1/8" = 1'-0"



1 / F101 FIRE PROTECTION RISER

1/4" = 1'-0"



2 / F101 BUILDING SECTION VIEW

1/8" = 1'-0"

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REFLECTED CEILING PLAN

F101

CODES AND STANDARDS

THIS PROJECT WAS DESIGNED IN ACCORDANCE WITH THESE CODES :

1. FLORIDA BUILDING CODE (FBC)
   - A. BUILDING - 2020 7TH EDITION
   - B. TEST PROTOCOLS FOR HIGH VELOCITY HURRICANE ZONES - 2020 7TH EDITION
2. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
   - A. NATIONAL ELECTRIC CODE (NFPA 70) - 2017
   - B. NATIONAL FIRE ALARM CODE (NFPA 72) - 2016
3. FLORIDA FIRE PREVENTION CODE - 2020
   - A. FIRE CODE (NFPA 1) - 2018 FLORIDA EDITION
   - B. LIFE SAFETY CODE (NFPA 101) - 2018 FLORIDA EDITION

ALL SYSTEMS SHALL MEET THE REQUIREMENTS OF THE FOLLOWING STANDARDS:

1. AMERICAN NATIONAL STANDARD INSTITUTES (ANSI)
2. ILLUMINATING ENGINEERING SOCIETY (IES)
3. INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
4. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATIONS (NEMA)
5. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
6. OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)
7. UNDERWRITER'S LABORATORIES, INC. (UL)
8. OWNER'S CONSTRUCTION STANDARDS

ELECTRICAL LEGEND

GENERAL WIRING DEVICES:

- $ — SINGLE POLE LIGHTING SWITCH. MOUNT 48" AFF TO TOP UNLESS NOTED OTHERWISE. SUBSCRIPT INDICATES AS FOLLOWS:
  - 3 - THREE-WAY LIGHTING SWITCH.
  - 4 - FOUR-WAY LIGHTING SWITCH.
  - D - SLIDE DIMMER SWITCH WITH PRESET.
  - M - MANUAL MOTOR STARTER.
  - a,b - LETTER INDICATES ZONE OF CONTROL.
  - T - TIME DELAY LIGHT SWITCH FOR DELAYED OFF TO EXHAUST FAN.
  - DT - DIGITAL TIME SWITCH WITH AUDIBLE & "FLASH LIGHTING" ALERTS.
- DUPLEX RECEPTACLE NEMA 5-20R. MOUNT 18" AFF UNLESS NOTED OTHERWISE. VERIFY DUPLEX MOUNTING REQUIREMENTS WITH ARCHITECTURAL DRAWINGS PRIOR TO ROUGH-IN. ALL GFI DEVICES AND DEVICES IN DAMP AND WET LOCATIONS SHALL BE WEATHER-RESISTANT "WR" TYPE. SUBSCRIPT INDICATES AS FOLLOWS:
  - G - GROUND FAULT CIRCUIT INTERRUPTER TYPE.
  - WP - GFI DEVICE WITH CLEAR WEATHERPROOF (IN-USE) COVERPLATE. IN EXTERIOR LOCATIONS MOUNT 30" AFG.
  - EWC - GFI, MNT EXPOSED UNDER EWC (COORDINATE WITH EWC PROVIDER).
  - TV - COORDINATE RECEPTACLE LOCATION WITH A/V OUTLET.
  - 84" - MOUNTING HEIGHT OF DEVICE AFF.
  - C - 50% CONTROLLED OUTLET, CONTROLLED BY OCCUPANCY SENSOR, SEE DIAGRAM.
  - CC - 100% CONTROLLED OUTLET, CONTROLLED BY OCCUPANCY SENSOR, SEE DIAGRAM.
  - T - TOMBSTONE
- DUPLEX RECEPTACLE NEMA 5-20R. MOUNTED FACE DOWN IN CEILING (IN EXPOSED STRUCTURE CEILINGS, PENDANT MOUNT TO HEIGHT PER ARCHITECT/ENGINEER).
- DUPLEX RECEPTACLE MOUNTED 42" AFF OR MOUNT 7" ABOVE COUNTER. VERIFY COUNTER HEIGHT PRIOR TO ROUGH-IN.
- 6-30 — SPECIAL NEMA TYPE RECEPTACLE, SUBSCRIPT INDICATES NEMA TYPE. VERIFY WITH EQUIPMENT BEING SUPPLIED. MOUNTED 18" AFF, UNLESS NOTED OTHERWISE.
- QUADRAPLEX RECEPTACLE (TWO NEMA 5-20R) MOUNTED 18" AFF UNLESS NOTED OTHERWISE.
- QUADRAPLEX RECEPTACLE (TWO NEMA 5-20R) MOUNTED 42" AFF OR MOUNT 7" ABOVE COUNTER. VERIFY COUNTER HEIGHT PRIOR TO ROUGH-IN.
- QUADRAPLEX RECEPTACLE (TWO NEMA 5-20R) MOUNTED FACE DOWN IN CEILING (IN EXPOSED STRUCTURE CEILINGS, PENDANT MOUNT TO HEIGHT PER ARCHITECT/ENGINEER).
- DUPLEX RECEPTACLE NEMA 5-20R MOUNTED IN SURFACE RACEWAY.
- QUADRAPLEX RECEPTACLE (TWO NEMA 5-20R) MOUNTED IN SURFACE RACEWAY.
- QUADRAPLEX RECEPTACLE (TWO NEMA 5-20R) MOUNTED 42" AFF OR MOUNT 7" ABOVE COUNTER MOUNTED IN SURFACE RACEWAY. VERIFY COUNTER HEIGHT PRIOR TO ROUGH-IN.
- 6-20 — SPECIAL NEMA TYPE RECEPTACLE MOUNTED IN SURFACE RACEWAY. VERIFY WITH EQUIPMENT BEING SUPPLIED.
- MAINTAINED OPERATOR PUSHBUTTON STATION WITH RED BUTTON AT 48" AFF.
- SURFACE MOUNTED RACEWAY. SEE DETAIL. PROVIDE WITH OUTLETS AS INDICATED.
- UTILITY FLOOR BOX. TAG INDICATES TYPE. SEE DETAILS.

SITE EQUIPMENT:

- HH2 — HANDHOLE. SEE DETAIL. TAG INDICATES TYPE.

LIGHTING CONTROL EQUIPMENT:

- S4 — WALL MOUNTED LIGHT CONTROL STATION. MOUNT 48" AFF TO TOP UNO. LETTER/NUMBER INDICATES AS FOLLOWS:
  - S4 - LOW VOLTAGE BUTTON SWITCH, # INDICATES QTY OF BUTTONS/ZONES.
  - D4 - LOW VOLTAGE BUTTON DIMMER SWITCH, # INDICATES QTY OF BUTTONS/ZONES.
  - O2 - LINE VOLTAGE OCCUPANCY/VACANY SENSOR (DUAL TECHNOLOGY) SWITCH, # INDICATES QTY OF BUTTONS. PROGRAM FOR MANUAL ON, AUTO OFF.
- DT — CEILING OR PENDANT MOUNTED LOW VOLTAGE 360° OCCUPANCY/VACANCY OR DAYLIGHT SENSOR. LETTERS INDICATE AS FOLLOWS:
  - DT - DUAL TECHNOLOGY.
  - DL - DAYLIGHT SENSOR.
- PC — PHOTOCELL.
- RC — ROOM CONTROLLER.
- PL — PLUG LOAD CONTROLLER.

LIGHTING FIXTURES:

- DL / a / H22 — TYPICAL LIGHT FIXTURE SYMBOLS. LETTERS & SHADING INDICATE AS FOLLOWS:

H22 - FIXTURE TAG. SEE LIGHTING FIXTURE SCHEDULE FOR DESCRIPTIONS. OTHER TEXT INDICATES AS FOLLOWS:
- a - ZONE OF CONTROL.
- DL - DIMMED BY DAYLIGHT SENSOR.
- 24/7 - ON CONTINUOUSLY FOR SECURITY (NOT SWITCHED).
- EM - FIXTURE HAS A BATTERY PACK AND IS EMERGENCY.
- 1/2 SHADED - FIXTURE HAS A BATTERY PACK AND IS EMERGENCY.

6DH EM / 24/7 — 14M

LIGHTNING PROTECTION:

- AIR TERMINAL
- BONDING CONDUCTOR
- CABLE DROP
- GROUND ROD

ACCESS CONTROL SYSTEM

- C — READER. MNT WITH TOP AT 48" AFF.
- 0-1 — ACS DOOR TYPE TAG (NOT THE SAME AS THE ARCHITECT'S DOOR TAG). SEE DOOR DETAILS.

DISTRIBUTION & POWER EQUIPMENT:

- 2P1A — PANELBOARD.
- 4MDS — SWITCHBOARD, SWITCHGEAR OR MCC.
- TPA / T — TRANSFORMER.
- VFD — VARIABLE FREQUENCY DRIVE W/INTEGRAL DISCONNECT. FURNISHED BY MECHANICAL, INSTALLED BY ELECTRICAL.
- ENCLOSED MOTOR STARTER.
- COMBINATION ENCLOSED MOTOR STARTER DISCONNECT.
- ENCLOSED CIRCUIT BREAKER.
- HEAVY DUTY SAFETY SWITCH.
- P — POWER RELAY IN ENCLOSURE.
- S — SPEED CONTROLLER. FURNISHED BY MECHANICAL, INSTALLED BY ELECTRICAL.
- ATSE — AUTOMATIC TRANSFER SWITCH.

MISCELLANEOUS EQUIPMENT:

- MOTOR.
- GA — EMERGENCY GENERATOR REMOTE ANNUNCIATOR. FLUSH MOUNTED AT 5'0" AFF.
- COPPER GROUNDING BUSBAR WITH STANDOFF INSULATORS. UNO, PROVIDE WITH #6AWG IN EMT FROM BUSBAR TO EMGB/MAIN ELECTRICAL SERVICE GROUND. MOUNT BUSBAR 12" AFF.
- J — JUNCTION BOX.
- E — ELECTRICAL CONNECTION TO EQUIPMENT. VERIFY LOCATION WITH EQUIPMENT PROVIDER. SUBSCRIPT INDICATES AS FOLLOWS:
  - AD - AUTOMATIC DOOR.
- R — ROUGH-IN BOX. MOUNT AT 18" AFF UNLESS SUBSCRIPTED OTHERWISE. PROVIDE 4" SQUARE BY 2-1/8" DEEP BOX, SINGLE-GANG RING & 1" CONDUIT TO ABOVE ACCESSIBLE CEILING AND TURNED HORIZONTAL WITH BUSHING AND PULL STRING.

FIRE ALARM SYSTEM:

- FACP — FIRE ALARM CONTROL PANEL.
- NAC — NOTIFICATION APPLIANCE CIRCUIT (NAC) EXTENDER PANEL.
- FA — REMOTE ANNUNCIATOR. FLUSH MOUNTED AT 5'0" AFF.
- DH — 24VDC MAGNETIC DOOR HOLDER.

SLC DEVICES:

- F — MANUAL PULL STATION. MNT WITH TOP AT 48" AFF.
- H — HEAT DETECTOR. CEILING MOUNT.
- S — PHOTOELECTRIC SMOKE DETECTOR. CEILING MOUNT.
- D — DUCT MOUNTED SAMPLE TUBE TYPE SMOKE DETECTOR. PROVIDED BY ELEC, INSTALLED BY MECH AND CONNECTED BY ELEC.
- R — ADDRESSABLE RELAY. SUBSCRIPT INDICATES AS FOLLOWS:
  - AHU - AHU SHUTDOWN.
  - LTG - INTERFACE WITH LIGHTING TO TURN LIGHTING ON DURING ALARM.
  - ACD - ACCESS CONTROLLED DOOR RELEASE.
- FS — MONITOR MODULE CONNECTED TO FLOW SWITCH.
- TS — MONITOR MODULE CONNECTED TO TAMPER SWITCH.
- MM — MONITOR MODULE.

NAC DEVICES:

- 75cd AV — WALL MOUNTED NOTIFICATION DEVICE. "AV" INDICATES AUDIO-VISUAL DEVICE, "V" INDICATES VISUAL ONLY DEVICE, "A" INDICATES AUDIO ONLY DEVICE. MOUNT AT 80" AFF TO STROBE OR 6" FROM CEILING, WHICHEVER IS LOWER. ALL STROBES SHALL BE SYNCHRONIZED. SUBSCRIPT INDICATES STROBE CANDELA RATING.
- 110cd AV — CEILING OR PENDANT MOUNTED NOTIFICATION DEVICE. "AV" INDICATES AUDIO-VISUAL DEVICE, "V" INDICATES VISUAL ONLY DEVICE, "A" INDICATES AUDIO ONLY DEVICE. MOUNT AT 80" AFF TO STROBE OR 6" FROM CEILING, WHICHEVER IS LOWER. ALL STROBES SHALL BE SYNCHRONIZED. SUBSCRIPT INDICATES STROBE CANDELA RATING.

OTHER:

- CIRCUIT RUN CONCEALED UG, BELOW FLOOR, ABOVE CEILING OR IN WALL.
- 2P2-9 — HOMERUN TO PANELBOARD. UNDERLINED TEXT INDICATES PANEL & CIRCUIT DESIGNATION.
- 1 — KEY NOTE TAG.
- 2P1A — BOLD UNDERLINED TEXT ADJACENT TO PLAN SYMBOL INDICATES ELECTRICAL EQUIPMENT IDENTIFICATION TAG. TYPICAL FOR PANELS, LIGHT FIXTURES, FLOORBOXES, TRANSFORMERS, ETC.
- LEADER.
- LEADER.

LINETYPE LEGEND:

- EXISTING TO REMAIN.
- NEW WORK.
- EXISTING TO BE DEMOLISHED.

ABBREVIATIONS

A	AMPS
AC	ABOVE COUNTER
ACS	ACCESS CONTROL SYSTEM
AF	AMP FRAME
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AHU	AIR HANDLING UNIT
AL	ALUMINUM
ARCH	ARCHITECT OR ARCHITECTURAL
AT	AMP TRIP
ATS	AUTOMATIC TRANSFER SWITCH
ATU	AIR TERMINAL UNIT
AWG	AMERICAN WIRE GAUGE
BAS	BUILDING AUTOMATION SYSTEM
BJ	BONDING JUMPER
BKR	CIRCUIT BREAKER
BLDG	BUILDING
BOD	BASIS OF DESIGN
C	CONDUIT
C/B, CB	CIRCUIT BREAKER
CL	CURRENT LIMITING
C/L	CENTERLINE
CLG	CEILING
CKT	CIRCUIT
CT	CURRENT TRANSFORMER
CU	COPPER
DEMO	DEMOLISH
DHC	DOOR HARDWARE CONTRACTOR
EC	ELECTRICAL CONTRACTOR
EGC	EQUIPMENT GROUNDING CONDUCTOR
ELEC	ELECTRICAL
EMGB	ELECTRICAL MAIN GROUNDING BUSBAR
EF	EXHAUST FAN
EX	EXISTING TO REMAIN
EXT	EXTERIOR
EWC	ELECTRIC WATER COOLER
EMT	ELECTRICAL METALLIC TUBING
EQUIP	EQUIPMENT
FMC	FLEXIBLE METAL CONDUIT
FACP	FIRE ALARM SYSTEM CONTROL PANEL
FU	FUSE
FA, F/A	FIRE ALARM
FLA	FULL LOAD AMPS
FLR	FLOOR
FSS	FUSED SAFETY SWITCH
FVNR	FULL VOLTAGE NON-REVERSING
GFI	GROUND FAULT INTERRUPTER
G	GROUND (OR GFI FOR RECEPTACLE SUBSCRIPT)
GC	GENERAL CONTRACTOR
GND	GROUND
GEC	GROUNDING ELECTRODE CONDUCTOR
HH	HANDHOLE
HOA	HAND-OFF-AUTOMATIC
HP	HEAT PUMP OR HORSEPOWER
HVAC	HEATING, VENTILATION & AIR-CONDITIONING
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
JB, JBOX	JUNCTION BOX
K	KILO
KAIC	KILO-AMPERE INTERRUPTING CAPABILITY
KCMIL	THOUSAND CIRCULAR MILS
LCP	LIGHTING CONTROL PANEL
LTG	LIGHTING
LFMC	LIQUID TIGHT FLEXIBLE METAL CONDUIT
LV	LOW VOLTAGE
MC	MECHANICAL CONTRCATOR
MCA	MINIMUM CIRCUIT AMPACITY
MCC	MOTOR CONTROL CENTER
MCE	MAIN COMMUNICATIONS EQUIPMENT ROOM
MCM	THOUSAND CIRCULAR MILS
MH	MANHOLE
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE
N1	NEMA 1
N3R	NEMA 3R
N/A, NA	NOT APPLICABLE
NEC	NATIONAL ELECTRICAL CODE
NESC	NATIONAL ELECTRICAL SAFETY CODE
N, NEU	NEUTRAL
OCPD	OVERCURRENT PROTECTION DEVICE
OFOI	OWNER FURNISHED OWNER INSTALLED
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OH	OVERHEAD
OHE	OVERHEAD ELECTRIC
OHP	OVERHEAD PRIMARY
OHS	OVERHEAD SECONDARY
P	POLE OR PHASE
PBD	PANELBOARD
PF	POWER FACTOR
PNL	PANELBOARD
PT	POTENTIAL TRANSFORMER
PWR	POWER
RCPT	RECEPTACLE
REQD	REQUIRED
RM	ROOM
RGS	RIGID GALVANIZED STEEL CONDUIT
RNC	RIGID NON-METALLIC CONDUIT
RVSS	REDUCED VOLTAGE SOLID STATE
SA	SURGE ARRESTER
SCA	SHORT CIRCUIT AMPS
SCCA	SHORT CIRCUIT CURRENT RATING
SF	SUPPLY FAN
SPD	SURGE PROTECTIVE DEVICE
SPEC	SPECIFICATION
SS	SAFETY SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TR	TELECOMMUNICATIONS ROOM
TGB	TELECOMMUNICATIONS GROUNDING BUSBAR
TMGB	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TX	TRANSFORMER
TYP	TYPICAL
UFR	UNDERFLOOR RACEWAY
UG	UNDERGROUND
UGE	UNDERGROUND ELECTRIC
UGP	UNDERGROUND PRIMARY
UGS	UNDERGROUND SECONDARY
UL	UNDERWRITERS' LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT
VA	VOLT-AMPERES
VAR	VOLT-AMPERES REACTIVE
VAV	VARIABLE AIR VOLUME UNIT
W	WATTS OR WIRE
WAO	WORK AREA OUTLET
WP	WEATHERPROOF
WSR	WITHSTAND RATING
XD	EXISTING TO BE DEMOLISHED
XFMR	TRANSFORMER
XR	EXISTING TO BE RELOCATED
Φ	PHASE
72°	DEGREES
Δ	DELTA
Ω	OHMS

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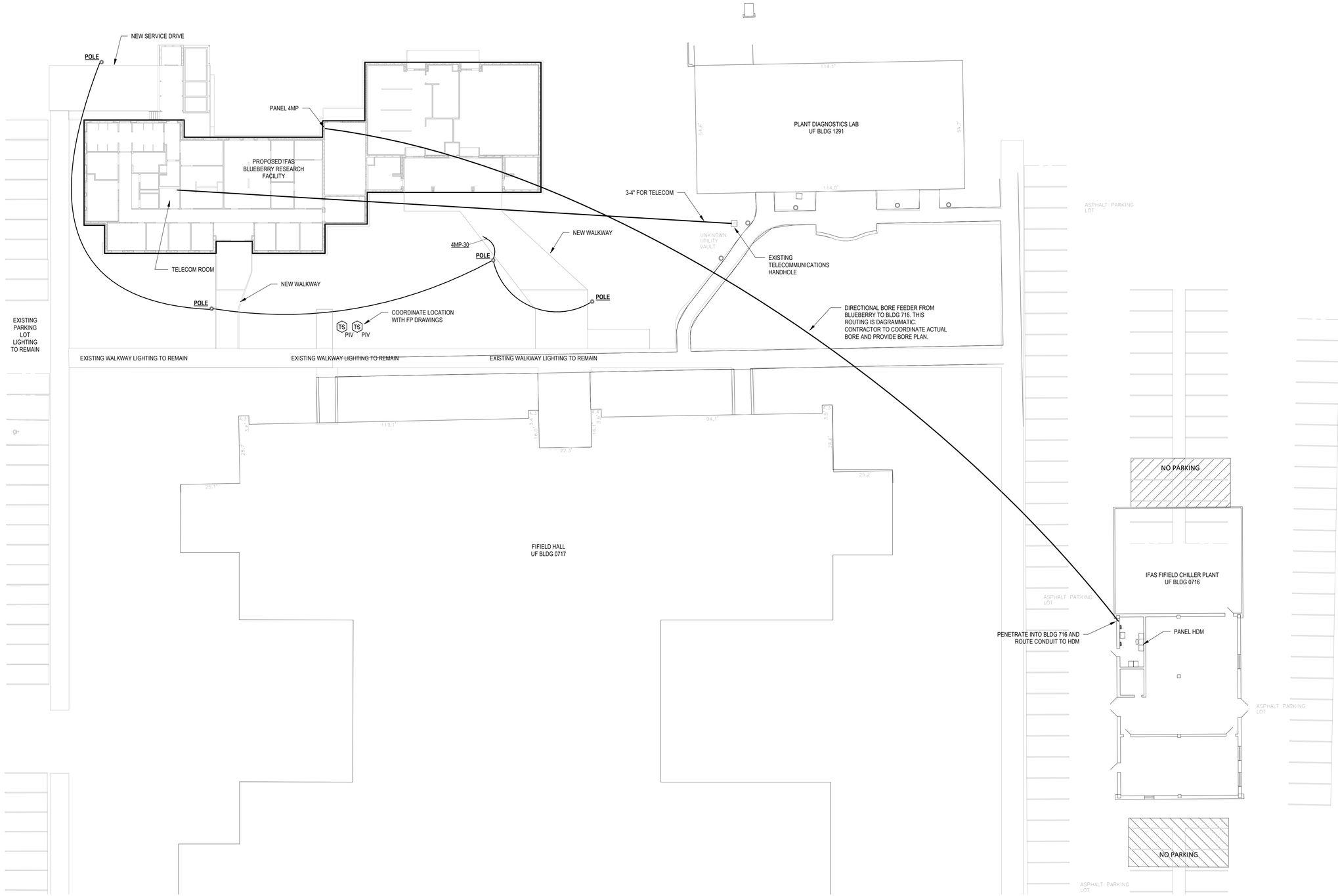
Sheet Information

ELECTRICAL - LEGEND, ABBREVIATIONS, CODES AND STANDARDS

E001



ELECTRICAL SITE PLAN
SCALE: 1" = 20'-0"

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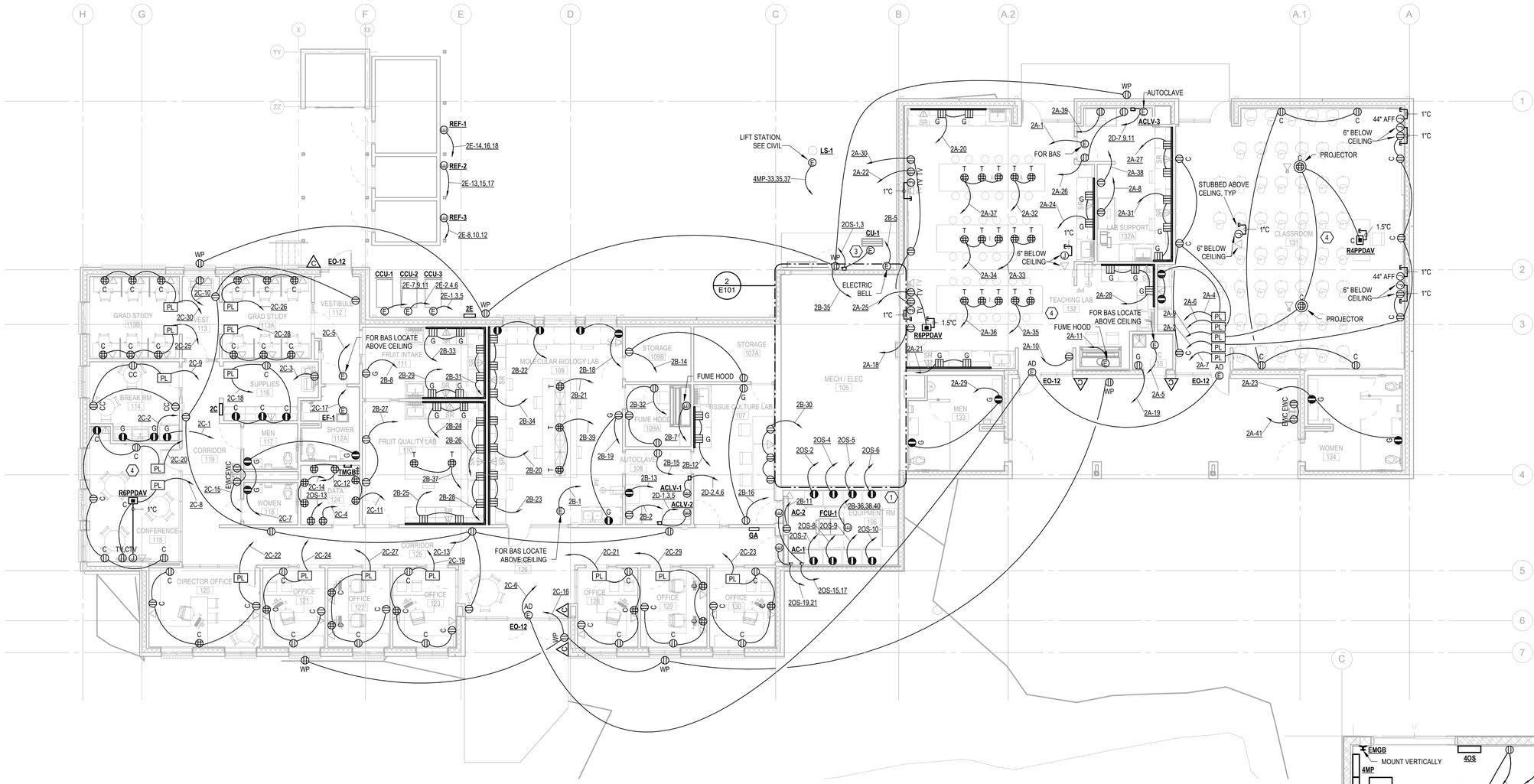
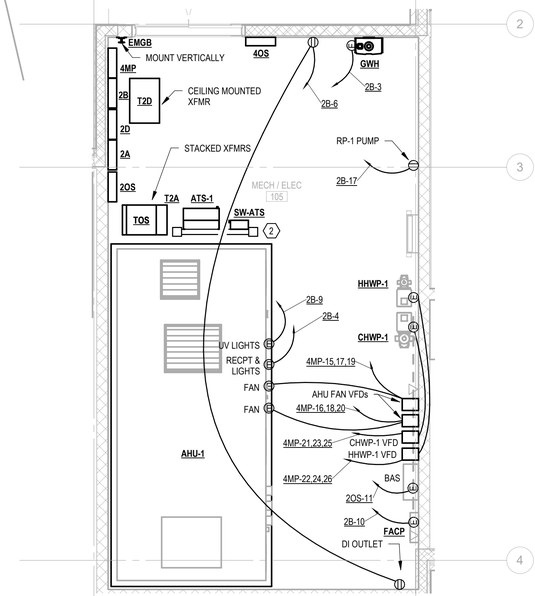
E011



1 FLOOR PLAN - POWER
SCALE: 1/8" = 1'-0"

KEY NOTES (#)

1. CIRCUIT TO OUTSIDE CONDENSING UNIT CU-1.
2. PROVIDE A UNISTRUT RACK TO MOUNT EQUIPMENT.
3. CIRCUIT TO AC-1.
4. SEE AV ROUGH-IN DIAGRAMS FOR ADDITIONAL SCOPE IN THIS ROOM.



2 ELECTRICAL ROOM
SCALE: 1/4" = 1'-0"

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Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

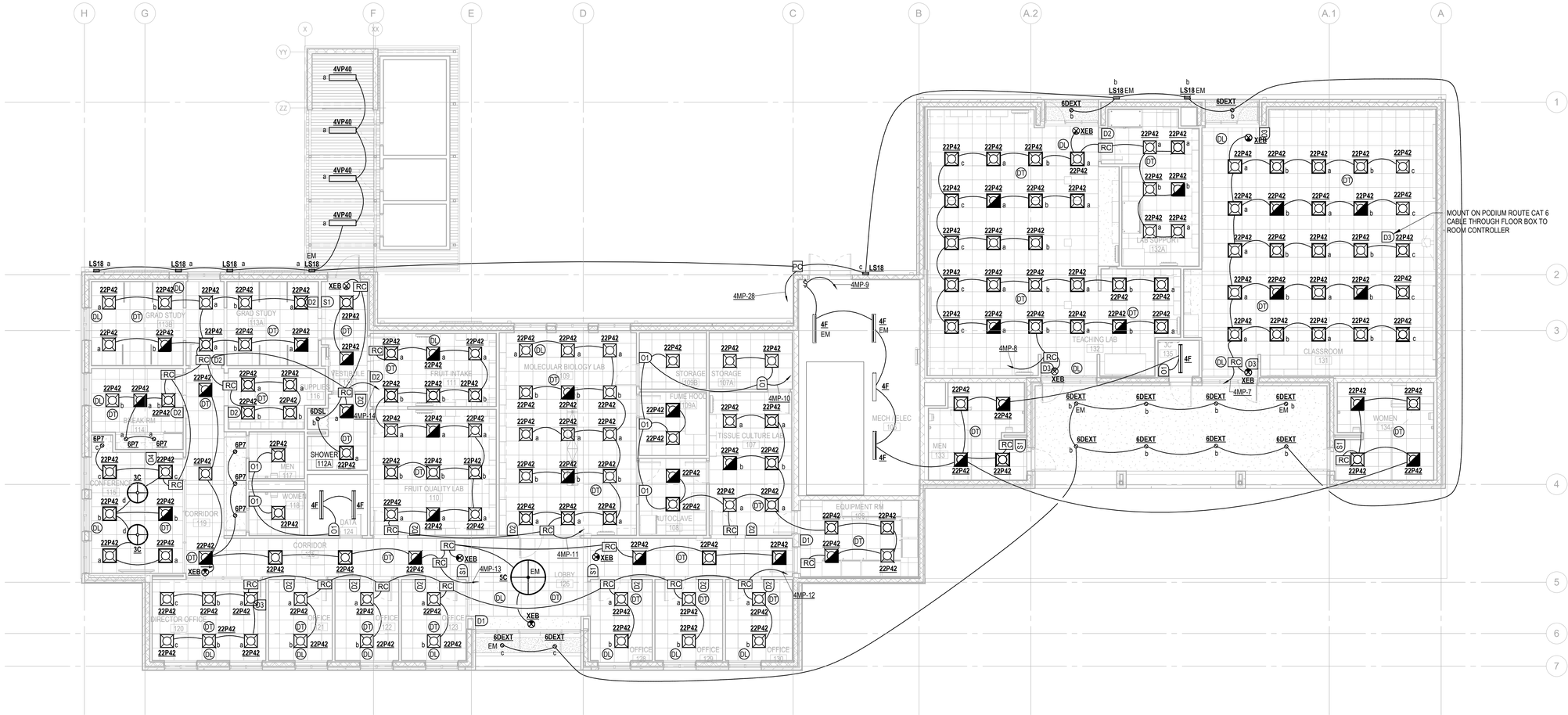
Revisions

No.	Description	Date

Sheet Information

FLOOR PLAN - POWER

E101



1 CEILING PLAN - LIGHTING
SCALE: 1/8" = 1'-0"

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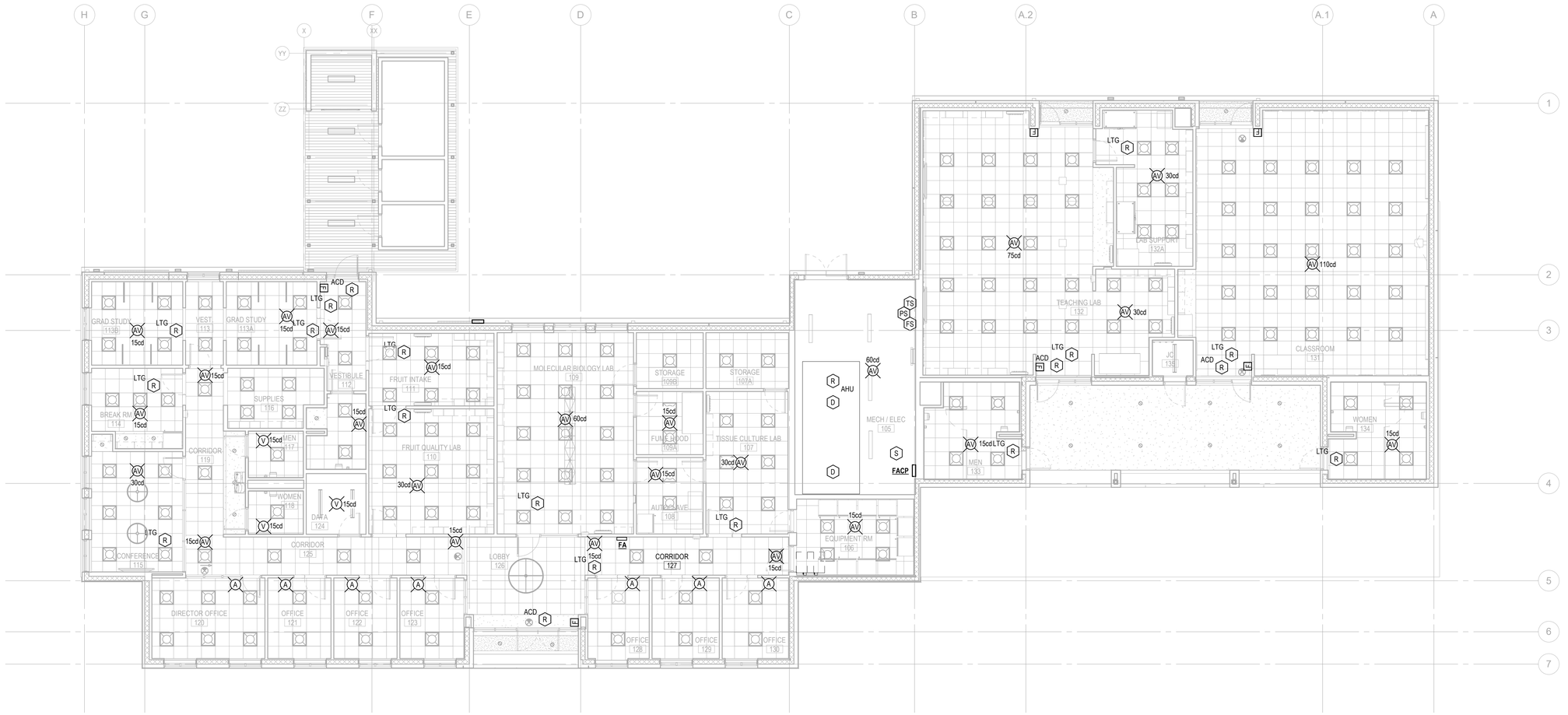
CEILING PLAN - LIGHTING

E111



CEILING PLAN - FIRE ALARM

SCALE: 1/8" = 1'-0"

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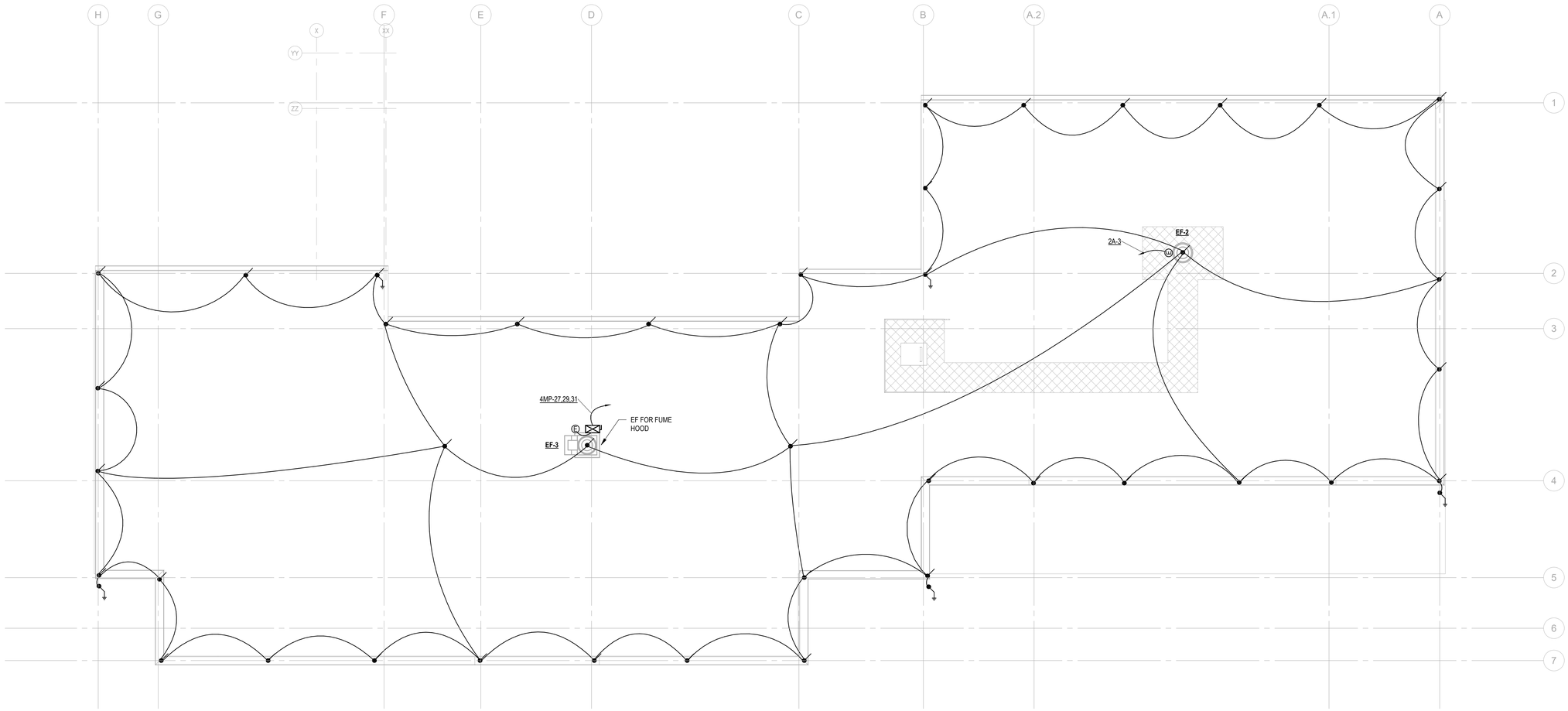
CEILING PLAN - FIRE ALARM

E112



ELECTRICAL ROOF PLAN
SCALE: 1/8" = 1'-0"

GENERAL LIGHTNING PROTECTION NOTE

CONTRACTOR SHALL PROVIDE A CLASS 1 LIGHTING PROTECTION SYSTEM IN COMPLIANCE WITH NFPA 780. SYSTEM SHALL BE PROVIDED WITH A MASTER LABEL ATTACHED TO THE BUILDING AND SHALL BE IN COMPLIANCE WITH UNDERWRITERS LABORATORIES, INC. MASTER LABEL SERVICE, UL96A. SEE SPECIFICATIONS FOR A COMPLETE DESCRIPTION. COORDINATE LAYOUT AND QUANTITY WITH ARCHITECTURAL PLANS. PROVIDE REQUIRED CONNECTIONS TO ROOF MOUNTED EQUIPMENT SUCH AS EXHAUST FANS, VENT-THRU-ROOF PIPES, ETC NOT SHOWN HERE, SEE MECHANICAL & PLUMBING PLANS.

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Revisions

No.	Description	Date

Sheet Information

ROOF PLAN

E121

SINGLE LINE DIAGRAM LEGEND

SCA:32.6KA — SHORT CIRCUIT AMPS. AVAILABLE SYMMETRICAL FAULT CURRENT IN kA AT EQUIPMENT/LOCATION INDICATED.

CIRCUIT BREAKER

NORMAL POWER FEEDER/CKT.

TRANSFORMER

GROUNDING ELECTRODE AND GROUNDING ELECTRODE CONDUCTOR

SWITCH

FUSE

CURRENT TRANSFORMER

ELECTRICITY METER

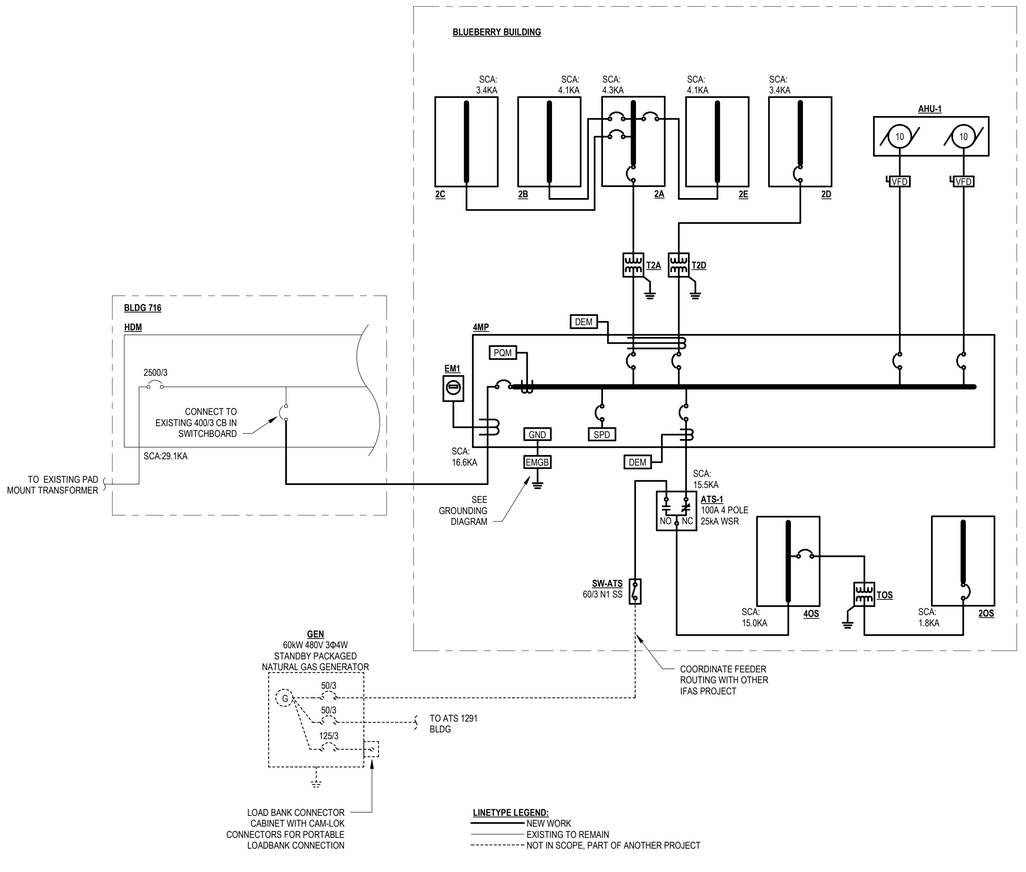
200 — MOTOR, NUMBER (IF SHOWN) INDICATES HORSEPOWER

PANELBOARD OR SWITCHBOARD. SEE PANELBOARD INFORMATION SCHEDULE FOR FEEDER SIZE AND PANELBOARD SIZE & DATA.

PQM — POWER QUALITY MONITOR WITH CT'S AND VOLTAGE CONNECTIONS.

DEM — DIGITAL ENERGY METER WITH CT'S AND VOLTAGE CONNECTIONS. FURNISHED BY DIV 25 INSTALLED BY DIV 26.

NOTE: OTHER SYMBOLS SHOWN IN THE SINGLE LINE DIAGRAM MAY BE IDENTIFIED IN THE MAIN ELECTRICAL LEGEND



1 SINGLE LINE DIAGRAM
NOT TO SCALE

MECHANICAL EQUIPMENT ELECTRICAL SCHEDULE

MARK	EQUIPMENT DESCRIPTION	VOLTAGE	PHASE	WIRE	LOAD	DISCONNECT		STARTER		SPD	SERVING PANEL	OCPD TRIP	MCA	CIRCUIT							NOTES
						TYPE	BY	TYPE	BY					QTY RUNS	PHASE	NEUTRAL	GROUND	CONDUIT	°C RATING	AMPACITY	
AHU-1	AIR HANDLING UNIT FAN	480	3	3	10 HP	SEE STARTER	MECH	VFD	MECH	NO	4MP	25	18	1	12	N/A	12	1/2"	60°	20 A	
	AIR HANDLING UNIT FAN	480	3	3	10 HP	SEE STARTER	MECH	VFD	MECH	NO	4MP	25	18	1	12	N/A	12	1/2"	60°	20 A	
	AIR HANDLING UNIT UV LIGHTS	120	1	2	3.5 A	INTEGRAL	MECH	N/A	N/A	NO	2B	15	6	1	12	12	12	1/2"	60°	20 A	
	AIR HANDLING UNIT LIGHTS & RECEPTACLE	120	1	2	5 A	INTEGRAL	MECH	N/A	N/A	NO	2B	15	6	1	12	12	12	1/2"	60°	20 A	
FCU-1	FAN COIL UNIT	208	3	2	3 A	INTEGRAL	MECH	INTEGRAL	MECH	NO	2B	15	4	1	12	N/A	12	1/2"	60°	20 A	
EF-1	TOILET EXHAUST FAN	120	1	2	7 A	INTEGRAL	MECH	RELAY	MECH	NO	2C	15	9	1	12	12	12	1/2"	60°	20 A	
EF-2	AUTOCLAVE EXHAUST FAN	120	1	2	1/4 HP	INTEGRAL	MECH	RELAY	MECH	NO	2A	15	2	1	12	12	12	1/2"	60°	20 A	
EF-3	FUME HOOD EXHAUST FAN	480	3	3	2 HP	SEE STARTER	ELEC	N3R FVNR	ELEC	NO	4MP	15	5	1	12	N/A	12	1/2"	60°	20 A	
CHWP-1	CHILLED WATER PUMP	480	3	3	3 HP	SEE STARTER	MECH	VFD	MECH	NO	4MP	15	6	1	12	N/A	12	1/2"	60°	20 A	
HHWP-1	HEATING HOT WATER PUMP	480	3	3	1 1/2 HP	SEE STARTER	MECH	VFD	MECH	NO	4MP	15	4	1	12	N/A	12	1/2"	60°	20 A	
AC-1	DX AIR HANDLER UNIT	208	1	2	1 A	15/2 N1 TS	ELEC	INTEGRAL	MECH	NO	2OS	15	1	1	12	N/A	12	1/2"	60°	20 A	
AC-2	DX AIR HANDLER UNIT	208	1	2	1 A	15/2 N1 TS	ELEC	INTEGRAL	MECH	NO	2OS	15	1	1	12	N/A	12	1/2"	60°	20 A	
CU-1	DX CONDENSING UNIT	208	1	2	16 A	30/2 N3R SS	ELEC	INTEGRAL	MECH	YES	2OS	30	21	1	10	N/A	10	1/2"	60°	30 A	
GWH	GAS WATER HEATER	120	1	2	4 A	CB	ELEC	N/A	N/A	NO	2B	15	10	1	12	12	12	1/2"	60°	20 A	
RP-1	RECIRCULATION PUMP	120	1	2	1/6 HP	CB	ELEC	INTEGRAL	MECH	NO	2B	15	4	1	12	12	12	1/2"	60°	20 A	
CCU-1	CONDENSING UNIT	208	3	3	16 A	25/30/3 N3R FSS	ELEC	INTEGRAL	MECH	NO	2E	25	20	1	12	N/A	12	1/2"	60°	20 A	
CCU-2	CONDENSING UNIT	208	3	3	16 A	25/30/3 N3R FSS	ELEC	INTEGRAL	MECH	NO	2E	25	20	1	12	N/A	12	1/2"	60°	20 A	
CCU-3	CONDENSING UNIT	208	3	3	16 A	25/30/3 N3R FSS	ELEC	INTEGRAL	MECH	NO	2E	25	20	1	12	N/A	12	1/2"	60°	20 A	
REF-1	WALK IN COOLER	208	3	3	15 A	40/60/3 N3R FSS	ELEC	N/A	N/A	NO	2E	40	40	1	8	N/A	10	1 "	60°	40 A	
REF-2	WALK IN COOLER	208	3	3	15 A	40/60/3 N3R FSS	ELEC	N/A	N/A	NO	2E	40	40	1	8	N/A	10	1 "	60°	40 A	
REF-3	WALK IN COOLER	208	3	3	15 A	40/60/3 N3R FSS	ELEC	N/A	N/A	NO	2E	40	40	1	8	N/A	10	1 "	60°	40 A	
ACLV-1	AUTOCLAVE	208	3	3	32 A	40/60/3 N1 FSS	ELEC	N/A	N/A	NO	2D	40	40	1	8	N/A	10	1 "	60°	40 A	
ACLV-2	AUTOCLAVE	208	3	3	32 A	40/60/3 N1 FSS	ELEC	N/A	N/A	NO	2D	40	40	1	8	N/A	10	1 "	60°	40 A	
ACLV-3	AUTOCLAVE	208	3	3	32 A	40/60/3 N1 FSS	ELEC	N/A	N/A	NO	2D	40	40	1	8	N/A	10	1 "	60°	40 A	
LS-1	LIFT STATION PUMP	480	3	3	3.1 A	INTEGRAL	CIVIL	INTEGRAL	CIVIL	NO	4MP	15	4	1	12	N/A	12	1/2"	60°	20 A	
NOTES	DISCONNECT ABBREVIATIONS: SS = SAFETY SWITCH, FSS = FUSED SAFETY SWITCH, CB = SERVING CB, TS = TOGGLE SWITCH, TSM = MOTOR RATED TS, C&P = CORD & PLUG, RELAY, ELEV DISC = SPECIAL ELEVATOR DISCONNECT																				
	(FOR EXAMPLE: 90/100/3 N1 FSS INDICATES A 3 POLE 100A NEMA 1 FUSED SAFETY SWITCH WITH 90A FUSES)																				
	STARTER ABBREVIATIONS: RELAY = MOTOR RATED POWER RELAY, FVNR = FVNR MAGNETIC MOTOR STARTER W/DISCONNECT, RVSS = REDUCED VOLTAGE SOLID STATE STARTER W/DISCONNECT, VFD = VARIABLE FREQUENCY DRIVE W/DISCONNECT																				
	OTHER ABBREVIATIONS: N1 = NEMA 1 ENCLOSURE, N3R = NEMA 3R ENCLOSURE, N4X = NEMA 4X STAINLESS STEEL ENCLOSURE, WP = WEATHERPROOF, 60/3 = 60A 3 POLE, ELEC = BY ELECTRICAL, MECH = BY MECHANICAL, EQUIP = BY EQUIPMENT, SPD = PROVIDE SPD AT UNIT																				
	OCPD, CONDUIT, WIRE, DISCONNECT, STARTER, ETC SIZES/RATINGS INDICATED ARE FOR THE BASIS OF DESIGN EQUIPMENT. EXACT SIZES/RATINGS SHALL BE PROVIDED THAT MATCH THE INSTALLED MECHANICAL EQUIPMENT REQUIREMENTS.																				
	SIZE ALL MOTOR STARTERS AND OVERLOADS AS REQUIRED FOR EQUIPMENT BEING POWERED.																				
	1. INDOOR UNIT POWERED FROM OUTDOOR UNIT.																				

TRANSFORMER SCHEDULE

TAG	PRIMARY	SECONDARY	PHASE	WIRE	ENCLOSURE	*MOUNTING	**TYPE	KVA	PRIMARY FEEDER***			SIZE GEC
									SIZE	75°C AMPACITY	PRIMARY DISCONNECT****	
T2A	480 DELTA	208Y/120	3	4	NEMA 1	FLR	STD	75	3#1,#4G,1.5"C	130	LOS CB	#2
T2D	480 DELTA	208Y/120	3	4	NEMA 1	CLG	STD	75	3#1,#4G,1.5"C	130	LOS CB	#2
TOS	480 DELTA	208Y/120	3	4	NEMA 1	STK	STD	30	3#8,#8G,3/4"C	50	LOS CB	#8

*MNT: FLR=FLOOR MOUNTED, PROVIDE CONCRETE BASE.
WALL=WALL MOUNTED, PROVIDE MANUFACTURER'S WALL BRACKET.
STK=STACKED ABOVE, PROVIDE UNISTRUT STAND.
CLG=CEILING MOUNTED, SUSPEND FROM CEILING WITH APPROPRIATELY SIZED THREADED ROD AND UNISTRUT.

**TYPE: STD=STANDARD PER SPECIFICATIONS.
K-#=K-FACTOR RATED PER SPECIFICATIONS, NUMBER AFTER K INDICATES K RATING.

***FOR SECONDARY FEEDER, SEE PANELBOARD SCHEDULE.

****PRIMARY DISCONNECTING MEANS:
LOCKABLE CB = UPSTREAM CB SHALL BE LOCKABLE
LOS CB = UPSTREAM CB IS IN LINE-OF-SIGHT
FSS = PROVIDE FUSED SAFETY SWITCH SIZED AS INDICATED

LIGHT FIXTURE SCHEDULE

TAG	DESCRIPTION	MANUFACTURER	CATALOG #	OR EQUAL BY	COLOR TEMP	LUMENS	INPUT WATTS	DIMMABLE	VOLTAGE	COLOR	MOUNTING	NOTES
22P42	2X2 PANEL	FUDAKIN	FDK-FP-22-27-40-40K-Y	DAYBRITE LAUREN	4000K	4200	40W	YES 0-10V	UNIV	WHITE	RECESSED	PROVIDE INTEGRAL DRIVER
4F	PENDANT LINEAR	FUDAKIN	FDK-LF-F1-4-45W-27V-40K-F	DAYBRITE LAUREN	4000K	6000	45W	YES 0-10V	UNIV	WHITE	PENDANT	
5C	5' CIRCULAR LED SURFACE	OCL	GL3-C1NA-60-MW-XXX-LED1-940K-UNV-DM1		4000K	9975	95W	YES 0-10V	UNIV	BY ARCH	SURFACE	
3C	3' CIRCULAR LED SURFACE	OCL	GL3-C1NA-36-MW-XXX-LED1-940K-UNV-DM1		4000K	3675	35W	YES 0-10V	UNIV	BY ARCH	SURFACE	
XEB	EDGE-LIT EXIT SIGN W/BATTERY PACK	BEGHELLI	BRU-SA-LG-U-M-AT	PATHWAY EMERGILITE PRESCOLITE	4000K	-	2W	NO	UNIV	MIRROR W/GREEN TEXT	WALL OR CEILING AS INDICATED	PROVIDE ARROW AND FACES AS PER PLANS, PROVIDE EMERGENCY NICAD BATTERY BACKUP, MIRROR PANEL BACKING, SELF-DIAGNOSTICS
LS18	LED WALL LUMINAIRE	GARDCO	111L-16L-350-WW-G2-3-UNV-DD-XX		3000K	1799	18W	YES 0-10V	UNIV	BY ARCH	WALL	
6DEXT	6" DOWNLIGHT EXTERIOR 2000 LUMEN	PEACHTREE	6BLRD-IC-18-40K-80-W-UNV	PHILIPS COLUMBIA COOPER	4000K	2000	32W	YES 0-10V	UNIV	BY ARCH	RECESSED	IC RATED
6DSL	6" ENCLOSED SHOWER DOWNLIGHT	PEACHTREE	6BLRD-EN-22-40K-80-PP-LH-W-UNV	PHILIPS COLUMBIA COOPER	4000K	~2200	21W	NO	UNIV	WHITE	RECESSED	UL WET LOCATION LISTED
6P7	6" ROUND PANEL	LAUREN ILLUMINATION	LCLCV-6-40-W-HE	PHILIPS COLUMBIA COOPER	4000K	~750	8W	YES 0-10V	UNIV	WHITE	RECESSED	PROVIDE WITH REMOTE DRIVER.
BATTPACK	EMERGENCY BATTERY PACK	BODINE	BSL SERIES	PATHWAY EMERGILITE PRESCOLITE	-	-	-	-	UNIV	-	INTEGRAL TO FIXTURE	LUMENS VARY BY FIXTURE TYPE, 90 MINUTES, UL 924 LISTED, TEST SWITCH, AUTO-CHARGER
4VP40	4' VAPORTIGHT	HE WILLIAMS	96-4-L40/840-HIAFR-DRV-UNV	PHILIPS COLUMBIA COOPER	4000K	~4000	40W	NO	UNIV	WHITE	SURFACE	PAINTED AFTER FABRICATION, IP65 RATED
POLE	LED POLE LIGHT	GARDCO	FIXTURE: PPT-140L-1150-WW-G2-T3-UNV POLE: GARDCO 12' LONG 4" DIA STRAIGHT ROUND ALUMINUM		3000K	5616	52W	YES 0-10V	UNIV	BY ARCH	12' POLE	PROVIDE AUTOMATIC MEANS TO REDUCE LIGHT 30% FROM MIDNIGHT TO 6AM

NOTES
FIXTURES WITH HALF FILLED IN CENTER OR SUBSCRIPT EM SHALL BE PROVIDED WITH A BATTER PACK. PROVIDE UNSWITCHED NORMAL CKT TO BATTERY PACK.
PROVIDE 0-10V WIRES FROM SWITCH/CONTROLLER TO ALL 0-10V DIMMABLE FIXTURES.
IF THERE IS A DISCREPANCY BETWEEN THE NOTES AND THE CATALOG NUMBER, THE NOTES SHALL PREVAIL.
PRIOR APPROVAL SUBMITTALS FOR MANUFACTURERS NOT LISTED MUST BE SUBMITTED TO THE ENGINEER 14 DAYS PRIOR TO BID DATE FOR REVIEW.

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UNIVERSITY OF FLORIDA MAIN CAMPUS

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Sheet Information

SINGLE LINE DIAGRAM

E201

BRANCH PANEL: 4MP

BASIS OF DESIGN: NF
SUPPLY FROM: HDM
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 480/277 Wye
PHASES: 3
WIRES: 4
KAIC: 35

BUSS RATING: 400 A
MCB OR MLO: MCB
MCB OR MLO SIZE: 400 A
NEUTRAL RATING: 100%
PQM: YES
SPD: YES
 # OF SECTIONS: 1
SERVICE RATED: YES

FEEDER
PHASES: 250
NEUTRAL: 250
GROUND: 2
CONDUIT: 3"
 # OF RUNS: 2
TOTAL AMPACITY: 510 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
4MP-1				32.70 kVA			5.71 kVA						4MP-2
4MP-3	PANELBOARD 2A VIA TX T2A	125 A	3		32.77 kVA			5.44 kVA		3	50 A	ATS-1	4MP-4
4MP-5						32.40 kVA			2.67 kVA				4MP-6
4MP-7	LIGHTS ROOM 131	20 A	1	1.02 kVA			1.16 kVA			1	20 A	LIGHTS ROOM 132	4MP-8
4MP-9	LIGHTS ROOMS 105, 134, 135, 138	20 A	1		0.80 kVA			0.68 kVA		1	20 A	LIGHTS ROOMS 106, 107, 108, 109A, 109B	4MP-10
4MP-11	LIGHTS ROOMS 109, 110, 111	20 A	1			1.20 kVA			0.72 kVA	1	20 A	LIGHTS ROOMS 120-123, 128-130	4MP-12
4MP-13	CORRIDOR 125,129, LOBBY 126	20 A	1	0.56 kVA			1.61 kVA			1	20 A	LIGHTS ROOMS 112-118, 124	4MP-14
4MP-15					3.88 kVA			3.88 kVA					4MP-16
4MP-17	AIR HANDLING UNIT FAN 1	25 A	3			3.88 kVA			3.88 kVA	3	25 A	AIR HANDLING UNIT FAN 2	4MP-18
4MP-19				3.88 kVA			3.88 kVA						4MP-20
4MP-21					1.33 kVA			0.58 kVA					4MP-22
4MP-23	CHILLED WATER PUMP (CHWP-1)	15 A	3			1.33 kVA			0.58 kVA	3	15 A	HEATING HOT WATER PUMP (HHWP-1)	4MP-24
4MP-25				1.33 kVA			0.58 kVA						4MP-26
4MP-27					0.94 kVA			1.02 kVA		1	20 A	OUTSIDE LIGHTS	4MP-28
4MP-29	EXHAUST FAN 3 (EF-3)	15 A	3			0.94 kVA			0.21 kVA	1	20 A	SIDEWALK POLE LIGHTS	4MP-30
4MP-31				0.94 kVA			26.56 kVA						4MP-32
4MP-33					0.87 kVA			26.56 kVA		3	20 A	T2D	4MP-34
4MP-35	LIFT STATION PUMP (LS-1)	15 A	3			0.87 kVA			26.56 kVA				4MP-36
4MP-37				0.87 kVA			0.00 kVA			1	20 A	SPARE	4MP-38
4MP-39	SPARE	20 A	1		0.00 kVA			0.00 kVA		1	20 A	SPARE	4MP-40
4MP-41	SPARE	20 A	1			0.00 kVA			0.00 kVA	1	20 A	SPARE	4MP-42
4MP-43	SPARE	20 A	1	0.00 kVA			0.00 kVA			--	--	SPACE	4MP-44
4MP-45	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	4MP-46
4MP-47	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4MP-48
4MP-49	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	4MP-50
4MP-51	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	4MP-52
4MP-53	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4MP-54
	TOTAL CONNECTED LOAD			80.62 kVA		78.69 kVA			75.12 kVA				
	TOTAL AMPS			293.0 A		286.1 A			271.2 A				

BRANCH PANEL: 2B

BASIS OF DESIGN: NQ
SUPPLY FROM: 2A
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 22

BUSS RATING: 150 A
MCB OR MLO: MLO
MCB OR MLO SIZE: 150 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 1/0
NEUTRAL: 1/0
GROUND: 6
CONDUIT: 2"
 # OF RUNS: 1
TOTAL AMPACITY: 150 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2B-1	BAS B-1 CONNECTION	20 A	1	0.30 kVA			0.35 kVA			1	20 A	AUTOCLAVE 108 FRIDGE RECEPT	2B-2
2B-3	GAS WATER HEATER (GWH)	20 A	1		0.48 kVA			0.60 kVA		1	20 A	AHU-1 MAINTENANCE LIGHTS/RECEPT	2B-4
2B-5	ELECTRIC BELL	20 A	1			3.33 kVA			0.18 kVA	1	20 A	MECH/ELEC ROOM 105 RECEPT	2B-6
2B-7	FUME HOOD 109A BSC	20 A	1	1.40 kVA			0.18 kVA			1	20 A	FRUIT INTAKE 111 WEST WALL RECEPT	2B-8
2B-9	AHU-1 UV LIGHTS	20 A	1		0.60 kVA			0.18 kVA		1	20 A	MECH/ELEC ROOM 105 FACP	2B-10
2B-11	EQUIPMENT ROOM 106 RECEPT	20 A	1			0.18 kVA			0.36 kVA	1	20 A	TISSUE CULTURE LAB 107 WEST RECEPT	2B-12
2B-13	AUTOCLAVE 108 RECEPT 1	20 A	1	0.18 kVA			0.36 kVA			1	20 A	STORAGE 109B & 107A RECEPT	2B-14
2B-15	AUTOCLAVE 108 RECEPT 2	20 A	1		0.18 kVA			0.36 kVA		1	20 A	TISSUE CULTURE LAB 107 RECEPT	2B-16
2B-17	RP-1 PUMP	20 A	1			0.36 kVA			0.36 kVA	1	20 A	MOLECULAR BIOLOGY LAB 109 NORTH 2 RECEPT	2B-18
2B-19	MOLECULAR BIOLOGY LAB 109 RECEPT	20 A	1	0.36 kVA			0.36 kVA			1	20 A	MOLECULAR BIOLOGY LAB 109 EAST WIREMOLD 2	2B-20
2B-21	MOLECULAR BIOLOGY LAB 109 TSTONE RECEPT	20 A	1		0.36 kVA			0.36 kVA		1	20 A	MOLECULAR BIOLOGY LAB 109 NORTH 1 RECEPT	2B-22
2B-23	MOLECULAR BIOLOGY LAB 109 EAST WIREMOLD 1	20 A	1			0.36 kVA			0.36 kVA	1	20 A	FRUIT QUALITY LAB 110 NORTH WIREMOLD	2B-24
2B-25	FRUIT QUALITY LAB 110 SOUTH WIREMOLD	20 A	1	0.36 kVA			0.36 kVA			1	20 A	FRUIT QUALITY LAB 110 EAST WIREMOLD 1	2B-26
2B-27	FRUIT QUALITY LAB 110 WEST WALL RECEPT	20 A	1		0.36 kVA			0.36 kVA		1	20 A	FRUIT QUALITY LAB 110 EAST WIREMOLD 2	2B-28
2B-29	FRUIT INTAKE 111 SOUTH WIREMOLD	20 A	1			0.36 kVA			0.54 kVA	1	20 A	TISSUE CULTURE LAB 107 EAST RECEPT	2B-30
2B-31	FRUIT INTAKE 111 EAST WIREMOLD	20 A	1	0.36 kVA			0.54 kVA			1	20 A	FUME HOOD 109A RECEPT	2B-32
2B-33	FRUIT INTAKE 111 NORTH WIREMOLD	20 A	1		0.36 kVA			0.54 kVA		1	20 A	MOLECULAR BIOLOGY LAB 109 EAST WIREMOLD 3	2B-34
2B-35	OUTER WALL NORTH RECEPT	20 A	1			0.72 kVA			0.37 kVA				2B-36
2B-37	FRUIT QUALITY LAB 110 TSTONE RECEPT	20 A	1	0.72 kVA			0.37 kVA			3	15 A	FAN COIL UNIT FC-1	2B-38
2B-39	MOLECULAR BIOLOGY LAB 109 TSTONE RECEPT	20 A	1		0.72 kVA			0.37 kVA					2B-40
2B-41	SPARE	20 A	1			0.00 kVA			0.00 kVA	1	20 A	SPARE	2B-42
2B-43	SPARE	20 A	1	0.00 kVA			0.00 kVA			1	20 A	SPARE	2B-44
2B-45	SPARE	20 A	1		0.00 kVA			0.00 kVA		--	--	SPACE	2B-46
2B-47	SPARE	20 A	1			0.00 kVA			0.00 kVA	--	--	SPACE	2B-48
2B-49	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2B-50
2B-51	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2B-52
2B-53	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2B-54
	TOTAL CONNECTED LOAD			6.20 kVA		5.83 kVA			7.48 kVA				
	TOTAL AMPS			52.2 A		48.6 A			62.8 A				

BRANCH PANEL: 2A

BASIS OF DESIGN: NQ
SUPPLY FROM: T2A
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 22

BUSS RATING: 400 A
MCB OR MLO: MCB
MCB OR MLO SIZE: 300 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 350
NEUTRAL: 350
GROUND: 4
CONDUIT: 3"
 # OF RUNS: 1
TOTAL AMPACITY: 310 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2A-1	BAS A-1 CONNECTION	20 A	1	0.10 kVA			0.90 kVA			1	20 A	CLASSROOM 131 FRONT ROOM RECEPTS	2A-2
2A-3	EXHAUST FAN 2 (EF-2)	15 A	1		0.20 kVA			0.36 kVA		1	20 A	CLASSROOM 131 COUNTERTOP RECEPTS	2A-4
2A-5	BAS A-2 CONNECTION	20 A	1			0.30 kVA			0.54 kVA	1	20 A	CLASSROOM 131 BACK ROOM RECEPTS	2A-6
2A-7	CLASSROOM 131 RECEPTS	20 A	1	0.72 kVA			1.20 kVA			1	20 A	LAB SUPPORT 132A FRIDGE 1	2A-8
2A-9	CLASSROOM 131 TV RECEPTS	20 A	1		0.72 kVA			0.18 kVA		1	20 A	TEACHING LAB 132 RECEPT	2A-10
2A-11	TEACHING LAB 132 BSC	20 A	1			1.40 kVA			6.20 kVA				2A-12
2A-13				7.70 kVA			5.83 kVA			3	150 A	PANELBOARD 2B	2A-14
2A-15	PANELBOARD 2C	150 A	3		7.76 kVA			7.48 kVA					2A-16
2A-17						7.71 kVA			0.18 kVA	1	20 A	TEACHING LAB 132 WIREMOLD WEST 1	2A-18
2A-19	JANITOR CLOSET 135 RECEPT	20 A	1	0.18 kVA			0.36 kVA			1	20 A	TEACHING LAB 132 WIREMOLD NORTH	2A-20
2A-21	TEACHING LAB 132 WIREMOLD SOUTH	20 A	1		0.36 kVA			0.36 kVA		1	20 A	TEACHING LAB 132 TV 2 RECEPT	2A-22
2A-23	WOMEN RESTROOM 134 RECEPT	20 A	1			0.36 kVA			0.36 kVA	1	20 A	TEACHING LAB 132 WIREMOLD EAST 1	2A-24
2A-25	TEACHING LAB 132 TV 1 RECEPT	20 A	1	0.36 kVA			0.36 kVA			1	20 A	LAB SUPPORT 132A RECEPT	2A-26
2A-27	LAB SUPPORT 132A WIREMOLD EAST 2	20 A	1		0.36 kVA			0.54 kVA		1	20 A	TEACHING LAB 132 WIREMOLD EAST 2	2A-28
2A-29	MEN RESTROOM 134 RECEPT	20 A	1			0.36 kVA			0.54 kVA	1	20 A	TEACHING LAB WEST WALL RECEPT	2A-30
2A-31	LAB SUPPORT 132A WIREMOLD EAST 1	20 A	1	0.54 kVA			0.72 kVA			1	20 A	TEACHING LAB 132 TABLE 1 RECEPT	2A-32
2A-33	TEACHING LAB 132 TABLE 2 RECEPT	20 A	1		0.72 kVA			1.08 kVA		1	20 A	TEACHING LAB 132 TABLE 2 RECEPT	2A-34
2A-35	TEACHING LAB 132 TABLE 3 RECEPT	20 A	1			0.72 kVA			1.08 kVA	1	20 A	TEACHING LAB 132 TABLE 3 RECEPT	2A-36
2A-37	TEACHING LAB 132 TABLE 1 RECEPT	20 A	1	1.08 kVA			1.20 kVA			1	20 A	LAB SUPPORT 132A FRIDGE 2	2A-38
2A-39	LAB SUPPORT 132A FRIDGE 3	20 A	1		1.20 kVA			11.45 kVA					2A-40
2A-41	WATER COOLERS CLASSROOM 131 ENTRY	20 A	1			1.20 kVA			11.45 kVA	3	150 A	2E	2A-42
2A-43	SPARE	20 A	1	0.00 kVA			11.45 kVA						2A-44
2A-45	SPARE	20 A	1		0.00 kVA			0.00 kVA		1	20 A	SPARE	2A-46
2A-47	SPARE	20 A	1			0.00 kVA			0.00 kVA	1	20 A	SPARE	2A-48
2A-49	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2A-50
2A-51	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2A-52
2A-53	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2A-54
	TOTAL CONNECTED LOAD			32.70 kVA		32.77 kVA			32.40 kVA				
	TOTAL AMPS			272.9 A		273.5 A			270.0 A				

BRANCH PANEL: 2C

BASIS OF DESIGN: NQ
SUPPLY FROM: 2A
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 10

BUSS RATING: 150 A
MCB OR MLO: MLO
MCB OR MLO SIZE: 150 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 1/0
NEUTRAL: 1/0
GROUND: 6
CONDUIT: 2"
 # OF RUNS: 1
TOTAL AMPACITY: 150 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2C-1	BREAK ROOM 114 FRIDGE RECEPT	20 A	1	0.18 kVA			0.36 kVA			1	20 A	BREAK ROOM 114 COUNTER RECEPT	2C-2
2C-3	SUPPLIES 116 COPY MACHINE	20 A	1		0.18 kVA			0.36 kVA		1	20 A	DATA 124 RECEPT SOUTH WALL	2C-4
2C-5	BAS C-1 CONNECTION	20 A	1			0.30 kVA			0.45 kVA	1	20 A	AUTOMATIC DOORS	2C-6
2C-7	TOILETS 117/118	20 A	1	0.54 kVA			0.68 kVA			1	20 A	CONFERENCE 115 FLOOR BOX AND TV	2C-8
2C-9	BREAK ROOM 114 RECEPT	20 A	1		0.54 kVA			0.80 kVA		1	20 A	VEST 113 COPY MACHINE	2C-10
2C-11	DATA 124 RECEPT EAST WALL	20 A	1			0.72 kVA			0.72 kVA	1	20 A	DATA 124 RECEPT NORTH WALL	2C-12
2C-13	LOBBY 126/CORRIDORS RECEPT	20 A	1	1.26 kVA			0.72 kVA			1	20 A	DATA 124 RECEPT WEST WALL	2C-14
2C-15	WATER COOLERS	20 A	1		1.20 kVA			0.72 kVA		1	20 A	OUTER WALL SOUTH RECEPT	2C-16
2C-17	EXHAUST FAN 1 (EF-1)	15 A	1			0.84 kVA			0.72 kVA	1	20 A	SUPPLIES 116 RECEPT	2C-18
2C-19	OFFICE 123 RECEPT	20 A	1	0.90 kVA			0.90 kVA			1	20 A	CONFERENCE 115 RECEPT	2C-20
2C-21	OFFICE 128 RECEPT	20 A	1		0.90 kVA			0.90 kVA		1	20 A	DIRECTOR OFFICE 120 RECEPT	2C-22
2C-23	OFFICE 130 RECEPT	20 A	1			0.90 kVA			0.90 kVA	1	20 A	OFFICE 121 RECEPT	2C-24
2C-25	GRAD STUDY 113B SOUTH RECEPT	20 A	1	1.08 kVA			1.08 kVA			1	20 A	GRAD STUDY 113A NORTH RECEPT	2C-26
2C-27	OFFICE 122 RECEPT	20 A	1		1.08 kVA			1.08 kVA		1	20 A	GRAD STUDY 113A SOUTH RECEPT	2C-28
2C-29	OFFICE 129 RECEPT	20 A	1			1.08 kVA			1.08 kVA	1	20 A	GRAD STUDY 113B NORTH RECEPT	2C-30
2C-31	SPARE	20 A	1	0.00 kVA			0.00 kVA			1	20 A	SPARE	2C-32
2C-33	SPARE	20 A	1		0.00 kVA			0.00 kVA		1	20 A	SPARE	2C-34
2C-35	SPARE	20 A	1			0.00 kVA			0.00 kVA	1	20 A	SPARE	2C-36
2C-37	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2C-38
2C-39	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2C-40
2C-41	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2C-42
2C-43	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2C-44
2C-45	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2C-46
2C-47	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2C-48
2C-49	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2C-50
2C-51	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2C-52
2C-53	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2C-54
	TOTAL CONNECTED LOAD			7.70 kVA		7.76 kVA			7.71 kVA				
	TOTAL AMPS			64.2 A		64.7 A			64.3 A				

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Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

Revisions

No.	Description	Date

Sheet Information

SCHEDULES

E301

BRANCH PANEL: 2D

BASIS OF DESIGN: NQ
SUPPLY FROM: T2D
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 10

BUSS RATING: 400 A
MCB OR MLO: MCB
MCB OR MLO SIZE: 300 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 350
NEUTRAL: 350
GROUND: 4
CONDUIT: 3"
 # OF RUNS: 1
TOTAL AMPACITY: 310 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2D-1				8.85 kVA			8.85 kVA						2D-2
2D-3	ACVL-2	40 A	3		8.85 kVA			8.85 kVA		3	40 A	ACVL-1	2D-4
2D-5						8.85 kVA			8.85 kVA				2D-6
2D-7				8.85 kVA			0.00 kVA			1	20 A	SPARE	2D-8
2D-9	ACVL-3	40 A	3		8.85 kVA			0.00 kVA		1	20 A	SPARE	2D-10
2D-11						8.85 kVA			0.00 kVA	1	20 A	SPARE	2D-12
2D-13	SPARE	20 A	1	0.00 kVA			0.00 kVA			1	20 A	SPARE	2D-14
2D-15	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2D-16
2D-17	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2D-18
2D-19	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2D-20
2D-21	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2D-22
2D-23	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2D-24
2D-25	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2D-26
2D-27	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2D-28
2D-29	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2D-30
2D-31	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2D-32
2D-33	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2D-34
2D-35	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2D-36
2D-37	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2D-38
2D-39	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2D-40
2D-41	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2D-42
			TOTAL CONNECTED LOAD	26.56 kVA		26.56 kVA		26.56 kVA					
			TOTAL AMPS	221.3 A		221.3 A		221.3 A					

BRANCH PANEL: 2E

BASIS OF DESIGN: NQ
SUPPLY FROM: 2A
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 3R
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 10

BUSS RATING: 250 A
MCB OR MLO: MLO
MCB OR MLO SIZE: 150 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 1/0
NEUTRAL: 1/0
GROUND: 6
CONDUIT: 2"
 # OF RUNS: 1
TOTAL AMPACITY: 150 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2E-1				1.92 kVA			1.92 kVA						2E-2
2E-3	CCU-3	25 A	3		1.92 kVA			1.92 kVA		3	25 A	CCU-2	2E-4
2E-5						1.92 kVA			1.92 kVA				2E-6
2E-7				1.92 kVA			1.90 kVA						2E-8
2E-9	CCU-1	25 A	3		1.92 kVA			1.90 kVA		3	40 A	REF-3	2E-10
2E-11						1.92 kVA			1.90 kVA				2E-12
2E-13				1.90 kVA			1.90 kVA						2E-14
2E-15	REF-2	40 A	3		1.90 kVA			1.90 kVA		3	40 A	REF-1	2E-16
2E-17						1.90 kVA			1.90 kVA				2E-18
2E-19	SPARE	20 A	1	0.00 kVA			0.00 kVA			--	--	SPACE	2E-20
2E-21	SPARE	20 A	1		0.00 kVA			0.00 kVA		--	--	SPACE	2E-22
2E-23	SPARE	20 A	1			0.00 kVA			0.00 kVA	--	--	SPACE	2E-24
2E-25	SPARE	20 A	1	0.00 kVA			0.00 kVA			--	--	SPACE	2E-26
2E-27	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2E-28
2E-29	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2E-30
2E-31	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2E-32
2E-33	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2E-34
2E-35	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2E-36
2E-37	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2E-38
2E-39	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2E-40
2E-41	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2E-42
			TOTAL CONNECTED LOAD	11.45 kVA		11.45 kVA		11.45 kVA					
			TOTAL AMPS	95.4 A		95.4 A		95.4 A					

BRANCH PANEL: 4OS

BASIS OF DESIGN: NF
SUPPLY FROM: ATS-1
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 480/277 Wye
PHASES: 3
WIRES: 4
KAIC: 25

BUSS RATING: 100 A
MCB OR MLO: MLO
MCB OR MLO SIZE: 50 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 8
NEUTRAL: 8
GROUND: 8
CONDUIT: 3/4"
 # OF RUNS: 1
TOTAL AMPACITY: 50 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
4OS-1				5.71 kVA			0.00 kVA			1	20 A	SPARE	4OS-2
4OS-3	PANELBOARD 2OS VIA TX TOS	50 A	3		5.44 kVA			0.00 kVA		1	20 A	SPARE	4OS-4
4OS-5						2.67 kVA			0.00 kVA	1	20 A	SPARE	4OS-6
4OS-7	SPACE	--	--	0.00 kVA			0.00 kVA			1	20 A	SPARE	4OS-8
4OS-9	SPACE	--	--		0.00 kVA			0.00 kVA		1	20 A	SPARE	4OS-10
4OS-11	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4OS-12
4OS-13	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	4OS-14
4OS-15	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	4OS-16
4OS-17	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4OS-18
4OS-19	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	4OS-20
4OS-21	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	4OS-22
4OS-23	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4OS-24
4OS-25	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	4OS-26
4OS-27	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	4OS-28
4OS-29	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	4OS-30
			TOTAL CONNECTED LOAD	5.71 kVA		5.44 kVA		2.67 kVA					
			TOTAL AMPS	22.2 A		21.2 A		9.6 A					

BRANCH PANEL: 2OS

BASIS OF DESIGN: NQ
SUPPLY FROM: TOS
MOUNTING: SURFACE
ENCLOSURE: NEMA TYPE 1
VOLTS: 120/208 Wye
PHASES: 3
WIRES: 4
KAIC: 10

BUSS RATING: 100 A
MCB OR MLO: MCB
MCB OR MLO SIZE: 100 A
NEUTRAL RATING: 100%
PQM: NO
SPD: NO
 # OF SECTIONS: 1
SERVICE RATED: NO

FEEDER
PHASES: 3
NEUTRAL: 3
GROUND: 8
CONDUIT: 1-1/4"
 # OF RUNS: 1
TOTAL AMPACITY: 100 A

NOTES

CKT	DESCRIPTION	TRIP	P	A	B	C	A	B	C	P	TRIP	DESCRIPTION	CKT
2OS-1	DX UNIT RM 106 AH/CU	30 A	2	1.66 kVA			1.20 kVA			1	20 A	EQUIPMENT ROOM 106 FRIDGE 1	2OS-2
2OS-3					1.66 kVA			1.20 kVA		1	20 A	EQUIPMENT ROOM 106 FRIDGE 2	2OS-4
2OS-5	EQUIPMENT ROOM 106 FRIDGE 3	20 A	1			1.20 kVA			1.20 kVA	1	20 A	EQUIPMENT ROOM 106 FRIDGE 4	2OS-6
2OS-7	EQUIPMENT ROOM 106 FRIDGE 5	20 A	1	1.20 kVA			1.20 kVA			1	20 A	EQUIPMENT ROOM 106 FRIDGE 6	2OS-8
2OS-9	EQUIPMENT ROOM 106 FRIDGE 7	20 A	1		1.20 kVA			1.20 kVA		1	20 A	EQUIPMENT ROOM 106 FRIDGE 8	2OS-10
2OS-11	MECH/ELEC ROOM 105 BAS	20 A	1			0.18 kVA			0.00 kVA	1	20 A	SPARE	2OS-12
2OS-13	QUAD RCPT DATA 124	20 A	1	0.36 kVA			0.00 kVA			1	20 A	SPARE	2OS-14
2OS-15	RM 106 AIR HANDLER 1 (AC-1)	20 A	2		0.09 kVA			0.00 kVA		1	20 A	SPARE	2OS-16
2OS-17						0.09 kVA			0.00 kVA	1	20 A	SPARE	2OS-18
2OS-19	TS-1	20 A	2	0.09 kVA			0.00 kVA			1	20 A	SPARE	2OS-20
2OS-21					0.09 kVA			0.00 kVA		--	--	SPACE	2OS-22
2OS-23	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2OS-24
2OS-25	SPACE	--	--	0.00 kVA			0.00 kVA			--	--	SPACE	2OS-26
2OS-27	SPACE	--	--		0.00 kVA			0.00 kVA		--	--	SPACE	2OS-28
2OS-29	SPACE	--	--			0.00 kVA			0.00 kVA	--	--	SPACE	2OS-30
			TOTAL CONNECTED LOAD	5.71 kVA		5.44 kVA		2.67 kVA					
			TOTAL AMPS	51.2 A		48.9 A		22.3 A					

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03	100% CONSTRUCTION DOCUMENTS	2020-11-17
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Revisions

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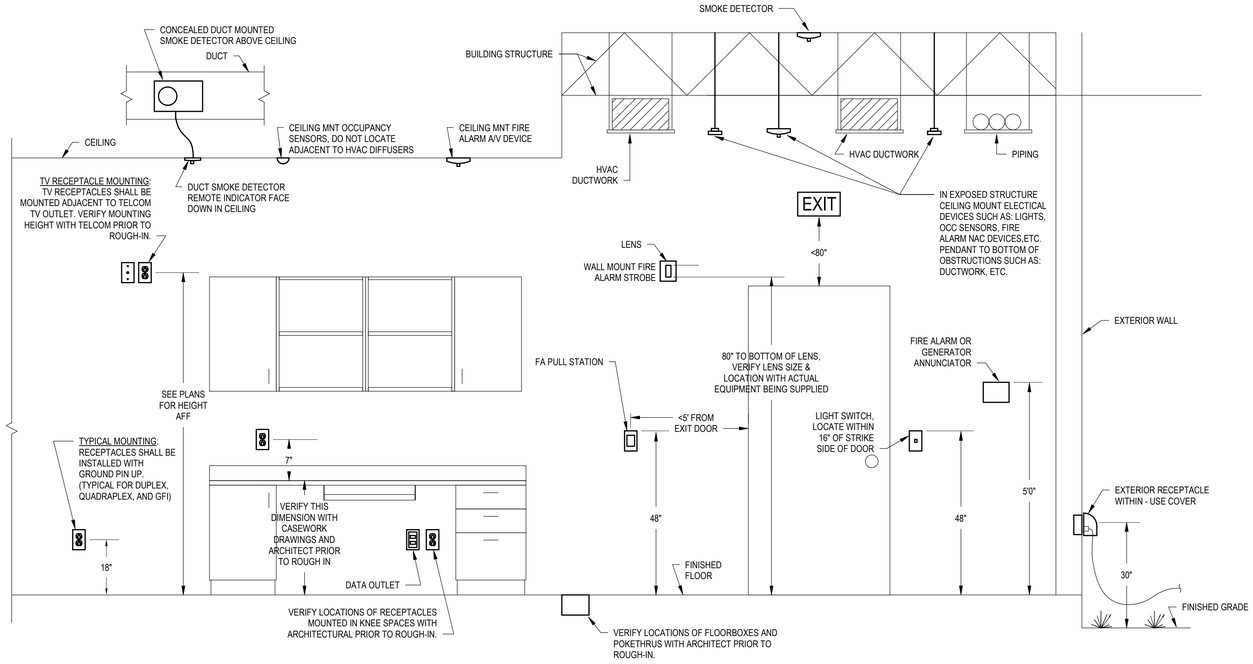
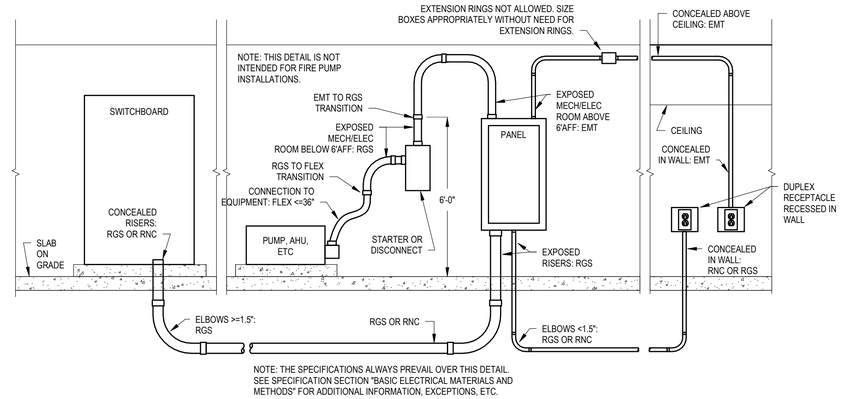
Sheet Information

SCHEDULES

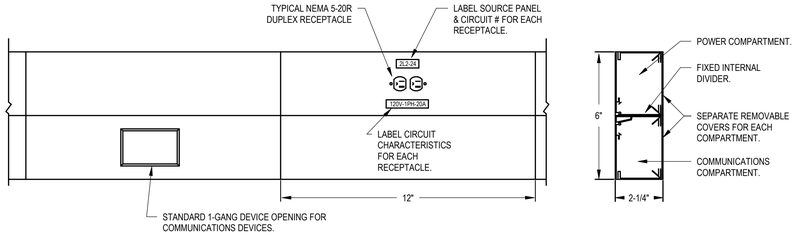
E302



1 TYPICAL DEVICE MOUNTING DETAIL
NOT TO SCALE

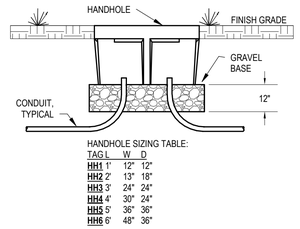


2 POWER & DISTRIBUTION RACEWAY APPLICATION DETAIL
NOT TO SCALE



NOTES:
1. DETAIL DEPICTS A TYPICAL RACEWAY SEGMENT AND DOES NOT CORRESPOND TO A SPECIFIC RACEWAY LOCATION. REFER TO POWER PLANS FOR SPECIFIC DEVICE AND CIRCUIT REQUIREMENTS.
2. RACEWAY AND COVER SHALL BE EXTRUDED ALUMINUM WITH CLEAR ANODIZED FINISH.
3. COORDINATE RACEWAY LENGTH AND MOUNTING HEIGHT WITH ARCHITECTURAL.

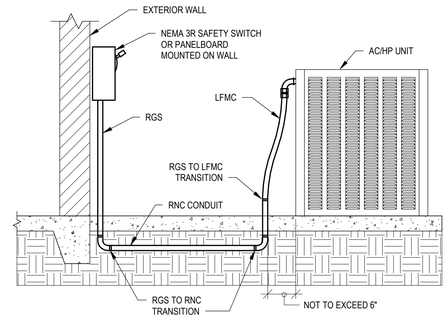
3 SURFACE RACEWAY DETAIL
NOT TO SCALE



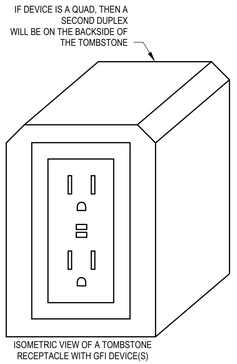
HANDHOLE SIZING TABLE:

TAG	L	W	D
HH1	1'	12"	12"
HH2	2'	13"	18"
HH3	3'	24"	24"
HH4	4'	30"	24"
HH5	5'	36"	36"
HH6	6'	48"	36"

4 HANDHOLE DETAIL
NOT TO SCALE



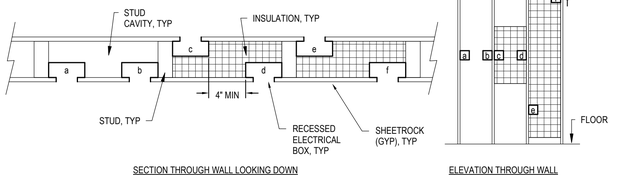
5 TYPICAL EXTERIOR AC/HP CONNECTION DETAIL
NOT TO SCALE



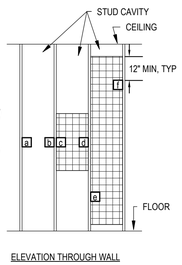
ISOMETRIC VIEW OF A TOMBSTONE RECEPTACLE WITH GFI DEVICE(S)

6 TOMBSTONE OUTLET DETAIL
NOT TO SCALE

BOXES THAT ARE REQUIRED TO BE MOUNTED IN THE SAME STUD CAVITY AND FACE OPPOSITE DIRECTIONS (ROOMS) REGARDLESS OF VERTICAL SEPARATION SHALL HAVE 3.5" THICK SOUND ATTENUATION BATT INSULATION INSTALLED FROM STUD TO STUD AND TO A MINIMUM OF 12" ABOVE AND 12" BELOW THE BOXES. IN NO CASE SHALL THESE BOXES BE CLOSER THAN 4" MEASURED EDGE OF BOX TO EDGE OF BOX.

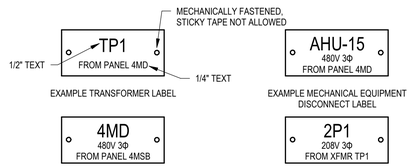


SECTION THROUGH WALL LOOKING DOWN



ELEVATION THROUGH WALL

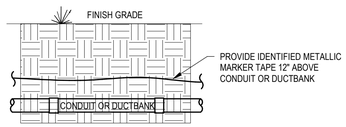
7 RECESSED BOXES IN STUD CAVITY
NOT TO SCALE



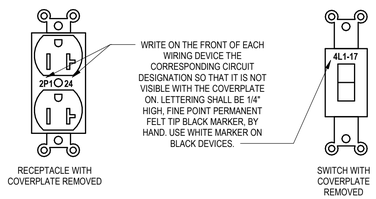
ENGRAVED PLASTIC TAG. TAG SHALL HAVE ALL EDGES BEVELED AND SMOOTH. SECURE TAG WITH A MINIMUM OF 2 CHROME (STAINLESS STEEL FOR WET OR DAMP LOCATIONS) SCREWS. ADHESIVE BACKING, TAPE, ETC IS NOT ALLOWED. DIMENSIONS SHALL BE AS REQUIRED TO FIT APPROPRIATE TEXT. COLORS AS FOLLOWS:

SYSTEM	LETTERS	BACKGROUND
NORMAL	BLACK	WHITE
OPTIONAL STANDBY	WHITE	RED

8 TYPICAL EQUIPMENT LABELING DETAIL
NOT TO SCALE



9 BURIED CONDUIT MARKER DETAIL
NOT TO SCALE



10 WIRING DEVICE LABEL DETAIL
NOT TO SCALE

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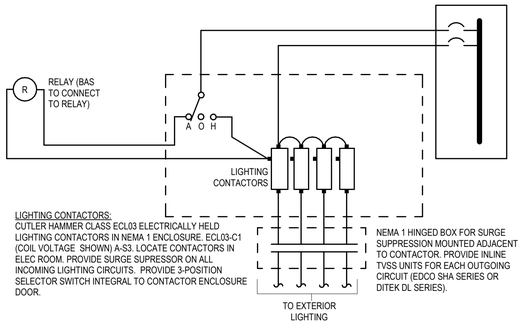
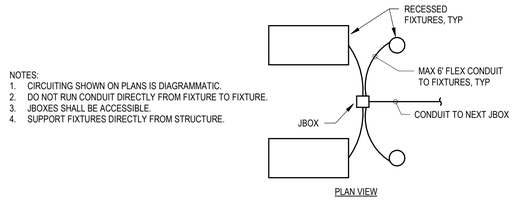
DETAILS

E401



EXTERIOR LIGHTING CONTROL DIAGRAM

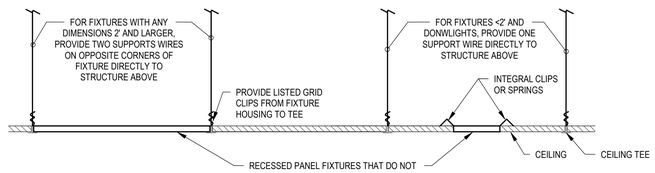
NOT TO SCALE



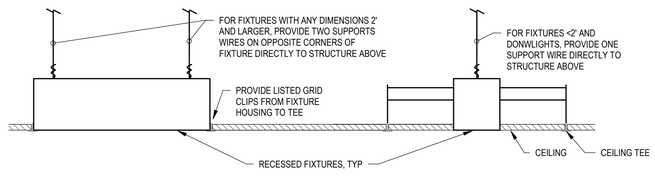
NOTES:
1. CIRCUITING SHOWN ON PLANS IS DIAGRAMMATIC.
2. DO NOT RUN CONDUIT DIRECTLY FROM FIXTURE TO FIXTURE.
3. JBOXES SHALL BE ACCESSIBLE.
4. SUPPORT FIXTURES DIRECTLY FROM STRUCTURE.

1 RECESSED LIGHT FIXTURE CONDUIT CONNECTIONS DIAGRAM

NOT TO SCALE



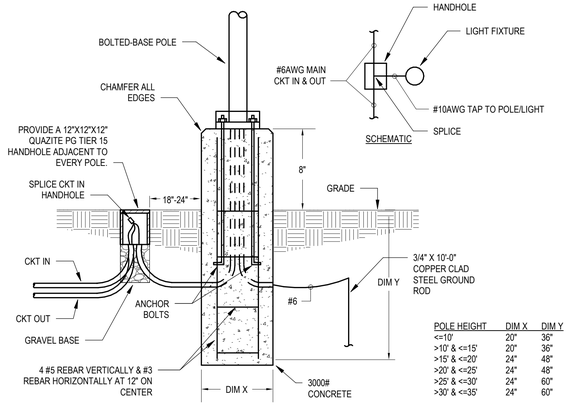
SECTION VIEW - RECESSED PANEL LIGHTS



SECTION VIEW - RECESSED LIGHTS

4 RECESSED LIGHT FIXTURE INSTALLATION DIAGRAM

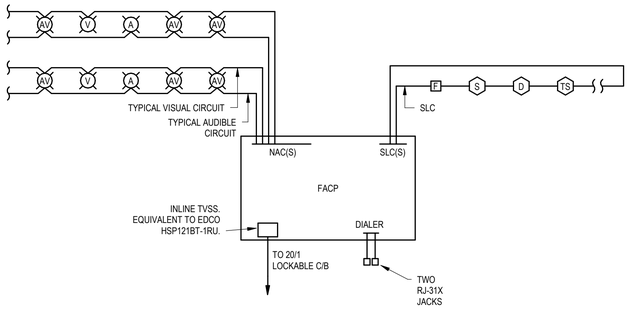
NOT TO SCALE



POLE HEIGHT	DIM X	DIM Y
<=10'	20"	36"
>10' & <=15'	20"	36"
>15' & <=20'	24"	48"
>20' & <=25'	24"	48"
>25' & <=30'	24"	60"
>30' & <=35'	24"	60"

5 CONCRETE BASE FOR SITE LIGHTING POLE DETAIL

NOT TO SCALE



FIRE ALARM RISER NOTES:
1. CIRCUITS AND DEVICES ARE SHOWN DIAGRAMMATICALLY.
2. NOT ALL DEVICES ARE SHOWN.
3. SEE PLANS FOR DEVICE QUANTITIES.
4. PROVIDE QTY OF NAC CIRCUITS AS REQUIRED PER SPECIFICATIONS.
5. ALL CABLING SHALL BE IN CONDUIT.
6. MINIMUM CONDUIT SIZE IS 3/4".

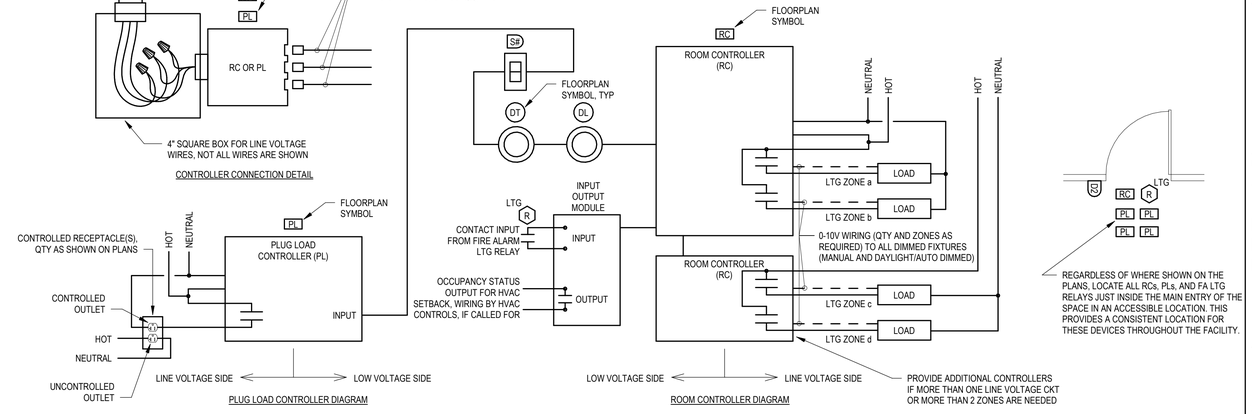
2 FIRE ALARM SYSTEM RISER DIAGRAM

NOT TO SCALE

NOTE: NOT ALL INPUTS AND FUNCTIONS MAY BE APPLICABLE TO PROJECT. SD = SMOKE DETECTOR HD = HEAT DETECTOR SYSTEM INPUT	ANNUNCIATION			NOTIFICATION				FIRE SAFETY CONTROL					
	SYSTEM OUTPUT	ALARM AT FACP & FAAN	SUPERVISORY AT FACP & FAAN	TROUBLE AT FACP & FAAN	ALARM AT RECEIVING STATION	SUPERVISORY AT RECEIVING STATION	TROUBLE AT RECEIVING STATION	ACTIVATE AUDIBLE AND VISUAL NOTIFICATION DEVICES	SHUTDOWN RESPECTIVE AHU	SHUTDOWN RESPECTIVE SMOKE DAMPERS	ACTIVATE ELEVATOR HOISTWAY VENT	RELEASE/CLOSE RESPECTIVE MAGNETIC HELD DOORS	SWITCH TO SECONDARY POWER	LIGHTING RELAY TO TURN ON EGRESS LIGHTS
MANUAL PULL STATION		✓			✓			✓			✓	✓		✓
WATERFLOW SWITCH		✓			✓			✓						✓
DUCT SD			✓			✓			✓	✓				
FIRE/SMOKE DOOR SD		✓			✓			✓				✓		✓
ALL OTHER SD AND ALL OTHER HD		✓			✓			✓						✓
TAMPER SWITCH OR PIV			✓			✓								
FIRE PUMP RUNNING, POWER LOSS, PHASE REVERSAL, LOW PRESSURE			✓			✓								
GENERATOR TROUBLE, FAILURE, ATS IN NON-AUTO			✓			✓								
KNOX BOX			✓			✓								
FA TROUBLE CONDITION (OPENS, SHORTS, OR GROUNDS)				✓			✓							
FA AC POWER FAIL				✓			✓						✓	

3 FIRE ALARM - SYSTEM INPUT/OUTPUT MATRIX

NOT TO SCALE



GENERAL NOTES:
1. THIS DIAGRAM IS NOT INTENDED TO SHOW THE ACTUAL QTY OF DEVICES. SEE PLANS FOR DEVICE QTY.
2. NOT ALL INSTANCES WILL REQUIRE ALL CONNECTIONS AND DEVICES SHOWN.
3. PROVIDE INPUT OUTPUT MODULE IF REQUIRED BY F/A OR HVAC, SEE F/A SHEETS AND MECHANICAL (OR IC) SHEETS FOR QTY REQUIRED.
4. VERIFY WIRING CONFIGURATION WITH ACTUAL SENSORS, CONTROLLERS & DEVICES BEING SUPPLIED. PROVIDE MANUFACTURER'S RECOMMENDED LV CABLING.
5. WHERE MORE THAN ONE LINE VOLTAGE CKT IS REQUIRED, PROVIDE ADDITIONAL CONTROLLERS AS REQUIRED. SEE PLANS.
6. WHERE MORE THAN TWO ZONES ARE REQUIRED, PROVIDE ADDITIONAL CONTROLLERS AS REQUIRED. SEE PLANS.
7. LIGHTING SPECIFICALLY CALLED OUT ON THE PLANS AS 24/7 SHALL NOT BE CONTROLLED BY THIS SYSTEM.
8. 0-10V DIM WIRING: PROVIDE AS REQUIRED FROM CONTROLLERS TO ALL DIMMED LIGHT FIXTURES (MANUAL & DAYLIGHT DIMMED).
9. IF RC/PL IS LOCATED ABOVE CEILING, PROVIDE A DYMO TYPE LABEL ON BOTTOM OF CEILING INDICATING LOCATION.
10. BASIS OF DESIGN IS WATTSTOPPER DLM.
    1. NON DIMMED: LMRC-100 SERIES. QTY AS REQUIRED FOR # OF ZONES.
    2. DIMMED: LMRC-200 SERIES. QTY AS REQUIRED FOR # OF ZONES.
    3. FOR MANUAL DIMMED ZONES ALSO PROVIDE ONE DIMMER SWITCH ADJACENT TO ZONE SWITCHES. SEE SWITCH DETAIL.

SEQUENCE OF OPERATIONS:

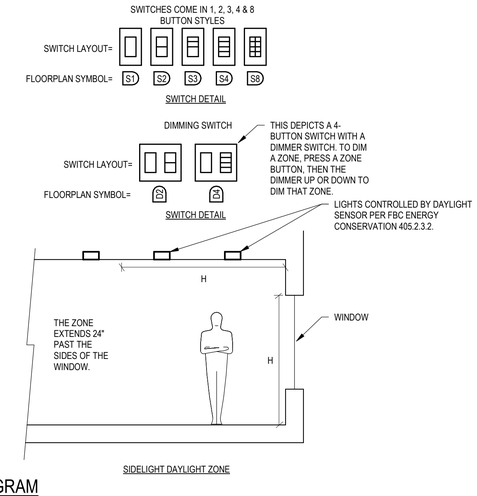
BASIC ROOM WITH "AUTO-ON" (FOR USE IN SPACES WITH MULTIPLE ZONES):
1. IF PROVIDED WITH FIRE ALARM LTG RELAY: LIGHTS SHALL TURN ON TO 100% AND STAY ON DURING A FIRE ALARM CONDITION (PER 2015 NFPA 101 7.8.1.2.2(5)).
2. WITH LIGHTS OFF, LIGHTS SHALL AUTOMATICALLY TURN ON TO NO MORE THAN 50% WHEN SENSORS DETECT OCCUPANCY (PER 2017 FBC C405.2.2.2).
3. LIGHTS SHALL REQUIRE MANUAL CONTROL TO TURN ON TO MORE THAN 50%.
4. ALL LIGHTS SHALL AUTOMATICALLY TURN OFF AFTER 20 MINUTE TIME DELAY OF NOT SENSING OCCUPANCY.

BASIC ROOM WITH "MANUAL-ON" (FOR USE IN SPACES WITH ONLY ONE ZONE):
1. IF PROVIDED WITH FIRE ALARM LTG RELAY: LIGHTS SHALL TURN ON TO 100% AND STAY ON DURING A FIRE ALARM CONDITION (PER 2015 NFPA 101 7.8.1.2.2(5)).
2. WITH LIGHTS OFF, LIGHTS SHALL REQUIRE MANUAL ON AT SWITCH LOCATION(S) (PER 2014 FBC C405.2.2.2).
3. ALL LIGHTS SHALL AUTOMATICALLY TURN OFF AFTER 20 MINUTE TIME DELAY OF NOT SENSING OCCUPANCY.

HALLWAYS, RESTROOMS, LOBBIES, ETC WITH NO LOCAL SWITCHES:
1. IF PROVIDED WITH FIRE ALARM LTG RELAY: LIGHTS SHALL TURN ON TO 100% AND STAY ON DURING A FIRE ALARM CONDITION (PER 2015 NFPA 101 7.8.1.2.2(5)).
2. WITH LIGHTS OFF, LIGHTS SHALL AUTOMATICALLY TURN ON TO 100% WHEN SENSORS DETECT OCCUPANCY.
3. ALL LIGHTS SHALL AUTOMATICALLY TURN OFF AFTER 20 MINUTE TIME DELAY OF NOT SENSING OCCUPANCY.

PLUG LOAD CONTROLLER:
1. CONTROLLED OUTLETS SHALL AUTOMATICALLY TURN ON WHEN SENSORS DETECT OCCUPANCY.
2. CONTROLLED OUTLETS SHALL AUTOMATICALLY TURN OFF AFTER 20 MINUTE TIME DELAY OF NOT SENSING OCCUPANCY.

DAYLIGHT SENSOR:
1. WITH LIGHTS ON (E.G. OCCUPANCY SENSORS ARE IN OCCUPIED STATE) LIGHTS AUTOMATICALLY DIM AS ENOUGH DAYLIGHT ENTERS SPACE.
2. WITH LIGHTS OFF DAYLIGHT SENSORS ARE INACTIVE.



6 ROOM CONTROLLER CONNECTION DIAGRAM

NOT TO SCALE

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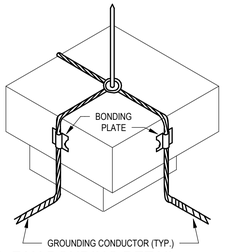
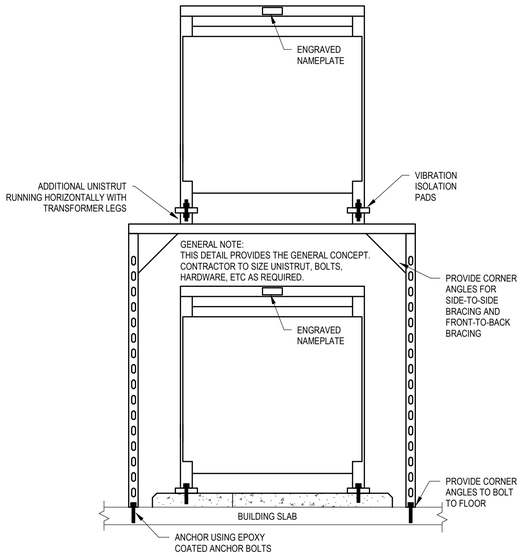
DETAILS

E402

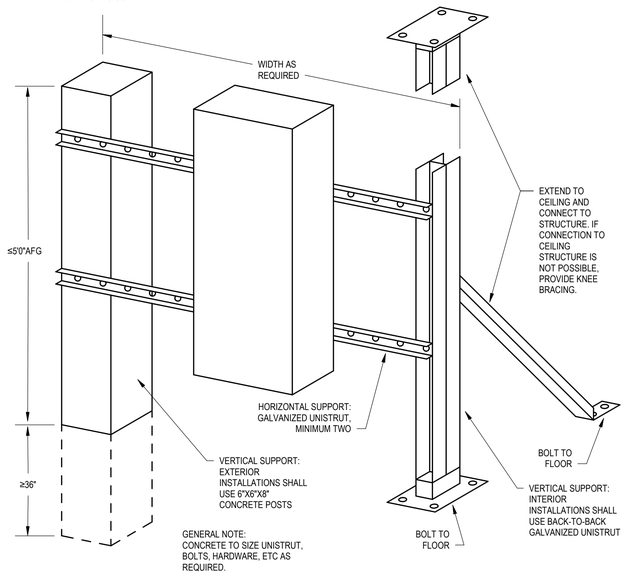


1 FAN BONDING DETAIL
NOT TO SCALE



FRONT SECTION VIEW

4 DRY TYPE STAND MOUNTED TRANSFORMER DETAIL
NOT TO SCALE



8 TYPICAL FREESTANDING EQUIPMENT RACK DETAIL
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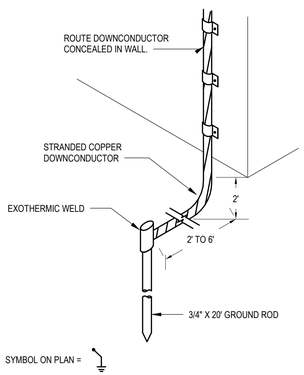
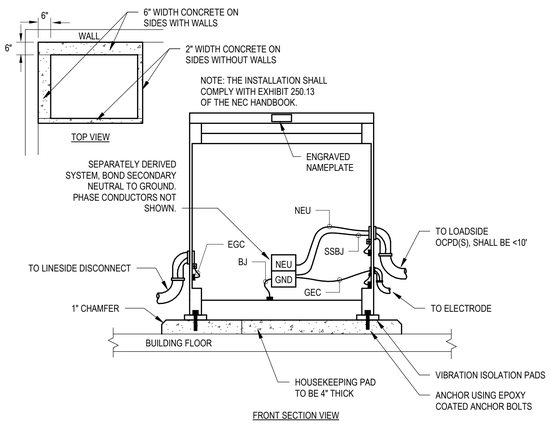
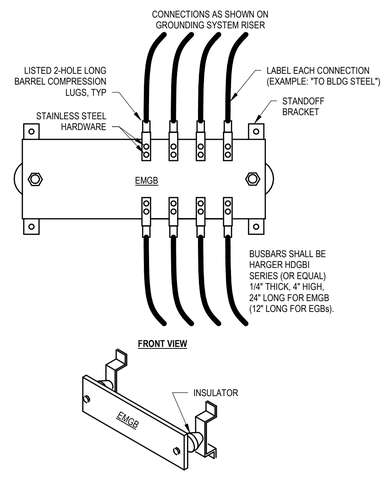


2 GROUNDING ARRANGEMENT
NOT TO SCALE

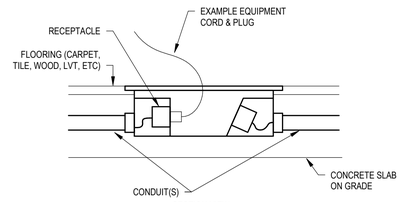


FRONT SECTION VIEW

5 DRY TYPE FLOOR MOUNTED TRANSFORMER DETAIL
NOT TO SCALE

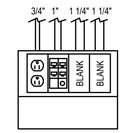


9 ELECTRICAL MAIN GROUNDING BUSBAR DETAIL
NOT TO SCALE



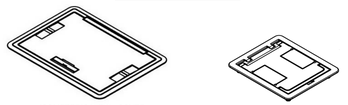
SECTION VIEW

NOTES:
1. COORDINATE FLOORBOX WITH GENERAL CONTRACTOR, STRUCTURED CABLING CONTRACTOR, BUILDING STRUCTURE, AND ARCHITECT PRIOR TO INSTALLATION.
2. FINAL LOCATION OF EACH FLOORBOX SHALL BE BY THE ARCHITECT IN THE FIELD.
3. PROVIDE MANUFACTURER'S "FIRE-PAN" FOR INSTALLATIONS WHERE IT IS NOT SLAB ON GRADE.
4. COVERS SHALL BE PAINTED ALUMINUM. ARCHITECT TO SELECT COLOR.
5. COVER SHALL BE EITHER RECESSED/FLUSH TYPE OR SURFACE TYPE. SURFACE TYPE (WHICH HAS A LIP/FLANGE TO OVERLAP THE FLOORING MATERIAL) IS TYPICALLY ONLY USED IN CARPETED FLOORS. ARCHITECT TO SELECT TYPE.
6. NOT ALL FLOORBOXES WILL HAVE ALL SERVICES AS SHOWN ABOVE. SEE PLANS AND TAGS FOR SERVICES TO POKETHRU.
7. ACCEPTS 3/4" TO 2" CONDUITS.
8. TAG DESCRIPTION: R INDICATES RECESSED, # INDICATES QTY OF GANGS, LETTERS INDICATE SERVICES PROVIDED (P=POWER, D=DATA(TELCOM), AV=AUDIO VISUAL, B=BLANK).
9. EXAMPLE TAG: **R6PDAV** THIS WOULD BE A RECESSED 6-GANG WITH POWER, DATA AND A/V.
10. BASIS OF DESIGN:
    2-GANG - WIREMOLD EVOLUTION RFB2 -OG.
    4-GANG - WIREMOLD EVOLUTION EFB45.
    6-GANG - WIREMOLD EVOLUTION EFB6.
    8-GANG - WIREMOLD EVOLUTION EFB8.
    OTHER APPROVED MANUFACTURERS: HUBBELL



R4XXXX

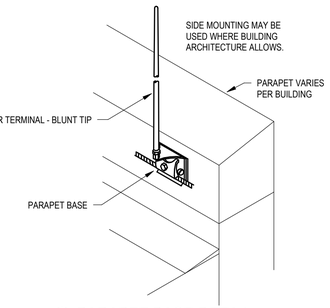
TOP VIEWS - COVERS REMOVED



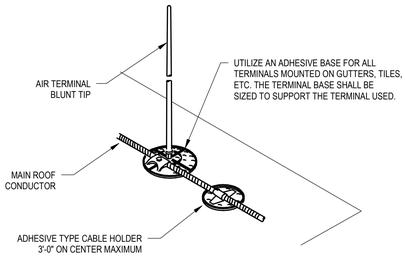
ISOMETERIC VIEW - COVER

RFB2 ISOMETERIC VIEW - COVER

3 FLOORBOX DETAIL - RECESSED
NOT TO SCALE



6 PARAPET BASE DETAIL
NOT TO SCALE



7 ADHESIVE AIR TERMINAL BASE DETAIL
NOT TO SCALE

NOTES:
PER NEC 250, PROVIDE A DEDICATED #1/0 GROUNDING ELECTRODE CONDUCTOR FROM THE EMGB TO EACH OF THE FOLLOWING:
1. MAIN ELECTRICAL SERVICE PANEL GROUND BUS
2. ROD ELECTRODE: 20' DELTA CONFIGURATION WITH (3) 20' GROUND RODS
3. LIGHTNING PROTECTION SYSTEM GROUND ROD (WHERE APPLICABLE)
4. METAL UG WATER PIPES (WHERE APPLICABLE)
5. METAL BLDG STRUCTURE
6. METAL SLAB REBAR

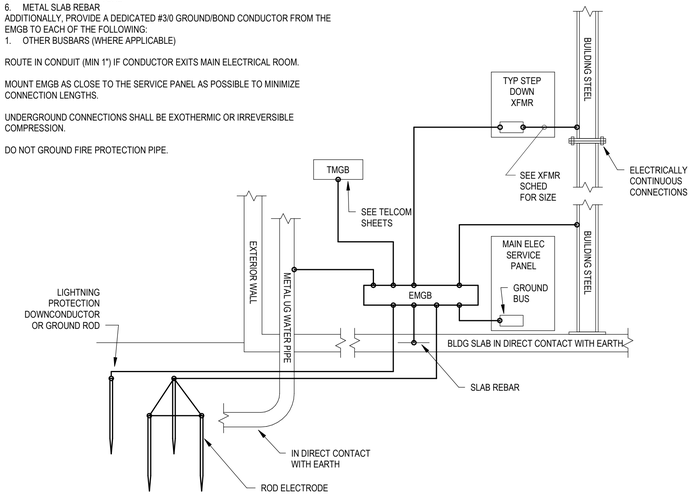
ADDITIONALLY, PROVIDE A DEDICATED #3/0 GROUND/BOND CONDUCTOR FROM THE EMGB TO EACH OF THE FOLLOWING:
1. OTHER BUSBARS (WHERE APPLICABLE)

ROUTE IN CONDUIT (MIN 1") IF CONDUCTOR EXITS MAIN ELECTRICAL ROOM.

MOUNT EMGB AS CLOSE TO THE SERVICE PANEL AS POSSIBLE TO MINIMIZE CONNECTION LENGTHS.

UNDERGROUND CONNECTIONS SHALL BE EXOTHERMIC OR IRREVERSIBLE COMPRESSION.

DO NOT GROUND FIRE PROTECTION PIPE.



10 GROUNDING BUSBAR SYSTEM RISER
NOT TO SCALE

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Moses Project # 19227

MARK R. AKIN
PE - 0059242

Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

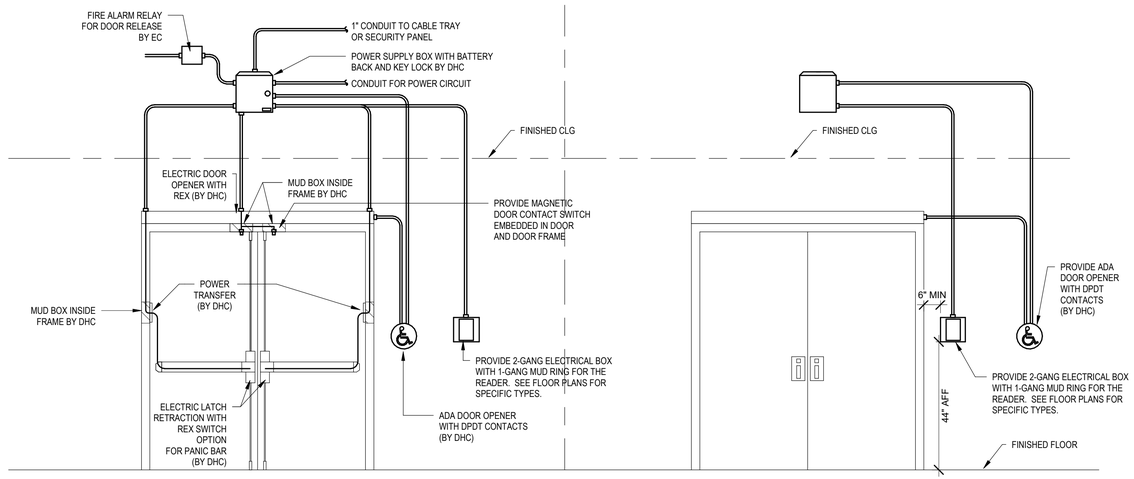
Revisions

No.	Description	Date

Sheet Information

DETAILS

E403



GENERAL NOTES:
1. CABLE TYPE AND SIZE MUST COMPLY WITH ALL ESTABLISHED REQUIREMENTS AND APPLICABLE CODES.
2. ALL CONDUITS SHALL BE 3/4" UNLESS NOTED OTHERWISE.
3. DOOR HARDWARE IS SHOWN FOR ILLUSTRATION PURPOSES ONLY. REFERENCE DIVISION 8 HARDWARE SCHEDULE AS NEEDED FOR ACTUAL HARDWARE SET.

EO-12 DESCRIPTION: DOUBLE MODE, SINGLE READER, EMERGENCY AND OPERATIONAL, NON-ADA

1 TYPICAL SECURITY DOOR - TYPE EO-12
NOT TO SCALE

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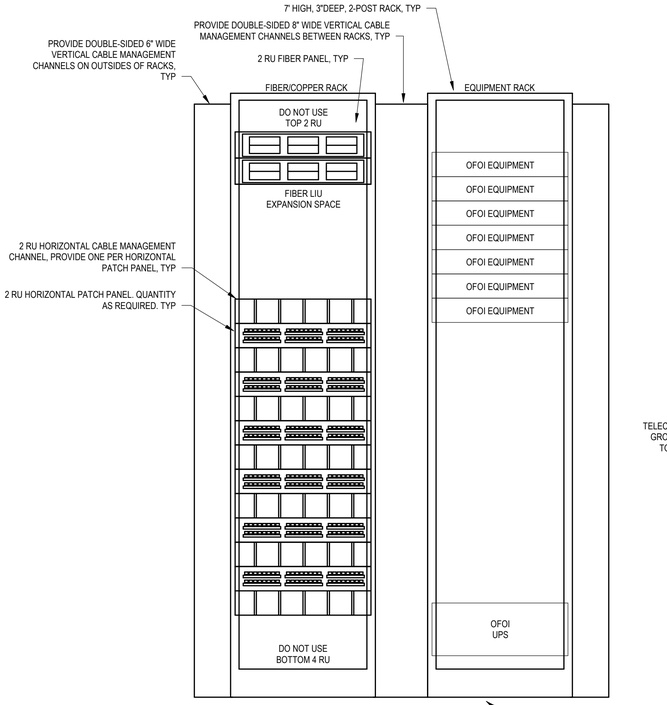
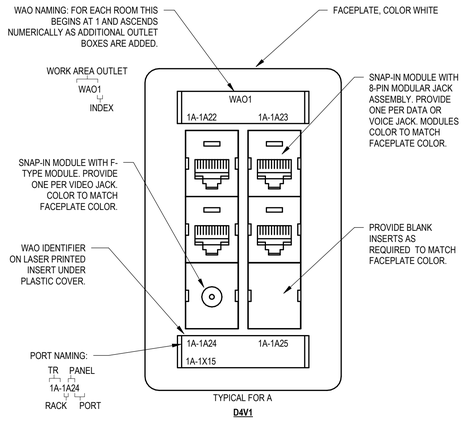
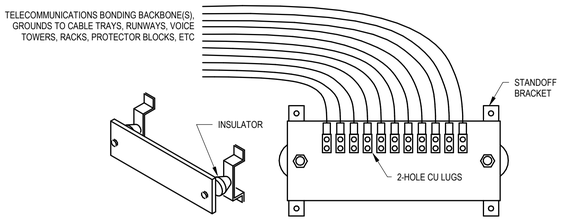


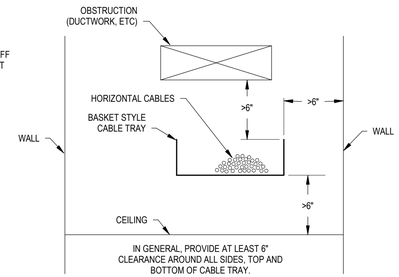
2 DOUBLE RACK ELEVATION
NOT TO SCALE



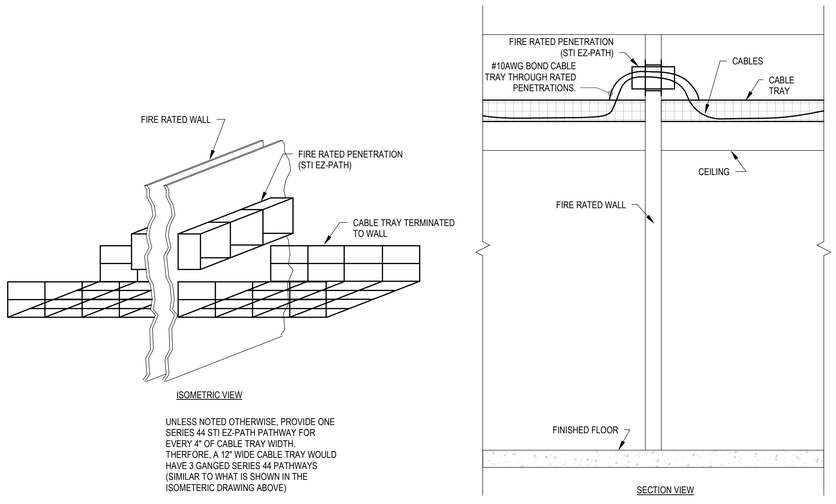
1 WAO FACEPLATE DETAIL
NOT TO SCALE



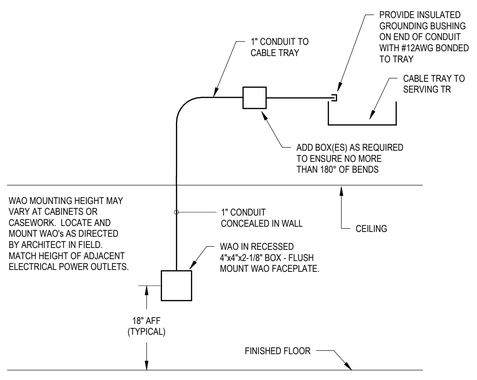
3 TMBG/TBG DETAIL
NOT TO SCALE



4 CABLE TRAY CLEARANCE DETAIL
NOT TO SCALE



5 FIRE RATED CABLE TRAY PENETRATION DETAIL
NOT TO SCALE



6 WAO MOUNTING DETAIL
NOT TO SCALE

ABBREVIATIONS

A	AMPS
AC	ABOVE COUNTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
BLDG	BUILDING
C	CONDUIT
C/L	CENTERLINE
CLG	CEILING
CU	COPPER
EC	ELECTRICAL CONTRACTOR
EF	ENTRANCE FACILITY
EGC	EQUIPMENT GROUNDING CONDUCTOR
EMGB	ELECTRICAL MAIN GROUNDING BUSBAR
EX	EXISTING TO REMAIN
EMT	ELECTRICAL METALLIC TUBING
FACP	FIRE ALARM SYSTEM CONTROL PANEL
FLR	FLOOR
GND	GROUND
GEC	GROUNDING ELECTRODE CONDUCTOR
IP	INTERNET PROTOCOL
JB	JUNCTION BOX
MCE	MAIN COMMUNICATIONS EQUIPMENT ROOM
M/M	MULTIMODE
MNS	MASS NOTIFICATION SYSTEM
MNT	MOUNTING HEIGHT
NEC	NATIONAL ELECTRICAL CODE
NIC	NOT IN CONTRACT
OFOI	OWNER FURNISHED OWNER INSTALLED
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
RM	ROOM
RGS	RIGID GALVANIZED STEEL CONDUIT
RNC	RIGID NON-METALLIC CONDUIT
SCSC	STRUCTURED CABLING SYSTEM CONTRACTOR
S/M	SINGLEMODE
TBB	TELECOMMUNICATIONS BONDING BACKBONE
TR	TELECOMMUNICATIONS ROOM
TGB	TELECOMMUNICATIONS GROUNDING BUSBAR
TMGB	TELECOMMUNICATIONS MAIN GROUNDING BUSBAR
TYP	TYPICAL
UFR	UNDERFLOOR RACEWAY
UL	UNDERWRITERS' LABORATORIES
UNO	UNLESS NOTED OTHERWISE
V	VOLT
VA	VOLT-AMPERES
W	WATTS
WAO	WORK AREA OUTLET
WAP	WIRELESS ACCESS POINT
WP	WEATHERPROOF

TELECOMMUNICATIONS LEGEND

D3V1 ▷ WORK AREA OUTLET (WAO). MOUNT ON WALL AT 18" AFF UNLESS SUBSCRIPTED OTHERWISE. SUBSCRIPTS INDICATE AS FOLLOWS:
MF - MOUNT IN MODULAR FURNITURE. COORDINATE WITH FURNITURE PRIOR TO ROUGH-IN.
CAM - INDICATES OUTLET IS FOR IP CAMERA, SEE DETAILS.
MNS - INDICATES OUTLET IS FOR MNS SPEAKER, SEE DETAILS.
WAP - INDICATES OUTLET IS LOCATED ABOVE CEILING FOR A WAP, SEE DETAIL.
84" - MOUNTING HEIGHT AFF.
D3V1 - WAO TYPE IDENTIFICATION TAG. THE NUMBER AFTER THE D INDICATES THE QUANTITY OF DATA/VOICE JACKS. THE NUMBER AFTER THE V INDICATES THE QUANTITY OF VIDEO JACKS. EACH JACK SHALL HAVE A DEDICATED HORIZONTAL CABLE HOMERUN. SEE TELECOMMUNICATIONS DETAILS AND NOTES FOR COLOR CODING AND OTHER OUTLET REQUIREMENTS.
FACP - FIRE ALARM CONTROL PANEL OUTLET IDENTIFICATION TAG. PROVIDE TWO RJ31X JACKS AND TWO DEDICATED HORIZONTAL CABLE HOMERUNS.

▷ WAO MOUNTED ABOVE COUNTER. COORDINATE WITH CASEWORK PRIOR TO ROUGH-IN.

▷ WAO MOUNTED FACE DOWN IN CEILING.

UTILITY FLOOR BOX. SEE DETAILS.

UTILITY FLOOR POKE-THRU. SEE DETAILS.

12"Wx4"D BASKET STYLE CABLE TRAY. SIZE AS INDICATED. 12"X4" UNO.

18"W LADDER STYLE CABLE TRAY. SIZE AS INDICATED.

7' FLOOR MOUNT 2 POST RACK WITH 18"W LADDER TRAY TO ADJACENT WALL.

TELECOMMUNICATIONS GROUNDING BUSBAR (TGB). SEE DETAILS AND NOTES.

PB 32"Wx60"Lx8"D PULL BOX. SIZE AS INDICATED.

CONDUIT TERMINATION TO INSULATED BUSHING.

S.T.I. EZ-PATH TRIPLE PATHWAY, FIRE RATED PATHWAY.

EMERGENCY CALL BOX. SEE DETAIL.

1 SHEET NOTE TAG.

LEADER.

LEADER.

TELCOM CONDUIT SIZE

THE MINIMUM SIZE CONDUIT IS 1". THE CONTRACTOR SHALL INCREASE SIZE AS REQUIRED FOR CONDUIT FILL BASED ON 40% MAX FILL RATIO AND THE QTY OF CABLES INTENDED TO BE PULLED INTO THE CONDUIT.

THE FOLLOWING IS BASED ON 0.23" OUTSIDE DIAMETER (OD) CABLES AND EMT CONDUIT:

EMT SIZE	MAX QTY (0.23" OD)
0.5"	2
0.75"	5
1"	8
1.25"	14
1.5"	19
2"	32
2.5"	56
3"	85
3.5"	111
4"	142

FOR EXAMPLE, IF THE PLANS SHOW A D12 OUTLET THE CONTRACTOR MUST PROVIDE ONE 1.25" CONDUIT OR TWO 1" CONDUITS. 0.5" AND 0.75" CONDUITS SHOWN FOR REFERENCE ONLY.

RESPONSIBILITIES & COORDINATION NOTE

THIS LIST IS NOT COMPREHENSIVE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY ADDITIONAL REQUIREMENTS SHOWN ON THE DRAWINGS AND/OR REQUIRED TO PROVIDE A COMPLETE SYSTEM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FULL COORDINATION WITH UF'S SCSC THROUGHOUT THE COURSE OF THE PROJECT.

RESPONSIBLE ENTITY DEFINITIONS ARE AS FOLLOWS:
OWNER = UF OR ITS SELECTED STRUCTURED CABLING SYSTEM CONTRACTOR (SCSC)
SP = SERVICE PROVIDER (COX, AT&T, ETC)
EC = ELECTRICAL CONTRACTOR

ITEM		RESPONSIBLE ENTITY
1.	EXTERIOR WORK:	
	A. CONDUIT (EXCEPT AS PER 1.2 BELOW)	OWNER
	B. CONDUIT TO 5' OUTSIDE BLDG	EC
	C. CABLES	OWNER AND/OR SP
	D. PULLBOXES, MANHOLES, ETC	OWNER
	E. EMERGENCY CALL BOXES	OWNER
2.	INTERIOR WORK:	
	A. RACEWAYS (INCL. FIRE-STOPPING):	
	a. BACKBONE CONDUIT & BOXES	EC
	b. WAO BOXES AND CONDUIT	EC
	c. HORIZONTAL CABLE TRAY	EC
	B. TELCOM ROOM BUILDOUT	
	a. BACKBOARDS	OWNER
	b. PERIMETER CABLE TRAY	OWNER
	c. RACKS W/VERTICAL WIRE MGMT	OWNER
	d. CABLE TRAY TO RACKS FROM WALL	OWNER
	C. CABLING:	
	a. BACKBONE CABLING:	
	1. CABLE (INCL. FIRE-STOPPING)	OWNER
	2. PANELS	OWNER
	3. TERMINATIONS & TESTING	OWNER
	4. LABELING & WARRANTY	OWNER
	b. HORZONTAL CABLING:	
	1. CABLE (INCL. FIRE-STOPPING)	OWNER
	2. WAOs	OWNER
	3. PATCHPANELS	OWNER
	4. TERMINATION	OWNER
	5. TESTING	OWNER
	6. LABELING	OWNER
	7. CABLE MGMT	OWNER
	8. WARRANTY	OWNER
	c. PATCH CABLES	OWNER
	D. GROUNDING:	
	a. BUSBARS	EC
	b. BACKBONE RACEWAY (INCL. FIRE-STOPPING)	EC
	c. BACKBONE CABLE (INCL. FIRE-STOPPING)	EC
	d. IN TELCOM ROOMS:	
	1. BONDS TO RACKS	OWNER
	2. BONDS TO BACKBONE RACEWAYS	OWNER
	3. BONDS TO PERIMETER TRAY	OWNER
	4. BONDS TO OTHER EQUIPMENT	OWNER
	E. ELECTRONICS:	
	a. WAPs	OWNER
	b. SWITCHES	OWNER
	c. ROUTERS	OWNER
	d. PHONE SYSTEM & PHONES	OWNER
	e. SERVERS	OWNER
	F. FINAL CLEANING	OWNER

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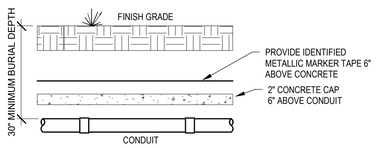
No.	Description	Date

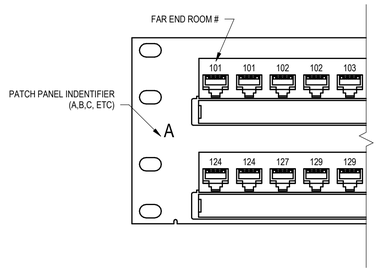
Sheet Information

TELECOM - LEGEND, ABBREVIATIONS, RESPONSIBILITIES & COORDINATION

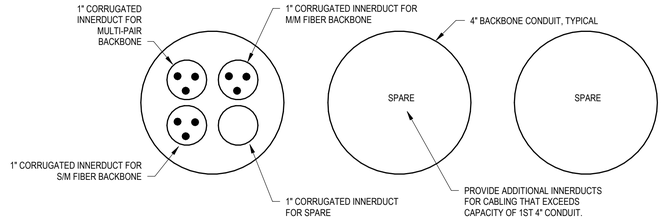
T001



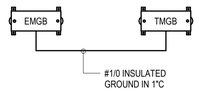
1 BURIED CONDUIT DETAIL
NOT TO SCALE



2 PATCH PANEL LABELING DETAIL
NOT TO SCALE



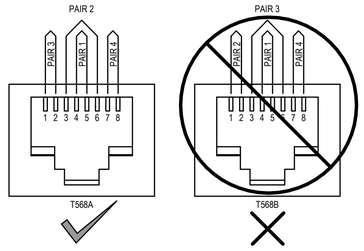
3 TYPICAL 3-4" INTERBUILDING BACKBONE RACEWAY SECTION
NOT TO SCALE



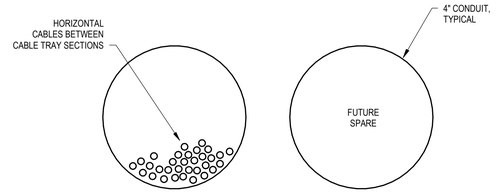
ALL TBB CABLES SHALL BE IN EMT (MINIMUM SIZE IS 1"). PROVIDE GROUNDING BUSHINGS ON EACH END AS REQUIRED. ROUTE GROUNDING BACKBONES PARALLEL TO CABLING BACKBONE RACEWAYS.

4 GROUNDING SYSTEM RISER
NOT TO SCALE

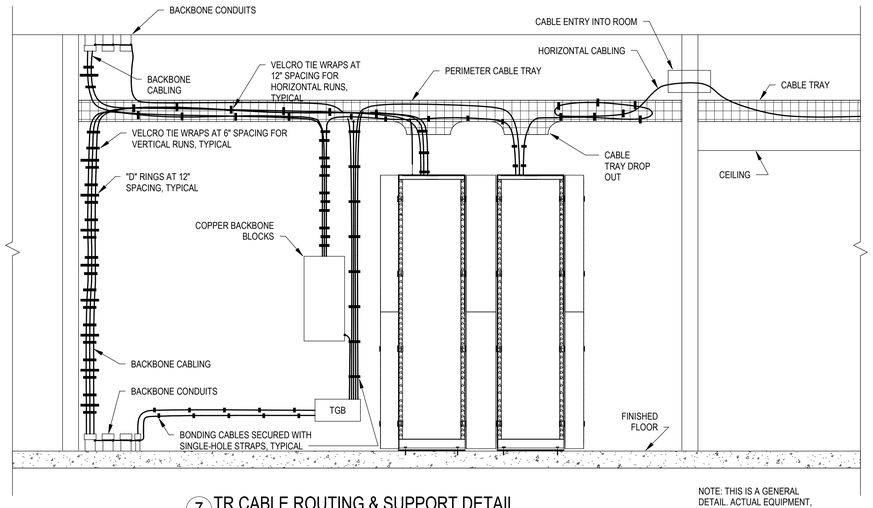
THIS PROJECT SHALL BE TERMINATED ACCORDING TO THE FOLLOWING WIRING CONFIGURATION:



5 WIRING TERMINATION STYLE DETAIL
NOT TO SCALE

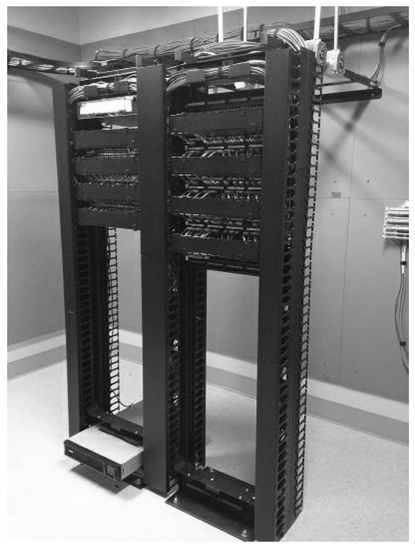


6 TYPICAL 2 - 4" INTRABUILDING BACKBONE RACEWAY SECTION
NOT TO SCALE



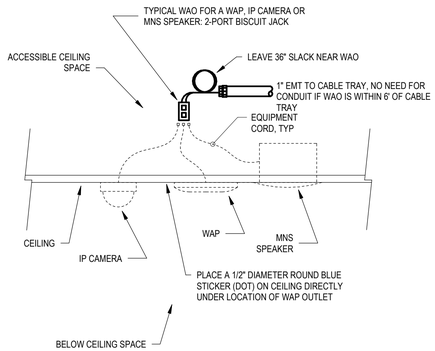
NOTE: THIS IS A GENERAL DETAIL. ACTUAL EQUIPMENT, RACK QUANTITIES, CABLE QUANTITIES, ETC MAY VARY.

7 TR CABLE ROUTING & SUPPORT DETAIL
NOT TO SCALE



NOTE: FOR INFORMATION ONLY AND INTENDED TO SHOW GENERAL COMPONENT LAYOUT. NOT INTENDED TO SHOW ACTUAL EQUIPMENT SIZE, QTY, ETC.

8 TYPICAL 2-RACK TR PICTURE
NOT TO SCALE



9 TYPICAL I.P. CAMERA, WAP, MNS SPEAKER DETAIL
NOT TO SCALE

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PE - 0059242

Project Information

Owner

IFAS BLUEBERRY RESEARCH FACILITY (UF 640)

UNIVERSITY OF FLORIDA
MAIN CAMPUS

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMNT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-18

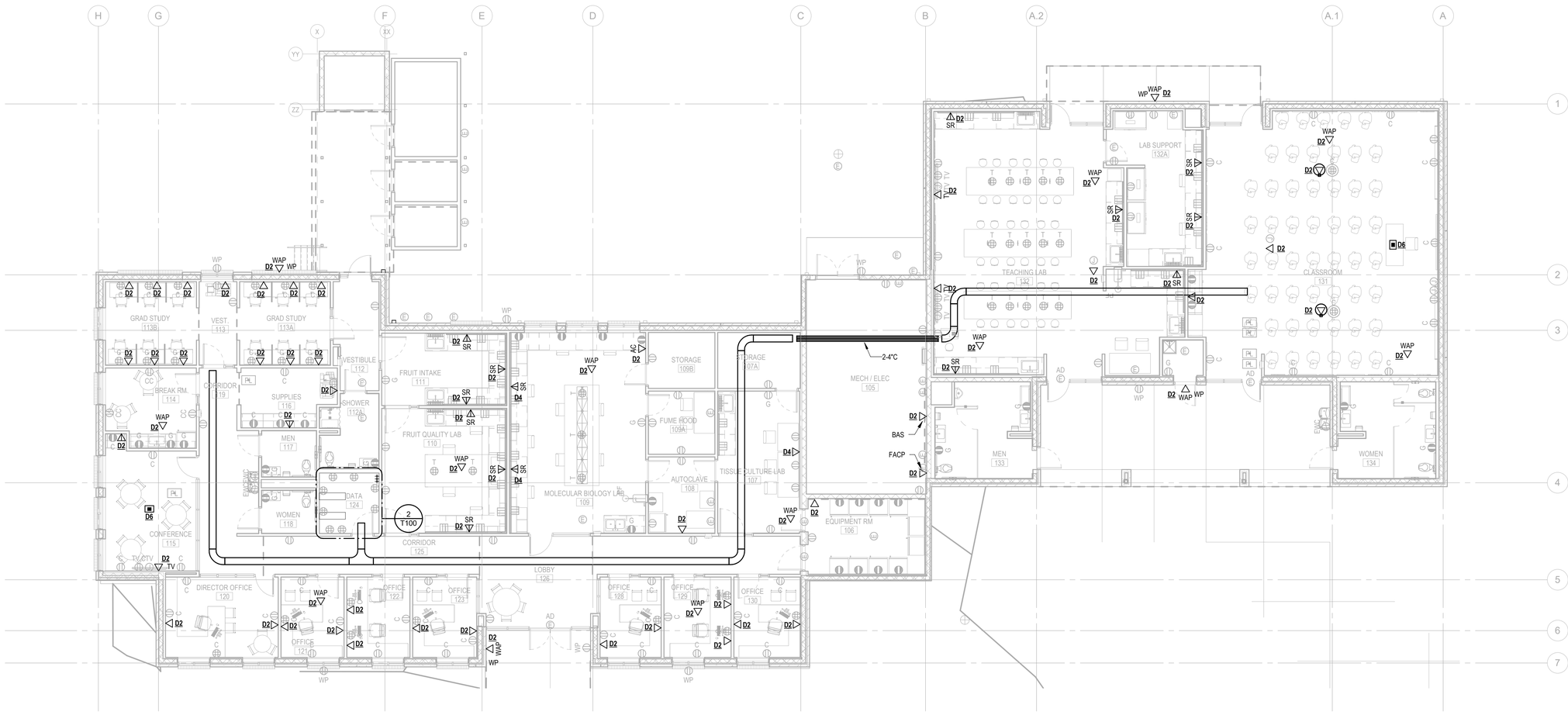
Revisions

No.	Description	Date

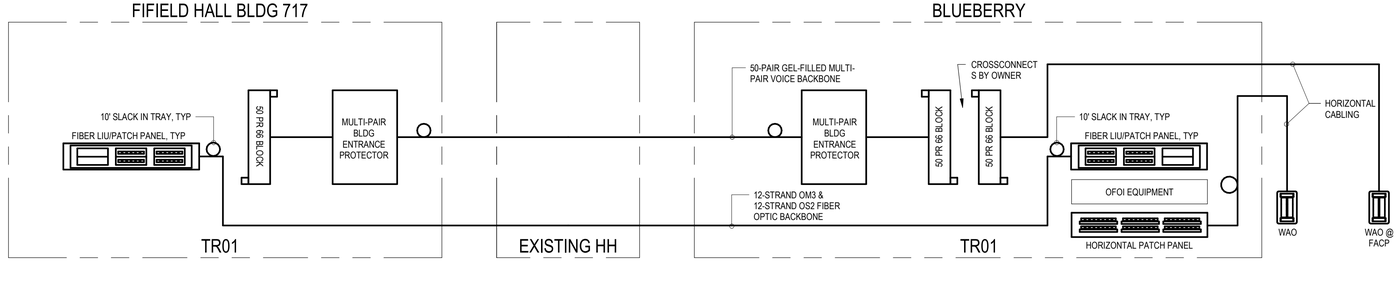
Sheet Information

DETAILS

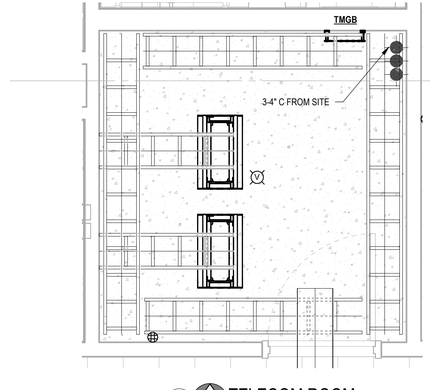
T002



1 TELECOM FIRST FLOOR PLAN
SCALE: 1/8" = 1'-0"



3 VOICE/DATA RISER
NOT TO SCALE



2 TELECOM ROOM
SCALE: 1/2" = 1'-0"

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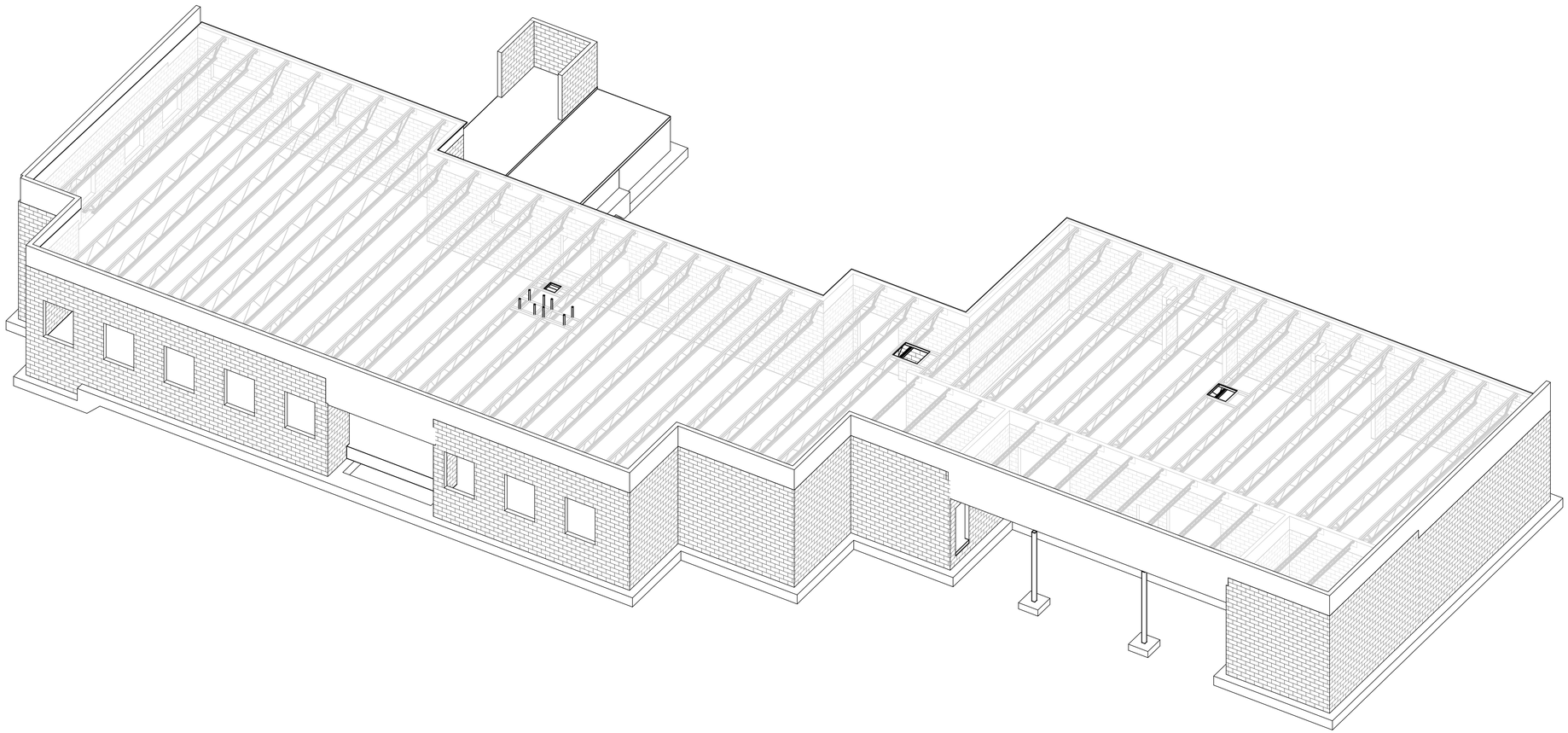
Revisions

No.	Description	Date

Sheet Information

FLOOR PLAN

T100



1 ISOMETRIC

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Certificate of Authorization No. 3818
WPM Project No. 505-1903700

DYLAN S. RICHARD
LICENSE
No. 80997
STATE OF FLORIDA
PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-16

Revisions

No.	Description	Date

Sheet Information

COVER SHEET

S000

GENERAL STRUCTURAL NOTES

PART I - DESIGN CRITERIA

A. GENERAL BUILDING CODE

1. THE CONSTRUCTION DOCUMENTS ARE BASED ON THE REQUIREMENTS OF THE FLORIDA BUILDING CODE SEVENTH EDITION(2020).

B. DEAD LOADS

1. HANGING CEILING AND MECHANICAL LOADS: AN ALLOWANCE OF 10 PSF HAS BEEN MADE FOR HANGING CEILING AND MECHANICAL EQUIPMENT LOADS SUCH AS DUCT WORK AND SPRINKLER PIPES.

C. LIVE LOADS

1. CONSTRUCTION LIVE LOADS: AN ALLOWANCE OF 20 PSF HAS BEEN PROVIDED FOR CONSTRUCTION LIVE LOADS WHICH INCLUDE BUT ARE NOT LIMITED TO MATERIALS, PERSONNEL AND EQUIPMENT IMPOSED ON THE STRUCTURE DURING CONSTRUCTION.

2. DESIGN LIVE LOADS ARE BASED ON THE MORE RESTRICTIVE OF THE UNIFORM LOAD LISTED BELOW OR THE CONCENTRATED LOAD LISTED ACTING OVER AN AREA 2.5 FEET SQUARE OR, IN THE CASE OF PARKING GARAGES, 20 SQUARE INCHES, OR STAIR TREADS, 4 SQUARE INCHES.
   a. ALL FLOORS: 100 PSF, 2,000 LBS
   b. MECHANICAL ROOMS:
      1) LARGE ROOMS: 150 PSF, REFER TO NOTE B BELOW.
      2) AIR HANDLER UNIT ROOMS, ELECTRICAL AND IT CLOSETS: 100 PSF AND REFER TO NOTE A BELOW.
   c. ROOFS:
      1) ORDINARY FLAT, PITCHED AND CURVED ROOFS: 20 PSF
      2) ROOFS SUBJECT TO MAINTENANCE WORKERS: 20 PSF, 300 LBS
   d. SIDEWALKS, PLAZAS, DRIVEWAYS SUBJECT TO VEHICULAR TRAFFIC: 250 PSF, 8,000 LBS
   e. STAIRS AND EXITS: 100 PSF, 300 LBS

   NOTES:
   a. DESIGN CONCENTRATED LOAD IS THAT REQUIRED BY ASSUMED EQUIPMENT WEIGHT.

3. REDUCTION OF LIVE LOADS:
   a. LIVE LOADS HAVE BEEN REDUCED USING THE STANDARD PROCEDURE FROM THE BUILDING CODE.
   b. FOR LIVE LOADS EXCEEDING 100 POUNDS PER SQUARE FOOT, NO REDUCTION HAS BEEN MADE, EXCEPT THAT THE DESIGN LIVE LOAD ON MEMBERS SUPPORTING TWO OR MORE FLOORS HAS BEEN REDUCED A MAXIMUM OF 20 PERCENT BUT THE LIVE LOAD IS NOT TO BE LESS THAN THAT CALCULATED BY THE FORMULA ABOVE.

D. WIND LOADS

1. WIND PRESSURES ARE BASED ON THE PROVISIONS OF THE FLORIDA BUILDING CODE WHICH REFER TO THE AMERICAN SOCIETY OF CIVIL ENGINEERS, MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES, ASCE 7-16 AND THE FOLLOWING CRITERIA:
   a. ULTIMATE DESIGN WIND SPEED (VULT): 134 MPH (3 SECOND GUST)
   b. NOMINAL DESIGN WIND SPEED (VASD): 104 MPH (3-SECOND GUST)
   c. BUILDING RISK CATEGORY: III
   d. WIND EXPOSURE CATEGORY: C
   e. INTERNAL PRESSURE COEFFICIENT (GCPI): +0.18/-0.18

2. THIS STRUCTURE IS NOT LOCATED IN A WIND-BORNE DEBRIS REGION AND HAS BEEN DESIGNED AS ENCLOSED. IMPACT-RESISTANT EXTERIOR GLAZING OR IMPACT-RESISTANT COVERING OVER EXTERIOR GLAZING IS NOT REQUIRED.

3. WIND PRESSURES USED FOR THE DESIGN OF COMPONENTS AND CLADDING ARE SHOWN IN THE FOLLOWING TABLE:

CLADDING TYPE	LOCATION OR ZONE	EFFECTIVE WIND AREA (SQ-FT)	WIND LOAD (PSF)
WALL	INTERIOR	10	+40/-43
WALL	INTERIOR	20	+38/-42
WALL	INTERIOR	50	+36/-39
WALL	INTERIOR	100	+34/-37
WALL	END ZONE	10	+40/-53
WALL	END ZONE	20	+38/-50
WALL	END ZONE	50	+36/-45
WALL	END ZONE	100	+34/-42
PARAPET	INTERIOR	10	+101/-71
PARAPET	INTERIOR	20	+91/-67
PARAPET	INTERIOR	50	+79/-63
PARAPET	INTERIOR	100	+69/-59
PARAPET	END ZONE	10	+138/-81
PARAPET	END ZONE	20	+117/-76
PARAPET	END ZONE	50	+90/-68
PARAPET	END ZONE	100	+69/-63
ROOF	INTERIOR	10	+18/-44
ROOF	INTERIOR	20	+17/-43
ROOF	INTERIOR	50	+16/-41
ROOF	INTERIOR	100	+16/-40
ROOF	EDGE	10	+18/-73
ROOF	EDGE	20	+17/-65
ROOF	EDGE	50	+16/-55
ROOF	EDGE	100	+16/-47
ROOF	CORNER	10	+18/-110
ROOF	CORNER	20	+17/-91
ROOF	CORNER	50	+16/-66
ROOF	CORNER	100	+16/-47
OVERHANG	INTERIOR	10	+16/-69
OVERHANG	INTERIOR	20	+16/-68
OVERHANG	INTERIOR	50	+16/-67
OVERHANG	INTERIOR	100	+16/-66
OVERHANG	EDGE	10	+16/-69
OVERHANG	EDGE	20	+16/-68
OVERHANG	EDGE	50	+16/-67
OVERHANG	EDGE	100	+16/-66

NOTES:
a. WIDTH OF END ZONE/EDGE/CORNER STRIP: 7 FEET
b. COMPONENT AND CLADDING PRESSURES ACT NORMAL TO THE SURFACE. POSITIVE PRESSURES ACT TOWARDS THE SURFACE AND NEGATIVE PRESSURES ACT AWAY FROM THE SURFACE.
c. DESIGN PRESSURE FOR COMPONENTS AND CLADDING SHALL NOT BE LESS THAN 16 PSF ACTING IN EITHER DIRECTION NORMAL TO THE SURFACE.
d. THE EFFECTIVE WIND AREA IS THE SPAN LENGTH MULTIPLIED BY AN EFFECTIVE WIDTH THAT NEED NOT BE LESS THAN ONE-THIRD THE SPAN LENGTH. FOR CLADDING FASTENERS, THE EFFECTIVE WIND AREA SHALL NOT BE GREATER THAN THE AREA THAT IS TRIBUTARY TO AN INDIVIDUAL FASTENER.
e. THE DESIGN PRESSURES LISTED ABOVE ARE CALCULATED USING A VALUE OF KD OF 0.85. THE VALUES MUST BE INCREASED BY 18% UNLESS LOAD COMBINATIONS SPECIFIED IN ASCE 7-16 ARE USED IN DESIGN.
f. AS PERMITTED BY SECTION 1709.5 OF THE FLORIDA BUILDING CODE FOR THE SELECTION OF LOAD-TESTED ASSEMBLIES, THE WIND PRESSURE SHALL BE DETERMINED USING THE ALLOWABLE STRESS DESIGN COMBINATIONS. THIS MAY BE DETERMINED BY MULTIPLYING THE TABULATED ULTIMATE WIND PRESSURES BY A REDUCTION FACTOR OF 0.6.

4. WIND PRESSURES USED FOR THE DESIGN OF ROOFTOP EQUIPMENT ARE SHOWN IN THE FOLLOWING TABLE:

LOAD TYPE	PROJECTED UNIT AREA (SQ-FT)	WIND LOAD (PSF)
LATERAL	ALL	+114/-114
UPLIFT	ALL	+55/-55

NOTES:
a. PRESSURES ACT NORMAL TO THE SURFACE. POSITIVE PRESSURES ACT TOWARDS THE SURFACE AND NEGATIVE PRESSURES ACT AWAY FROM THE SURFACE.
b. DESIGN PRESSURE FOR COMPONENTS AND CLADDING SHALL NOT BE LESS THAN 16 PSF ACTING IN EITHER DIRECTION NORMAL TO THE SURFACE.
c. THE DESIGN PRESSURES LISTED ABOVE ARE CALCULATED USING A VALUE OF KD OF 0.85. THE VALUES MUST BE INCREASED BY 18% UNLESS LOAD COMBINATIONS SPECIFIED IN ASCE 7-10 ARE USED IN DESIGN.

E. FUTURE EXPANSION

1. NO PROVISIONS FOR ANY FUTURE EXPANSIONS HAVE BEEN MADE IN THE STRUCTURAL DESIGN.

F. BUILDING MOVEMENT AND DEFLECTIONS

1. THE BUILDING MOVEMENT SPECIFIED HEREIN IS ANTICIPATED TO OCCUR AND SHOULD BE CONSIDERED BY THE CONTRACTOR IN THE PERFORMANCE OF THE WORK.

2. SPANDREL BEAM DEFLECTIONS. THE FOLLOWING PROVISION SHOULD BE MADE FOR SUPERIMPOSED LOAD DEFLECTION OF ONE FLOOR RELATIVE TO AN ADJACENT FLOOR IN THE DESIGN, FABRICATION, AND ERECTION OF THE BUILDING CLADDING:
   a. TYPICAL SPANDREL BEAM: 3/8"

   SUPERIMPOSED LOAD DEFLECTION IS DEFINED AS ALL DEFLECTION ANTICIPATED TO OCCUR AFTER THE CLADDING HAS BEEN ERECTED. THE RELATIVE DEFLECTION ABOVE DOES NOT INCLUDE THE FLOOR DEFLECTION CAUSED BY THE WEIGHT OF THE CLADDING ITSELF OR THE DEAD LOAD DEFLECTION OF THE FLOOR FRAMING ITSELF, NOR DOES IT INCLUDE ANY ALLOWANCE FOR FABRICATION OR ERECTION TOLERANCES.

3. FLOOR DEFLECTIONS: THE FOLLOWING PROVISION FOR SUPERIMPOSED LOAD DEFLECTIONS SHALL BE MADE IN THE DESIGN, FABRICATION, AND INSTALLATION OF ALL PARTITIONS, GLASS WALLS, AND OTHER ELEMENTS SUPPORTED BY AND ATTACHED TO THE STRUCTURE:
   a. TYPICAL FLOOR MEMBERS: SPAN/360 BUT NOT LESS THAN 3/8"
   b. TYPICAL ROOF MEMBERS: SPAN/360 BUT NOT LESS THAN 3/8"

4. LATERAL FRAME WIND DEFLECTION (DRIFT): THE FOLLOWING PROVISION FOR LATERAL FRAME DEFLECTION IN THE PLANE OF THE WALL OF ONE FLOOR RELATIVE TO AN ADJACENT FLOOR SHALL BE MADE IN THE DESIGN, FABRICATION AND INSTALLATION OF THE BUILDING CLADDING:
   a. TYPICAL FLOOR TO FLOOR: FLOOR HEIGHT/400
   THE DEFLECTIONS LISTED ABOVE ARE BASED ON WIND LOADS WITH A 10-YEAR MEAN RECURRENCE INTERVAL.

G. RESTRAINED CONSTRUCTION CLASSIFICATION

1. IN ACCORDANCE WITH ASTM E 119, ALL FLOOR CONSTRUCTION IS CLASSIFIED AS RESTRAINED CONSTRUCTION.

H. DESIGN LOAD FOR RESTROOM ACCESSORIES

1. GRAB BARS, TUB AND SHOWER SEATS, FASTENERS, AND MOUNTING DEVICES SHALL BE DESIGNED TO RESIST A CONCENTRATED LOAD OF 250 POUNDS AT ANY LOCATION AND IN ANY DIRECTION.

I. HANDRAILS AND GUARDS

1. THE HANDRAIL ASSEMBLIES AND GUARDS SHALL BE DESIGNED FOR 50 PLF OR A CONCENTRATED LOAD OF 200 POUNDS AT ANY POINT APPLIED IN ANY DIRECTION AT THE TOP AND TO TRANSFER THIS LOAD THROUGH THE SUPPORTS TO THE STRUCTURE. THESE LOADS NEED NOT BE ASSUMED TO ACT CONCURRENTLY.

J. ROOFTOP EQUIPMENT ANCHORAGE

1. ALL ROOF TOP EQUIPMENT CURBS, ROOF TOP MECHANICAL EQUIPMENT, EQUIPMENT TIE DOWNS, AND CONNECTIONS OF ALL EQUIPMENT TO BUILDING STRUCTURE FOR WIND LOADING ARE TO BE DESIGNED AND ENGINEERED BY A REGISTERED SPECIALTY ENGINEER RETAINED BY THE MECHANICAL EQUIPMENT SUPPLIER. SIGNED AND SEALED DRAWINGS AND CALCULATIONS ARE TO BE SUBMITTED TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL. THE EQUIPMENT MANUFACTURER SHALL PROVIDE THE ATTACHMENT OF THE UNIT TO THE STRUCTURE AND SUBMIT TO THE ENGINEER LOADS, LOCATIONS, AND METHODS OF ATTACHMENT. THE STRUCTURAL ENGINEER WILL MAKE PROVISIONS IN THE DESIGN OF THE PRIMARY STRUCTURAL FRAME TO ACCOMMODATE THE LOADS AND ATTACHMENTS SUBMITTED BY THE MANUFACTURER.

PART II - FOUNDATION

A. GEOTECHNICAL REPORT

1. FOUNDATION DESIGN IS BASED ON THE GEOTECHNICAL INVESTIGATION REPORT "SUMMARY OF REPORT OF A GEOTECHNICAL SITE EXPLORATIONS - UF 640 BLUEBERRY RESEARCH GAINESVILLE, ALACHUA COUNTY, FLORIDA, GSE PROJECT NO 14486" DATED MARCH 26, 2020. ADDITIONAL INFORMATION WAS PROVIDED IN "ADDENDUM 1" DATED MAY 6, 2020.

2. THE GEOTECHNICAL REPORT IS AVAILABLE TO THE GENERAL CONTRACTOR UPON REQUEST TO THE OWNER. THE INFORMATION INCLUDED THEREIN MAY BE USED BY THE GENERAL CONTRACTOR FOR HIS GENERAL INFORMATION ONLY. THE ARCHITECT AND ENGINEER WILL NOT BE RESPONSIBLE FOR THE ACCURACY OR APPLICABILITY OF SUCH DATA THEREIN.

B. SHALLOW FOUNDATION TYPE

1. SPREAD FOOTING:
   a. DESIGN PRESSURES
      1) TOTAL LOAD: 3,000 PSF NET ALLOWABLE PRESSURE
      2) ALLOWABLE PRESSURES ARE INCREASED 33% FOR COMBINED GRAVITY AND WIND LOADS.

C. CONSTRUCTION DEWATERING

1. THE CONTRACTOR SHALL DETERMINE THE EXTENT OF CONSTRUCTION DEWATERING REQUIRED FOR THE EXCAVATION. THE CONTRACTOR SHALL SUBMIT TO THE GEOTECHNICAL ENGINEER FOR REVIEW THE PROPOSED PLAN FOR CONSTRUCTION DEWATERING, PRIOR TO BEGINNING THE EXCAVATION.

PART III - REINFORCED CONCRETE

A. CLASSES OF CONCRETE

1. ALL CONCRETE SHALL CONFORM TO THE REQUIREMENTS OF THE "CLASSES OF CONCRETE MATRIX" ON SHEET S403 UNLESS NOTED OTHERWISE ON THE DRAWINGS.

B. HORIZONTAL CONSTRUCTION JOINTS IN CONCRETE POURS

1. THERE SHALL BE NO HORIZONTAL CONSTRUCTION JOINTS IN ANY CONCRETE POURS UNLESS SHOWN ON THE DRAWINGS. THE ARCHITECT/ENGINEER SHALL APPROVE ALL DEVIATIONS OR ADDITIONAL JOINTS IN WRITING.

C. REINFORCING STEEL

1. ALL REINFORCING STEEL SHALL BE ASTM A 615 GRADE 60 UNLESS NOTED OTHERWISE ON THE DRAWINGS OR IN THESE NOTES.

2. REINFORCING STEEL IN ARCHITECTURAL PRECAST CONCRETE: ASTM A 615, GRADE 60.

3. REINFORCING STEEL: PROVIDE REINFORCING STEEL CONFORMING TO ASTM A 706 FOR ALL REINFORCING STEEL REQUIRED TO BE WELDED AND WHERE NOTED ON THE DRAWINGS.
   a. FIELD WELDING TO BE DONE BY WELDERS CERTIFIED BY THE LADBS FOR REINFORCING STEEL. CONTINUOUS INSPECTION BY A DEPUTY INSPECTOR IS REQUIRED.
   b. SHOP WELDS MUST BE PERFORMED IN AN LADBS-LICENSED FABRICATION SHOP.

4. DEFORMED BAR ANCHORS: 3/8" TO 5/8" DIAMETER AWS D1.1 TYPE C (TABLE 7.1) STUDS MANUFACTURED IN CONFORMANCE WITH SPECIFICATION ASTM A 1064 WITH A MINIMUM YIELD STRENGTH 70,000 PSI. 3/4" OR LARGER DIAMETER, ASTM A706 BARS OF EQUAL SIZE WITH WELDS TO STEEL SUBSTRATE THAT DEVELOP FULL STRENGTH OF ANCHOR. ASTM A 615 REINFORCING BARS SHALL NOT BE SUBSTITUTED FOR DEFORMED BAR ANCHORS.

5. HEADED STUD ANCHORS FOR EMBEDDED PLATES: AWS D1.1 TYPE A STUDS MANUFACTURED IN CONFORMANCE WITH SPECIFICATION ASTM A 29 WITH A MINIMUM TENSILE STRENGTH OF 61,000 PSI.

6. HEADED SHEAR STUDS FOR SHEAR REINFORCEMENT: ASTM A 1044 WITH A MINIMUM YIELD STRENGTH OF 51,000 PSI.

7. SMOOTH WELDED WIRE REINFORCEMENT: ASTM A 185, YIELD STRENGTH 65,000 PSI.

D. PLACEMENT OF WELDED WIRE REINFORCEMENT

1. WHEREVER WELDED WIRE REINFORCEMENT IS SPECIFIED AS REINFORCEMENT, IT SHALL BE CONTINUOUS ACROSS THE ENTIRE CONCRETE SURFACE AND NOT INTERRUPTED BY BEAMS OR GIRDERS AND PROPERLY LAPPED PER ACI 318, 25.5.3 AND 25.5.4.

E. REINFORCEMENT IN TOPPING SLABS

1. PROVIDE MINIMUM REINFORCEMENT AS NOTED BELOW IN ALL TOPPING SLABS UNLESS SPECIFIED OTHERWISE ON THE DRAWINGS.
   a. WELDED SMOOTH WIRE REINFORCEMENT 6x6-W2.9xW2.9.

F. REINFORCEMENT IN HOUSEKEEPING PADS

1. PROVIDE MINIMUM REINFORCEMENT AS NOTED BELOW IN ALL HOUSEKEEPING PADS SUPPORTING MECHANICAL EQUIPMENT UNLESS SPECIFIED OTHERWISE ON THE DRAWINGS.
   a. WELDED SMOOTH WIRE REINFORCEMENT 6x6-W2.9xW2.9.

G. REINFORCING STEEL COVERAGE

1. REINFORCING STEEL COVERAGE SHOULD CONFORM TO THE REQUIREMENTS SPECIFIED IN DETAILS LABELED "TYPICAL CLEAR CONCRETE COVER" ON SHEET S007 UNLESS NOTED OTHERWISE ON THE DRAWINGS. COVER SPECIFIED SHALL BE CONSIDERED MINIMUMS THAT MAY REQUIRE INCREASING WHERE REINFORCING STEEL INTERSECTS FOR DIFFERENT MEMBER TYPES. COVER IN STRUCTURAL MEMBERS NOT SPECIFIED IN THE DETAILS SHALL CONFORM TO THE REQUIREMENTS OF ACI 318 UNLESS SPECIFIED OTHERWISE ON THE DRAWINGS. THE REINFORCING STEEL DETAILER SHALL ADJUST REINFORCING STEEL CAGE SIZES AT INTERSECTING STRUCTURAL MEMBERS AS REQUIRED TO ALLOW CLEARANCE FOR INTERSECTING REINFORCING BAR LAYERS WITH MINIMUM SPECIFIED COVER.

PART IV - CONCRETE MASONRY

A. SCOPE

1. REFER TO ARCHITECT'S DRAWINGS FOR THE EXTENT OF MASONRY WALLS. NON-LOADBEARING WALLS MAY NOT BE SHOWN ON THE STRUCTURAL DRAWINGS.

2. REINFORCED CONCRETE MASONRY SHALL BE USED AS BACK-UP FOR EXTERIOR BRICK WALLS AND ELSEWHERE AS INDICATED ON THE DRAWINGS. SEE ARCHITECTURAL WALL SECTIONS.

3. PROVIDE ONE-COURSE HORIZONTAL BOND BEAM REINFORCE WITH 1-#5 CONTINUOUS AT EVERY FLOOR LEVEL, ROOF LEVEL, AND PARAPET, MINIMUM.

B. CONCRETE MASONRY UNITS.

1. CONCRETE STRENGTH OF MASONRY UNITS (BASED ON NET AREA) SHALL BE 1,900 PSI MINIMUM.

2. UNITS SHALL CONFORM TO ASTM C 55 OR ASTM C 90 AND SAMPLED IN ACCORDANCE WITH ASTM C 140.

C. MORTAR

1. USE ONLY PORTLAND CEMENT/LIME, TYPE M OR S, MORTAR CONFORMING TO ASTM C 270. PROVIDE AN AVERAGE COMPRESSIVE STRENGTH AT 28 DAYS OF 1,800 PSI MINIMUM.

D. GROUT

1. MIX DESIGNS:
   a. FOR FILLING SPACES 4" OR LARGER IN BOTH HORIZONTAL DIRECTIONS, USE "COARSE GROUT" WITH A MINIMUM COMPRESSIVE STRENGTH OF 3,000 PSI. THE GROUT SHALL BE TESTED IN ACCORDANCE WITH ASTM C1019. FOR FILLING SPACES LESS THAN 4" IN ONE OR BOTH HORIZONTAL DIRECTIONS, USE "FINE GROUT" PROPORTIONED PER ASTM C 476.
   b. USE 3,000 PSI NORMALWEIGHT CONCRETE FOR FILLING SPACES 10" AND LARGER IN BOTH DIRECTIONS. THE GROUT SHALL BE TESTED IN ACCORDANCE WITH ASTM C 1019.
   c. ALL GROUT MIX DESIGN SUBMITTALS SHALL INCLUDE THE RESULTS OF THE TESTS PERFORMED IN ACCORDANCE WITH ASTM C 1019.
   d. SLUMP RANGE AT POINT OF FINAL DISCHARGE: 8" TO 11".
   e. THE USE OF AIR ENTRAINING ADMIXTURES IS NOT ALLOWED.

E. MINIMUM REINFORCEMENT FOR CONCRETE MASONRY UNITS

1. REINFORCING STEEL IN CONCRETE MASONRY CONSTRUCTION: ASTM A 615, GRADE 60.

2. PROVIDE VERTICAL REINFORCEMENT IN CELLS OF CONCRETE MASONRY UNITS (FULLY EMBEDDED IN GROUT) AS SHOWN ON THE PLANS AND OTHER DETAILS. MINIMUM REINFORCEMENT OF INTERIOR AND EXTERIOR MASONRY SHALL BE AS FOLLOWS:
   a. 1-#5 AT A MAXIMUM SPACING OF 48 INCHES
   b. 1-#5 AT EACH CORNER
   c. 1-#5 AT EACH SIDE OF OPENINGS UP TO 12 FEET WIDE
   d. 2-#5 OR 1-#7 AT BOTH SIDES OF OPENINGS OVER 12 FEET WIDE
   e. HEAVIER REINFORCEMENT MAY BE REQUIRED BY PLAN NOTES OR DETAILS IN THE DRAWINGS.

3. MINIMUM LAP OF ALL REINFORCING STEEL SHALL BE AS FOLLOWS:
   a. #5: 30 INCHES
   b. #6: 36 INCHES
   c. #7: 42 INCHES
   REFER TO DETAILS AND SCHEDULES FOR OTHER LAP SPLICE LENGTH REQUIREMENTS.
   DO NOT LAP VERTICAL REINFORCEMENT AT INTERSECTING BOND BEAMS. REINFORCEMENT SHALL BE CONTINUOUS THROUGH INTERSECTING BOND BEAMS.

4. PROVIDE HORIZONTAL REINFORCEMENT IN BED JOINTS EVERY OTHER COURSE (MAXIMUM 16" SPACING) IN TYPICAL WALLS AND IN EVERY COURSE (MAXIMUM 8" SPACING) IN PARAPETS AND CANTILEVERED WALLS.

5. TERMINATION OF REINFORCING STEEL:
   a. ALL VERTICAL REINFORCEMENT SHALL HAVE STANDARD HOOK INTO BOND BEAM OR TIE BEAM. TERMINATE AT HIGHEST BOND BEAM OR TIE BEAM IF MASONRY DOES NOT EXTEND TO ROOF OR GROUTED CELL IS NOT CONTINUOUS TO ROOF. HOOK SHALL EXTEND TO THE UPPERMOST HORIZONTAL REINFORCEMENT OF THE BOND BEAM OR TIE BEAM AND HAVE A MINIMUM EMBEDMENT OF 6".
   b. ALL HORIZONTAL REINFORCEMENT AT ENDS OF BOND BEAMS OR TIE BEAMS SHALL HAVE STANDARD HOOK INTO VERTICAL GROUTED CELL. PROVIDE CORNER BARS SUCH THAT HORIZONTAL REINFORCEMENT IS CONTINUOUS AROUND CORNERS.

F. REINFORCING STEEL COVERAGE

1. COVER TO REINFORCING STEEL WITHIN MASONRY ELEMENTS SHALL NOT BE LESS THAN THE FOLLOWING:
   a. EXPOSED TO EARTH OR WEATHER: 2" (#6 AND LARGER BARS), 1.5" (#5 AND SMALLER BARS).
   b. NOT EXPOSED TO EARTH OR WEATHER: 1.5"
   c. LONGITUDINAL WIRES OF JOINT REINFORCEMENT SHALL BE FULLY EMBEDDED IN MORTAR OR GROUT WITH A MINIMUM COVER OF 5/8" WHEN EXPOSED TO EARTH AND WEATHER AND 1/2" WHEN NOT EXPOSED TO EARTH OR WEATHER.

G. CONTROL JOINTS

1. CONTROL JOINTS SHALL BE PROVIDED IN ALL CONCRETE MASONRY CONSTRUCTION. REFER TO TYPICAL CONTROL JOINT DETAIL ON SHEET S401 FOR GUIDELINES AND SPACINGS.

H. STABILITY AND BRACING OF MASONRY WALLS DURING CONSTRUCTION

1. ALL MASONRY WALLS SHOWN ON THE ARCHITECTURAL AND STRUCTURAL DRAWINGS HAVE BEEN DESIGNED TO RESIST THE REQUIRED CODE VERTICAL AND LATERAL FORCES APPLIED TO THEM IN THE FINAL CONSTRUCTED CONFIGURATION ONLY ASSUMING FULL BRACING TOP, BOTTOM, AND/OR SIDE OF WALL AS SHOWN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PROPERLY AND ADEQUATELY BRACE ALL MASONRY WALLS AT ALL STAGES DURING CONSTRUCTION TO RESIST ERECTION LOADS AND LATERAL LOADS THAT COULD POSSIBLY BE APPLIED PRIOR TO COMPLETION OF CONSTRUCTION.

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No. 80997
STATE OF FLORIDA
PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

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Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-16

Revisions

No.	Description	Date

Sheet Information

GENERAL STRUCTURAL NOTES

S001

GENERAL STRUCTURAL NOTES

PART V - STRUCTURAL STEEL

A. MATERIAL

1. HOT ROLLED STRUCTURAL MEMBERS: ALL HOT ROLLED STEEL PLATES, SHAPES, SHEET PILING, AND BARS SHALL BE NEW STEEL CONFORMING TO ASTM SPECIFICATION A 6.

2. ASTM SPECIFICATION AND GRADE: CLEARLY MARK THE GRADE OF STEEL ON EACH PIECE, WITH A DISTINGUISHING MARK VISIBLE FROM FLOOR SURFACES, FOR THE PURPOSE OF FIELD INSPECTION OF PROPER GRADE OF STEEL. UNLESS NOTED OTHERWISE ON THE DRAWINGS, STRUCTURAL STEEL SHALL BE AS FOLLOWS:
   a. W- AND WT-SHAPES: ASTM A 992.
   b. M- AND S-SHAPES: ASTM A572, GRADE 50.
   c. C-SHAPES: ASTM A572, GRADE 50.
   d. L-SHAPES: ASTM A 36.
   e. ROUND HSS: ASTM A 500, GRADE B (FY=42 KSI).
   f. RECTANGULAR HSS: ASTM A 500, GRADE C (FY=50 KSI).
   g. BASE PLATES: ALL BASE PLATES SHALL CONFORM TO ASTM A 36 UNLESS NOTED OTHERWISE ON THE DRAWINGS.
   h. EDGE ANGLES, BENT PLATES, ANGLE HANGERS, AND ANGLE KICKERS: ASTM A 36.
   i. CONNECTION MATERIAL:
      1) ALL CONNECTION MATERIAL, EXCEPT AS NOTED OTHERWISE HEREIN OR ON THE DRAWINGS, INCLUDING BEARING PLATES, GUSSET PLATES, STIFFENER PLATES, FILLER PLATES, ANGLES, ETC. SHALL CONFORM TO ASTM A 36 UNLESS A HIGHER GRADE OF STEEL IS REQUIRED BY STRENGTH AND PROVIDED THE RESULTING SIZES ARE COMPATIBLE WITH THE CONNECTED MEMBERS.
   j. OTHER STEEL: ANY OTHER STEEL NOT INDICATED OTHERWISE SHALL CONFORM TO ASTM A 992 OR ASTM A 572, GRADE 50, EXCEPT PLATES AND ANGLES THAT SHALL BE ASTM A 36.

B. CONNECTIONS

1. CONNECTION DETAILS NOT COMPLETELY DETAILED ON THE DRAWINGS INCLUDING MATERIAL GRADE AND SIZES, WELD SIZES, AND NUMBER OF BOLTS SHALL BE DESIGNED BY THE CONTRACTOR PER THE SPECIFICATIONS. CONCEPTUAL CONNECTION DETAILS WITH THE REQUIRED MEMBER DESIGN FORCES ARE SHOWN ON THE DRAWINGS AND ARE APPLICABLE TO ALL CONNECTIONS NOT DESIGNED AND FULLY DETAILED ON THE DRAWINGS. THE CONCEPTUAL DETAILS ARE PROVIDED ONLY TO INDICATE THE CONNECTION TYPE REQUIRED AND MAY NOT FULLY REPRESENT THE COMPLEXITY OF THE CONNECTION AS REQUIRED BY THE FINAL CONNECTION DESIGN FOR THE FORCES THEY MUST RESIST. ADDITIONAL CONNECTION ELEMENTS MAY NOT BE SPECIFICALLY SHOWN IN THE CONCEPTUAL DETAILS BUT MAY BE REQUIRED BY THE FINAL CONNECTION DESIGN, SUCH AS STIFFENER PLATES, DOUBLER PLATES, SUPPLEMENT/ REINFORCING PLATES OR OTHER CONNECTION MATERIAL. THE FABRICATOR IS RESPONSIBLE FOR ENGAGING THE SERVICES OF A CONNECTION SPECIALTY ENGINEER TO PREPARE A FINAL CONNECTION DESIGN FOR SUBMISSION THAT MEETS THE REQUIREMENTS OF THE CONCEPTUAL CONNECTION DETAILS AND RESISTS THE INDICATED DESIGN FORCES.

2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

3. REACTIONS NOTED ON THE PLANS ARE BASED ON FACTORED LOADS AND ARE INTENDED FOR USE WITH THE LOAD AND RESISTANCE FACTOR DESIGN METHOD.

C. STRUCTURAL BOLTS AND THREADED FASTENERS

1. A 325 BOLTS: ALL BOLTS IN STRUCTURAL CONNECTIONS SHALL CONFORM TO ASTM A 325 TYPE 1, UNLESS INDICATED OTHERWISE ON THE DRAWINGS.

2. THREADED ROUND STOCK: THREADED RODS SHALL CONFORM TO:
   a. ASTM A 572 GRADE 50 (TO 2 INCHES IN DIAMETER).

D. WELDING

1. UNLESS NOTED OTHERWISE, ELECTRODES FOR WELDING SHALL CONFORM TO E70XX (SMAW), F7XX-EXXX (SAW), ER70S-X (GMAW), OR E7XT-X (FCAW).

E. ANCHOR RODS

1. UNLESS INDICATED OTHERWISE IN THE COLUMN SCHEDULE OR ON THE DRAWINGS, ANCHOR RODS SHALL CONFORM TO ASTM F 1554 GRADE 55 (WITH SUPPLEMENTARY REQUIREMENT S1) AND THE SIZE SHALL BE 3/4" DIAMETER AND SHALL EMBED INTO THE CONCRETE FOUNDATION A DISTANCE OF 1'-0" WITH A HEAVY HEX NUT AT THE EMBEDDED END. STRIKE BOLT THREADS AT THE EMBEDDED END AT TWO PLACES BELOW THE NUT.

F. GROUT

1. GROUT BELOW STRUCTURAL STEEL BASE PLATES SHALL BE NON-METALLIC, NON-SHRINK GROUT WITH A MINIMUM STRENGTH OF 6,000 PSI WHEN BEARING ON 3,000 PSI CONCRETE OR LESS, A STRENGTH OF 8,000 PSI WHEN BEARING ON CONCRETE BETWEEN 3,000 AND 4,000 PSI, AND, UNLESS NOTED OTHERWISE ON THE DRAWINGS, A STRENGTH OF 8,000 PSI WHEN BEARING ON CONCRETE GREATER THAN 4,000 PSI.

PART VI - STEEL JOISTS

A. FABRICATION AND ERECTION

1. END SUPPORTS AND END ANCHORAGE:
   a. PROVIDE STANDARD DEPTH OF BEARING FOR ALL JOISTS AS SHOWN BELOW UNLESS NOTED OTHERWISE ON THE DRAWINGS:
      1) ALL K SERIES: 2 1/2"
   b. PROVIDE FLAT BEARING FOR ALL JOISTS UNLESS NOTED OTHERWISE ON DRAWINGS. INCREASE THE DEPTH OF THE SEAT ON THE HIGH END OF SLOPED JOISTS AS REQUIRED TO PROVIDE CLEARANCE FOR THE CONNECTION.

B. DESIGN

1. ALL JOISTS SHALL CARRY THE DESIGN LOADS AS SPECIFIED IN THE SJI LOAD TABLES AS THE MINIMUM REQUIREMENT. ADDITIONALLY, THE JOISTS SHALL BE DESIGNED TO CARRY ANY OTHER LOAD TYPES AND PATTERNS AS INDICATED ON THE DRAWINGS.

2. STEEL JOISTS, BRIDGING, AND THEIR CONNECTIONS SHALL BE DESIGNED FOR A NET UPLIFT EQUAL TO THE UPWARD COMPONENT AND CLADDING WIND PRESSURES SHOWN ON THE STRUCTURAL DRAWINGS MINUS 5 PSF OF DEAD LOAD.

3. JOIST GIRDERS SHALL BE DESIGNED FOR THE UPLIFT CONCENTRATED LOADS SHOWN ON THE DRAWINGS.

4. STEEL JOISTS, BRIDGING, AND THEIR CONNECTIONS SHALL BE DESIGNED FOR ADDITIONAL DOWN FORCE RESULTING FROM WIND AS SHOWN ON THE STRUCTURAL DRAWINGS. DOWN FORCE WIND LOADING IN COMBINATION WITH DEAD AND LIVE LOADS MAY CONTROL THE DESIGN OF THESE ELEMENTS.

PART VII - STEEL DECKS

A. ROOF DECK

1. SCHEDULE:

LOCATION	MINIMUM YIELD STRENGTH	DEPTH OF DECK	GAGE OF DECK	TYPE
TYPICAL ROOF	33	1.5"	18	WR

NOTES:
MINIMUM YIELD STRENGTH, KIPS PER INCHES^2
WR: WIDE RIB, TYPE B

2. ATTACHMENT OF DECK:
   a. MINIMUM ATTACHMENT AT SUPPORTS: STEEL DECK UNITS SHALL BE FASTENED TO ALL SUPPORT MEMBERS AT EACH RIB (36/7) WITH 3/4" DIAMETER PUDDLE WELDS, UNLESS NOTED OTHERWISE. AT MEMBERS PARALLEL TO DECK SPAN, SPACING OF FASTENERS SHALL BE 6".
   b. MINIMUM ATTACHMENT AT SIDE LAPS: SIDE LAPS OF ADJACENT UNITS SHALL BE FASTENED BY WELDING, SHEET METAL SCREWS, OR BUTTON PUNCHING AT A MAXIMUM OF 12", UNLESS NOTED OTHERWISE.

3. FLAT, RIDGE, AND VALLEY PLATES:
UNLESS NOTED OTHERWISE, CONTRACTOR SHALL PROVIDE FLAT PLATES (20 GAGE MINIMUM) AT ALL LOCATIONS WHERE ROOF DECK CHANGES DIRECTION AND RIDGE OR VALLEY PLATES (20 GAGE MINIMUM) AT ALL LOCATIONS WHERE ROOF SLOPE EXCEEDS 1/2" PER FOOT.

PART VIII - SUBMITTALS

A. SUBMITTAL LIST AND SCHEDULE

1. THE GENERAL CONTRACTOR SHALL PREPARE A DETAILED LIST AND SCHEDULE OF ALL SUBMITTAL ITEMS TO BE SENT TO THE STRUCTURAL ENGINEER PRIOR TO THE START OF CONSTRUCTION. THIS LIST SHALL BE UPDATED AND REVISED AND KEPT CURRENT AS THE JOB PROGRESSES. THE SUBMITTAL LIST SHALL BE ORGANIZED AS SHOWN BELOW:
   a. SHOP DRAWINGS
   b. DESIGN CALCULATIONS
   c. PRODUCT DATA, CERTIFICATES, REPORTS, AND OTHER LITERATURE

B. SUBMITTALS TO BE PROVIDED TO STRUCTURAL ENGINEER

1. STRUCTURAL SUBMITTALS: IN ADDITION TO THE SUBMITTALS REQUIRED BY THE STRUCTURAL SPECIFICATIONS, THE FOLLOWING SUBMITTALS SHALL BE PROVIDED:
   a. LAYOUT OF EMBEDDED ITEMS (PLATES, ANGLES, BOLTS, ETC.) OR ITEMS ATTACHED TO THE STRUCTURAL FRAME FOR BUILDING CLADDING ATTACHMENT OR FOR ATTACHMENT OF OTHER ITEMS.

2. DEFERRED SUBMITTALS:
   a. THE FOLLOWING ITEMS ARE CONSIDERED DEFERRED SUBMITTALS BY THE REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE:
      1) COLD-FORMED METAL FRAMING (S&S)
      2) FORMWORK (REC)
      3) METAL FABRICATIONS, RAILINGS, AND GRATINGS (S&S)
      4) ROOF TOP EQUIPMENT AND ANCHORAGES (S&S)
      5) STEEL JOISTS (S&S)
      6) STEEL STAIRS (S&S)
      7) STRUCTURAL STEEL CONNECTIONS (S&S)
      8) WINDOW WASHING AND FALL ARREST SYSTEMS (S&S)

   NOTES:

   (S&S) ITEMS MARKED THUS SHALL HAVE THE SHOP DRAWINGS AND DELEGATED DESIGN SUBMITTALS (INCLUDING CALCULATIONS) SEALED PER THE PROJECT SPECIFICATIONS BY AN ENGINEER REGISTERED IN THE STATE WHERE THE PROJECT IS LOCATED.

   (REC) ITEMS MARKED THUS SHALL BE SUBMITTED TO ENGINEER FOR RECORD ONLY AND WILL NOT HAVE THE ENGINEER'S SHOP DRAWING STAMP AFFIXED.

   b. DOCUMENTS FOR DEFERRED SUBMITTAL ITEMS SHALL BE SUBMITTED TO THE REGISTERED DESIGN PROFESSIONAL AND SHALL BE FORWARDED TO THE BUILDING OFFICIAL.
   c. DEFERRED SUBMITTAL ITEMS SHALL NOT BE INSTALLED UNTIL THE DEFERRED SUBMITTAL DOCUMENTS HAVE BEEN APPROVED BY THE BUILDING OFFICIAL.

3. SUBMITTALS WITH IMPACT TO STRUCTURE:
   a. CONSTRUCTION AND CONTROL JOINT LOCATIONS IN INSULATING CONCRETE
   b. INSULATING CONCRETE MIX DESIGNS
   c. MECHANICAL EQUIPMENT WEIGHTS

4. SUBMITTAL REQUIREMENTS:
   a. ALL SHOP DRAWINGS MUST BE REVIEWED AND ELECTRONICALLY STAMPED BY THE GENERAL CONTRACTOR PRIOR TO SUBMITTAL.
   b. CONTRACTOR SHALL PROVIDE THE SUBMITTAL IN ELECTRONIC PORTABLE DOCUMENT FORMAT (PDF) PER THE SPECIFICATIONS.
   c. THE OMISSION FROM THE SHOP DRAWINGS OF ANY MATERIALS REQUIRED BY THE CONTRACT DOCUMENTS TO BE FURNISHED SHALL NOT RELIEVE THE CONTRACTOR OF THE RESPONSIBILITY OF FURNISHING AND INSTALLING SUCH MATERIALS, REGARDLESS OF WHETHER THE SHOP DRAWINGS HAVE BEEN REVIEWED AND APPROVED.

C. REPRODUCTION

1. THE USE OF ELECTRONIC FILES OR REPRODUCTIONS OF THESE CONTRACT DOCUMENTS BY ANY CONTRACTOR, SUBCONTRACTOR, ERECTOR, FABRICATOR, OR MATERIAL SUPPLIER IN LIEU OF PREPARATION OF SHOP DRAWINGS SIGNIFIES THEIR ACCEPTANCE OF ALL INFORMATION SHOWN HEREON AS CORRECT, AND OBLIGATES THEMSELVES TO ANY JOB EXPENSE, REAL OR IMPLIED, ARISING DUE TO ANY ERRORS THAT MAY OCCUR HEREON.

PART IX - MISCELLANEOUS

A. CONTRACT DOCUMENTS

1. IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO OBTAIN ALL CONTRACT DOCUMENTS AND LATEST ADDENDA AND TO SUBMIT SUCH DOCUMENTS TO ALL SUBCONTRACTORS AND MATERIAL SUPPLIERS PRIOR TO THE SUBMITTAL OF SHOP DRAWINGS, FABRICATION OF ANY STRUCTURAL MEMBERS, AND ERECTION IN THE FIELD.

2. THE CONTRACT STRUCTURAL DRAWINGS AND SPECIFICATIONS REPRESENT THE FINISHED STRUCTURE, AND, EXCEPT WHERE SPECIFICALLY SHOWN, DO NOT INDICATE THE METHOD OR MEANS OF CONSTRUCTION. THE CONTRACTOR SHALL SUPERVISE AND DIRECT THE WORK AND SHALL BE SOLELY RESPONSIBLE FOR ALL CONSTRUCTION MEANS, METHODS, PROCEDURES, TECHNIQUES, AND SEQUENCE.

3. OPENINGS THROUGH FLOORS, ROOFS, AND WALLS FOR DUCTS, PIPING, AND/OR CONDUIT SHALL BE COORDINATED BY THE CONTRACTOR. CONTRACTOR SHALL VERIFY SIZES AND LOCATIONS OF HOLES AND OPENINGS WITH THE MECHANICAL, ELECTRICAL, PLUMBING, AND FIRE PROTECTION DRAWINGS AND THE RESPECTIVE SUBCONTRACTORS.

4. REFER TO DRAWINGS OTHER THAN STRUCTURAL FOR COMPLETE INFORMATION INCLUDING: TYPES OF FLOOR SLAB FINISHES AND THEIR LOCATIONS, FLOOR SLAB DEPRESSIONS AND CURBS, OPENINGS IN STRUCTURAL WALLS, ROOFS AND FLOORS REQUIRED BY ARCHITECTURAL AND MEP FEATURES, STAIRS, RAMPS, ETC.

5. WHERE MEMBER LOCATIONS ARE NOT SPECIFICALLY DIMENSIONED, MEMBERS ARE EITHER LOCATED ON COLUMNS LINES OR ARE EQUALLY SPACED BETWEEN LOCATED MEMBERS.

6. IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR SPECIFIED ON THE DRAWINGS OR IN THE SPECIFICATIONS, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS SHOWN OR SPECIFIED IN SIMILAR CONDITIONS.

B. DRAWING CONFLICTS

1. THE GENERAL CONTRACTOR SHALL COMPARE THE ARCHITECTURAL AND STRUCTURAL DRAWINGS AND REPORT ANY DISCREPANCY BETWEEN EACH SET OF DRAWINGS AND WITHIN EACH SET OF DRAWINGS TO THE ARCHITECT AND ENGINEER PRIOR TO THE FABRICATION AND INSTALLATION OF ANY STRUCTURAL MEMBERS.

C. CONFLICTS IN STRUCTURAL REQUIREMENTS

1. WHERE CONFLICT EXISTS AMONG THE VARIOUS PARTS OF THE STRUCTURAL CONTRACT DOCUMENTS, STRUCTURAL DRAWINGS, GENERAL NOTES, AND SPECIFICATIONS, THE STRICTEST REQUIREMENTS, AS INDICATED BY THE ENGINEER, SHALL GOVERN.

D. EXISTING CONDITIONS

1. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND CONDITIONS OF THE EXISTING BUILDING AT THE JOB SITE AND REPORT ANY DISCREPANCIES FROM ASSUMED CONDITIONS SHOWN ON THE DRAWINGS TO THE ARCHITECT AND ENGINEER PRIOR TO THE FABRICATION AND ERECTION OF ANY MEMBERS.

2. WORK SHOWN ON THE DRAWINGS IS NEW, UNLESS NOTED AS EXISTING.

3. EXISTING CONSTRUCTION SHOWN ON THE DRAWINGS WAS OBTAINED FROM EXISTING CONSTRUCTION DOCUMENTS AND LIMITED SITE OBSERVATION. THESE DRAWINGS OF EXISTING CONSTRUCTION ARE AVAILABLE FOR CONTRACTOR USE. HOWEVER, THE AVAILABLE DRAWINGS OF EXISTING CONSTRUCTION ARE NOT NECESSARILY COMPLETE. THE CONTRACTOR SHALL FIELD VERIFY ALL PERTINENT INFORMATION.

4. DEMOLITION, CUTTING, DRILLING, ETC. OF EXISTING WORK SHALL BE PERFORMED WITH GREAT CARE SO AS NOT TO JEOPARDIZE THE STRUCTURAL INTEGRITY OF THE EXISTING BUILDING. IF ANY ARCHITECTURAL, STRUCTURAL, OR MEP MEMBERS NOT DESIGNATED FOR REMOVAL INTERFERE WITH THE NEW WORK, THE ARCHITECT SHALL BE NOTIFIED IMMEDIATELY AND APPROVAL OBTAINED PRIOR TO REMOVAL OF THOSE MEMBERS.

5. THE CONTRACTOR SHALL SAFELY SHORE EXISTING CONSTRUCTION WHEREVER EXISTING SUPPORTS ARE REMOVED TO ALLOW THE INSTALLATION OF NEW WORK. ALL SHORING METHODS AND SEQUENCING OF DEMOLITION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND HIS ENGINEER.

6. THE CONTRACTOR SHALL VERIFY THE LOCATION OF EXISTING UTILITIES PRIOR TO THE START OF CONSTRUCTION AND TAKE CARE TO PROTECT EXISTING UTILITIES THAT ARE TO REMAIN IN SERVICE.

7. THE CONTRACTOR SHALL REPAIR ALL DAMAGE CAUSED DURING CONSTRUCTION WITH SIMILAR MATERIALS AND WORKMANSHIP TO RESTORE CONDITIONS TO LEVELS ACCEPTABLE TO THE ARCHITECT.

E. ADJACENT BUILDINGS AND PROPERTY

1. THE GENERAL CONTRACTOR SHALL ENSURE THAT ALL CONSTRUCTION METHODS USED WILL NOT CAUSE DAMAGE TO THE ADJACENT BUILDINGS AND PROPERTY. THIS SHALL INCLUDE ALL FOUNDATION INSTALLATION.

2. THE GENERAL CONTRACTOR IS ADVISED TO PERFORM ALL PHOTOGRAPHIC SURVEYS AND OTHER DOCUMENTATION OF THE ADJACENT BUILDINGS BEFORE THE START OF AND DURING CONSTRUCTION.

F. RESPONSIBILITY OF THE CONTRACTOR FOR STABILITY OF THE STRUCTURE DURING CONSTRUCTION

1. ALL STRUCTURAL ELEMENTS OF THE PROJECT HAVE BEEN DESIGNED BY THE STRUCTURAL ENGINEER TO RESIST THE REQUIRED CODE VERTICAL AND LATERAL FORCES THAT COULD OCCUR IN THE FINAL COMPLETED STRUCTURE ONLY. THE ABILITY OF THE STRUCTURAL FRAME TO RESIST THE REQUIRED CODE FORCES DERIVES FROM THE COMPLETE INSTALLATION OF THE LATERAL FORCE RESISTING SYSTEMS AND DIAPHRAGMS DESCRIBED BELOW. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO DESIGN AND PROVIDE ALL REQUIRED BRACING DURING CONSTRUCTION TO MAINTAIN THE STABILITY AND SAFETY OF ALL STRUCTURAL ELEMENTS DURING THE CONSTRUCTION PROCESS UNTIL THE LATERAL-LOAD RESISTING OR STABILITY-PROVIDING SYSTEM IS COMPLETELY INSTALLED AND ALL DESIGNATED CONCRETE ELEMENTS (IF ANY) HAVE REACHED A MINIMUM OF 75% OF THEIR DESIGN STRENGTH. THIS INCLUDES DESIGNING FOR ALL APPLICABLE TEMPORARY, CONSTRUCTION AND ENVIRONMENTAL FORCES PER ASCE 37 INCLUDING BUT NOT LIMITED TO WIND AND SEISMIC ON THE STRUCTURE DURING CONSTRUCTION. THE REQUIRED STRUCTURAL ELEMENTS ARE:

PART IX - MISCELLANEOUS (CONTINUED)

   a. MASONRY OR CONCRETE LOADBEARING WALL SYSTEM:
      1) LATERAL-FORCE RESISTING SYSTEM
         a) MASONRY WALLS UPON WHICH STRUCTURAL STEEL ELEMENTS OR CONCRETE HORIZONTAL FRAMING ELEMENTS BEAR.
      2). DIAPHRAGM
         a) A STEEL DECK DIAPHRAGM THAT IS COMPLETELY ATTACHED TO ALL ROOF MEMBERS ACCORDING TO SPECIFICATIONS AND THAT CREATES A CONTINUOUS ELEMENT LINKING THE LATERAL-FORCE RESISTING SYSTEM TO ALL OTHER COLUMNS.
   b. SLAB-ON-GRADE:
      1) DIAPHRAGM
         a) THE SLAB-ON-GRADE IS NOT USED AS A STRUCTURAL DIAPHRAGM.

G. RESPONSIBILITY OF THE CONTRACTOR FOR CONSTRUCTION LOADS

1. THE STRUCTURE HAS BEEN DESIGNED FOR THE LOADS IDENTIFIED WITHIN THESE STRUCTURAL DRAWINGS THAT ARE ANTICIPATED TO BE APPLIED TO THE FINAL STRUCTURE ONCE COMPLETED AND OCCUPIED. THE CONTRACTOR SHALL NOT OVERLOAD THE STRUCTURE DURING CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CHECKING THE ADEQUACY OF THE STRUCTURE TO SUPPORT ANY APPLIED CONSTRUCTION LOADS, INCLUDING THOSE DUE TO CONSTRUCTION VEHICLES OR EQUIPMENT, MATERIAL HANDLING OR STORAGE, SHORING OR RESHORING, OR ANY OTHER CONSTRUCTION ACTIVITY. THE CONTRACTOR SHALL SUBMIT CALCULATIONS SIGNED AND SEALED BY AN ENGINEER LICENSED IN THE STATE WHERE THE PROJECT IS LOCATED VERIFYING THE ADEQUACY OF THE STRUCTURE FOR ANY PROPOSED CONSTRUCTION LOADS THAT ARE IN EXCESS OF THE STATED DESIGN LOADS. THE STRUCTURAL ENGINEER IS NOT RESPONSIBLE TO DESIGN OR CHECK THE STRUCTURE FOR LOADS APPLIED TO THE STRUCTURE FOR ANY CONSTRUCTION ACTIVITY.

H. CONTRACTOR SUBSTITUTIONS

1. ANY MATERIALS OR PRODUCTS SUBMITTED FOR APPROVAL THAT ARE DIFFERENT FROM THE MATERIAL OR PRODUCTS SPECIFIED IN THE STRUCTURAL CONTRACT DOCUMENTS WILL BE APPROVED ONLY IF THE FOLLOWING CRITERIA ARE SATISFIED:
   a. A COST SAVINGS TO THE OWNER IS DOCUMENTED AND SUBMITTED WITH THE REQUEST.
   b. THE MATERIAL OR PRODUCT HAS BEEN APPROVED BY THE INTERNATIONAL CODE COUNCIL (ICC) AND THE ICC REPORT IS SUBMITTED WITH THE REQUEST.
      1) THE ICC ESR THAT IS SUBMITTED MUST REFERENCE THE BUILDING CODE UNDER WHICH THE PROJECT IS PERMITTED.
      2) ICC REPORTS THAT HAVE BEEN DISCONTINUED AT THE TIME OF PRODUCT INSTALLATION WILL NOT BE ACCEPTED.

2. SUBMITTALS NOT SATISFYING THE ABOVE CRITERIA WILL NOT BE CONSIDERED.

I. MECHANICAL EQUIPMENT WEIGHTS

1. THE GENERAL CONTRACTOR SHALL SUBMIT ACTUAL WEIGHTS OF EQUIPMENT TO BE USED IN THE PROJECT TO THE STRUCTURAL ENGINEER FOR VERIFICATION OF LOADS USED IN THE DESIGN AT LEAST THREE WEEKS PRIOR TO FABRICATION AND CONSTRUCTION OF THE SUPPORTING STRUCTURE.

J. THE STRUCTURAL ENGINEER'S ROLE DURING CONSTRUCTION

1. THE ENGINEER SHALL NOT HAVE CONTROL NOR CHARGE OF, AND SHALL NOT BE RESPONSIBLE FOR, CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, OR PROCEDURES, FOR SAFETY PRECAUTIONS AND PROGRAMS IN CONNECTION WITH THE WORK, FOR THE ACTS OR OMISSION OF THE CONTRACTOR, SUBCONTRACTOR, OR ANY OTHER PERSONS PERFORMING ANY OF THE WORK, OR FOR THE FAILURE OF ANY OF THEM TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

2. PERIODIC SITE OBSERVATION BY FIELD REPRESENTATIVES OF WALTER P. MOORE AND ASSOCIATES IS SOLELY FOR THE PURPOSE OF BECOMING GENERALLY FAMILIAR WITH THE PROGRESS AND QUALITY OF THE WORK COMPLETED AND DETERMINING, IN GENERAL, IF THE WORK OBSERVED IS BEING PERFORMED IN A MANNER INDICATING THAT THE WORK, WHEN FULLY COMPLETED, WILL BE IN ACCORDANCE WITH THE STRUCTURAL CONTRACT DOCUMENTS. THIS LIMITED SITE OBSERVATION SHOULD NOT BE CONSTRUED AS EXHAUSTIVE OR CONTINUOUS TO CHECK THE QUALITY OR QUANTITY OF THE WORK, BUT RATHER PERIODIC IN AN EFFORT TO KEEP THE OWNER REASONABLY INFORMED ABOUT THE PROGRESS AND QUALITY OF THE PORTION OF THE STRUCTURE COMPLETED.

K. MAINTENANCE STATEMENT

1. ALL STRUCTURES REQUIRE PERIODIC MAINTENANCE TO EXTEND LIFESPAN AND TO ENSURE STRUCTURAL INTEGRITY FROM EXPOSURE TO THE ENVIRONMENT. A PLANNED PROGRAM OF MAINTENANCE SHALL BE ESTABLISHED BY THE BUILDING OWNER. THIS PROGRAM SHALL INCLUDE SUCH ITEMS SUCH AS BUT NOT LIMITED TO PAINTING OF STRUCTURAL STEEL, PROTECTIVE COATING FOR CONCRETE, SEALANTS, CAULKED JOINTS, EXPANSION JOINTS, CONTROL JOINTS, SPALLS AND CRACKS IN CONCRETE, AND PRESSURE WASHING OF EXPOSED STRUCTURAL ELEMENTS EXPOSED TO A SALT ENVIRONMENT OR OTHER HARSH CHEMICALS.

L. SPECIALTY ENGINEER REQUIREMENTS

1. THE FLORIDA STATE BOARD OF PROFESSIONAL ENGINEERS HAS ISSUED RULES ON RESPONSIBILITIES OF PROFESSIONAL ENGINEERS CONCERNING THE DESIGN OF STRUCTURES, PURSUANT TO CHAPTER 61G15-31 OF THE FLORIDA ADMINISTRATIVE CODE. CERTAIN COMPONENTS OF THE STRUCTURE REQUIRE THE WORK OF A SPECIALTY ENGINEER FOR THE DESIGN. ALL PROCEDURES STATED IN THE RULES SHALL APPLY TO THESE SPECIALTY COMPONENTS.

PART X - DRAWING INTERPRETATION

A. DRAWING VIEWS LABELED AS "TYPICAL"

1. PARTIAL PLANS, ELEVATIONS, SECTIONS, DETAILS, OR SCHEDULES LABELED WITH "TYPICAL" AT THE BEGINNING OF THEIR TITLE SHALL APPLY TO ALL SITUATIONS OCCURRING ON THE PROJECT THAT ARE THE SAME OR SIMILAR TO THOSE SPECIFICALLY SHOWN. THE APPLICABILITY OF THE CONTENT OF THESE VIEWS TO LOCATIONS ON THE PLAN CAN BE DETERMINED FROM THE TITLE OF THE VIEWS. SUCH VIEWS SHALL APPLY WHETHER OR NOT THEY ARE KEYED IN AT EACH LOCATION. DECISIONS REGARDING APPLICABILITY OF THESE "TYPICAL" VIEWS SHALL BE DETERMINED BY THE STRUCTURAL ENGINEER.

B. STRUCTURAL ABBREVIATIONS, SYMBOLS, AND NOTATIONS

1. REFER TO SHEET SO03 AND SO04 FOR ABBREVIATIONS, SYMBOLS, AND NOTATIONS USED ON THE STRUCTURAL DRAWINGS.

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Certificate of Authorization No. 3818
WPM Project No. 505-1903700

DYLAN S. RICHARD
LICENSE
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STATE OF FLORIDA
PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

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Revisions

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Sheet Information

GENERAL STRUCTURAL NOTES

S002

STRUCTURAL SYMBOLS AND NOTATIONS

MATERIAL IDENTIFICATION SYMBOLS

THE FOLLOWING MATERIAL IDENTIFICATION SYMBOLS MAY BE USED IN THE SECTIONS AND DETAILS:

ALUMINUM | CAST-IN-PLACE CONCRETE | EARTH | EARTH (UNDISTURBED) | EXISTING CONSTRUCTION | GRAVEL | GROUT

MASONRY | POLYSTYRENE | RIGID INSULATION | ROCK | STEEL | STRUCTURAL PRECAST CONCRETE | WOOD

THE FOLLOWING MATERIAL IDENTIFICATION SYMBOLS MAY BE USED IN THE PLANS:

STEEL COLUMN | CONCRETE COLUMN | CONCRETE WALL | LOADBEARING MASONRY WALL | NON-LOADBEARING MASONRY WALL | STRUCTURAL PRECAST WALL | GRATING

BOUNDARY OF EXISTING CONSTRUCTION

BOUNDARY OF EXISTING CONSTRUCTION TO BE DEMOLISHED

BOUNDARY OF FUTURE EXPANSION

BOUNDARY OF CONCRETE TOPPING SLAB POURED ON SUBSTRUCTURE

SYMBOLIC LINEWORK

THE FOLLOWING SYMBOLIC LINEWORK MAY BE USED THROUGHOUT THE DRAWINGS:

REFERENCE GRID LINE SYMBOL

CENTERLINE SYMBOL

PLAN MATCHLINE SYMBOL

NON-STRUCTURAL LINE SYMBOL

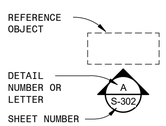
WELDED WIRE REINFORCEMENT SYMBOL

STEEL JOIST LINE SYMBOL

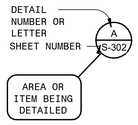
OPENING LINE SYMBOL

VIEW REFERENCE SYMBOLS

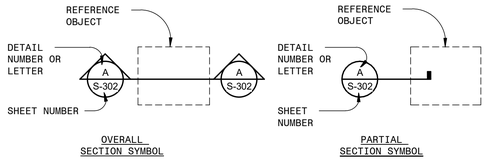
THESE FOLLOWING SYMBOLS MAY BE USED THROUGHOUT THE DRAWINGS TO REFER TO OTHER VIEWS:



FRAMING ELEVATION SYMBOL



DETAIL REFERENCE SYMBOL

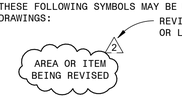


OVERALL SECTION SYMBOL

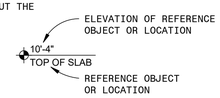
PARTIAL SECTION SYMBOL

UNIVERSAL SYMBOLS

THESE FOLLOWING SYMBOLS MAY BE USED THROUGHOUT THE DRAWINGS:



REVISION CLOUD SYMBOL



ELEVATION DESIGNATION SYMBOL

UNIVERSAL SYMBOLS (CONTINUED)

THESE FOLLOWING SYMBOLS MAY BE USED THROUGHOUT THE DRAWINGS:

REFERENCE GRID INDICATOR SYMBOL

WORK POINT SYMBOL

FLAT FACE BREAK MARK

CURVED FACE BREAK MARK

LINE BREAK MARK

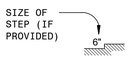
PLAN SYMBOLS

THE FOLLOWING SYMBOLS MAY BE USED THROUGHOUT THE PLANS.

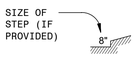
SLOPE TRANSITION INDICATOR SYMBOL

RAMP SLOPE INDICATOR SYMBOL

SLOPE PITCH INDICATOR SYMBOL



STEP INDICATOR SYMBOL

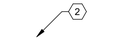


STEP TO SLOPE INDICATOR SYMBOL

RIDGE INDICATOR SYMBOL

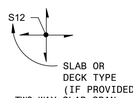
PROJECT NORTH ARROW SYMBOL

BORING LOCATION SYMBOL

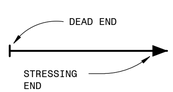


KEYNOTE INDICATOR SYMBOL

ONE-WAY SLAB OR DECK SPAN INDICATOR SYMBOL

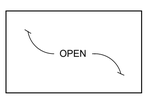


TWO-WAY SLAB SPAN INDICATOR SYMBOL



POST-TENSIONING TENDON SYMBOLS

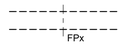
SMALL OPENINGS IN STRUCTURAL SLAB OR DECK



LARGE OPENING IN STRUCTURAL SLAB OR DECK

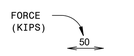
REINFORCING STEEL WITH 90° HOOK

REINFORCING STEEL WITH 180° HOOK



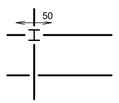
CONCRETE FRAMING PENETRATION

STEEL FRAMING PENETRATION

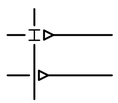


PASS-THROUGH FORCE SYMBOL

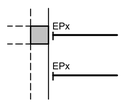
BRACE/KICKER DIRECTION INDICATOR SYMBOL



CONNECTION WITH PASS THROUGH FORCE



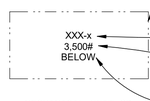
MOMENT CONNECTION (NON-SEISMIC)



CONNECTION TO CONCRETE WITH EMBEDDED PLATE

PLAN SYMBOLS (CONTINUED)

THE FOLLOWING SYMBOLS MAY BE USED THROUGHOUT THE PLANS.



MECHANICAL UNIT OR OTHER EQUIPMENT

STRUCTURAL ELEMENTS TAGS

THE FOLLOWING STRUCTURAL ELEMENT TAGS, USED IN CONJUNCTION WITH SCHEDULES, MAY APPEAR ON THE DRAWINGS:

Bxx DENOTES SLAB BOTTOM REINFORCEMENT TYPE "xx"
BMxx DENOTES CONCRETE BEAM TYPE "xx"
BPxx DENOTES BASE PLATE TYPE "xx"
Cxx DENOTES COLUMN TYPE "xx"
CFxx DENOTES CONTINUOUS FOOTING TYPE "xx"
DPxx DENOTES DRILLED PIER TYPE "xx"
EPxx DENOTES EMBEDDED PLATE TYPE "xx"
Fxx DENOTES SPREAD FOOTING TYPE "xx"
FPxx DENOTES FRAMING PENETRATION TYPE "xx"
GBxx DENOTES GRADE BEAM TYPE "xx"
MWxx DENOTES CMU WALL TYPE "xx"
Pxx DENOTES PIER TYPE "xx"
PCxx DENOTES PILE OR PIER CAP TYPE "xx"
Sxx DENOTES ONE-WAY SLAB TYPE "xx"
SRxx DENOTES HEADED SHEAR STUD REINFORCEMENT TYPE "xx"
SFxx DENOTES STRIP FOOTING TYPE "xx"
Txx DENOTES SLAB TOP REINFORCEMENT TYPE "xx"
WFxx DENOTES WALL FOOTING TYPE "xx"

ABBREVIATIONS

THE FOLLOWING ABBREVIATIONS MAY BE USED IN THE DRAWINGS:

@	AT	LLH	LONG LEG HORIZONTAL
&	AND	LLV	LONG LEG VERTICAL
#	NUMBER	LONG	LONGITUDINAL
Ø	ROUND, DIAMETER	LSH	LONG SIDE HORIZONTAL
ADDL	ADDITIONAL	LSLP	LONG-SLOTTED HOLE PARALLEL
AESS	ARCHITECTURAL EXPOSED STRUCTURAL STEEL	LSLT	LONG-SLOTTED HOLE TRANSVERSE
		LSV	LONG SIDE VERTICAL
AFF	ABOVE FINISHED FLOOR	LWC	LIGHTWEIGHT CONCRETE
AHR	ANCHOR	M	MOMENT
AHU	AIR HANDLING UNIT	MAS	MASONRY
ALT	ALTERNATE	MAX	MAXIMUM
APPROX	APPROXIMATE	MC	MOMENT CONNECTION
AR	ANCHOR ROD	MECH	MECHANICAL
ARCH	ARCHITECTURAL	MEZZ	MEZZANINE
BC	BOTTOM OF COLUMN	MFR	MANUFACTURER
BF	BRACED FRAME	MH	HORIZONTAL MOMENT
BLDG	BUILDING	MIN	MINIMUM
BM	BEAM	MISC	MISCELLANEOUS
BO	BOTTOM OF	MTL	METAL
BOD	BOTTOM OF DECK	NF	NEAR FACE
BOT	BOTTOM	NIC	NOT IN CONTRACT
BRDG	BRIDGING	NS	NEAR SIDE
BRG	BEARING	NTS	NOT TO SCALE
BTWN	BETWEEN	NWC	NORMALWEIGHT CONCRETE
C	CAMBER	OC	ON CENTER
CANTIL	CANTILEVER	OD	OUTSIDE DIAMETER
CFSF	COLD-FORMED STEEL FRAMING	OPH	OPPOSITE HAND
CIP	CAST-IN-PLACE	OPNG	OPENING
CJ	CONSTRUCTION/CONTROL JOINT	OPP	OPPOSITE
CJP	COMPLETE JOINT PENETRATION	OVS	OVERSIZED HOLE
CL	CENTERLINE	P	AXIAL LOAD
CMU	CONCRETE MASONRY UNIT	PAF	POWDER ACTUATED FASTENER
COL	COLUMN	PAR	PARALLEL
CONC	CONCRETE	PCC	PRECAST CONCRETE
CONN	CONNECTION	PCF	POUNDS PER CUBIC FOOT
CONSTR	CONSTRUCTION	PCY	POUNDS PER CUBIC YARD
CONT	CONTINUOUS	PERP	PERPENDICULAR
COORD	COORDINATE	PL	PLATE
COV	COVER	PLF	POUNDS PER LINEAR FOOT
CPRS	COMPRESSIBLE	PJP	PARTIAL JOINT PENETRATION
CTRS	CENTERS	PRELIM	PRELIMINARY
db	BAR DIAMETER	PROP	PROPERTY
DBA	DEFORMED BAR ANCHOR	PSF	POUNDS PER SQUARE FOOT
DCW	DEMAND CRITICAL WELD	PSI	POUNDS PER SQUARE INCH
DET	DETAIL	PT	POST-TENSION(ED)
DIA	DIAMETER	QTY	QUANTITY
DIM	DIMENSION	R	REACTION
DWA	DEFORMED WIRE ANCHOR	RAD	RADIUS
DWG	DRAWING	REF	REFERENCE
EA	EACH	REINF	REINFORCEMENT
EF	EACH FACE	REM	REMAINDER
EJ	EXPANSION JOINT	REQD	REQUIRED

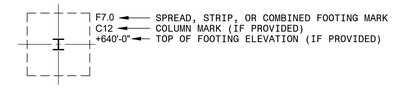
ABBREVIATIONS

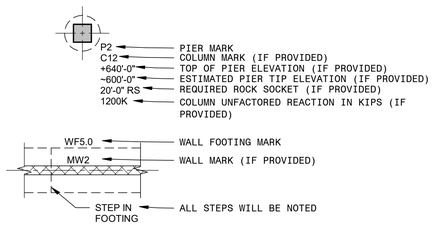
THE FOLLOWING ABBREVIATIONS MAY BE USED IN THE DRAWINGS:

EL	ELEVATION	REV	REVISION
ELEV	ELEVATOR	RS	ROCK SOCKET
EMBED	EMBEDMENT, EMBEDDED	RTU	ROOF TOP UNIT
ENGR	ENGINEER	SC	SLIP CRITICAL
EQ	EQUAL	SCHED	SCHEDULE(D)
EQUIP	EQUIPMENT	SDS	SELF-DRILLING SCREW
EQUIV	EQUIVALENT	SECT	SECTION
EW	EACH WAY	SHT	SHEET
EXIST	EXISTING	SIM	SIMILAR
EXP	EXPANSION	SLBB	SHORT LEG BACK TO BACK
EXT	EXTERIOR	SLRS	SEISMIC LOAD RESISTING SYSTEM
FAB	FABRICATE	SOG	SLAB-ON-GRADE
f'c=	28 DAY CONCRETE STRENGTH=	SPA	SPACING
f'm=	28 DAY MASONRY STRENGTH=	SPEC	SPECIFICATION
FD	FLOOR DRAIN	SPRT	SUPPORT
FDTN	FOUNDATION	SQ	SQUARE
FF	FAR FACE	SS	STAINLESS STEEL
FIN	FINISH(ED)	SSLP	SHORT-SLOTTED HOLE PARALLEL
FLR	FLOOR	SSLT	SHORT-SLOTTED HOLE TRANSVERSE
FS	FAR SIDE	STD	STANDARD
FTG	FOOTING	STIF	STIFFENER
FUT	FUTURE	STIR	STIRRUP
FV	FIELD VERIFY	STL	STEEL
Fy=	YIELD STRENGTH=	STRUCT	STRUCTURE, STRUCTURAL
GALV	GALVANIZE(D)	SW	SHEAR WALL
GEN	GENERAL	SYMM	SYMMETRIC, SYMMETRICAL
GR	GRADE	T	TORSION
H	HORIZONTAL REACTION	TC	TOP OF COLUMN
HGR	HANGER	THD	THREADED
HORIZ	HORIZONTAL	TO	TOP OF
HSA	HEADED STUD ANCHOR	TOC	TOP OF CONCRETE
HSS	HOLLOW STRUCTURAL SECTION	TOM	TOP OF MASONRY
ID	INSIDE DIAMETER	TOS	TOP OF STEEL, TOP OF SLAB
INFO	INFORMATION	TRANS	TRANSVERSE
INT	INTERIOR	TYP	TYPICAL
JT	JOINT	UNO	UNLESS NOTED OTHERWISE
K	KIPS (1000 LBS)	VERT	VERTICAL
KSF	KIPS PER SQUARE FOOT	WF	WIDE FLANGE
KSI	KIPS PER SQUARE INCH	WP	WORK POINT
LBS	POUNDS	WS	WATERSTOP
Ld	DEVELOPMENT LENGTH	WT	WEIGHT
LLBB	LONG LEG BACK TO BACK	WWR	WELDED WIRE REINFORCEMENT
		XS	EXTRA STRONG
		XXS	DOUBLE EXTRA STRONG

FOUNDATION ANNOTATION STYLES

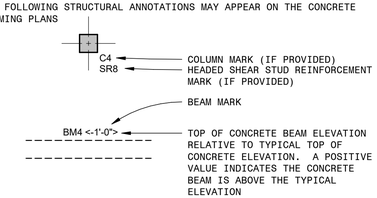
THE FOLLOWING STRUCTURAL ANNOTATIONS MAY APPEAR ON THE FOUNDATION PLANS:





CONCRETE ANNOTATION STYLES

THE FOLLOWING STRUCTURAL ANNOTATIONS MAY APPEAR ON THE CONCRETE FRAMING PLANS



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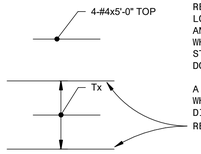
STRUCTURAL SYMBOLS AND NOTATIONS

S003

STRUCTURAL SYMBOLS AND NOTATIONS (CONTINUED)

CONCRETE ANNOTATION STYLES (CONTINUED)

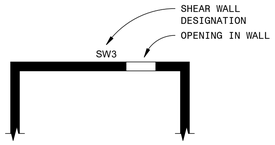
THE FOLLOWING STRUCTURAL ANNOTATIONS MAY APPEAR ON THE CONCRETE FRAMING PLANS



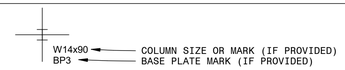
REINFORCING STEEL NOTED IN PLAN SHALL BE LOCATED ACCORDING TO PLAN NOTES, TYPICAL VIEWS, AND SCHEDULES. HOOKS ARE INDICATED IN PLAN WHERE REQUIRED FOR NON-SCHEDULED REINFORCING STEEL. WHERE HOOKS ARE SHOWN, LENGTHS PROVIDED DO NOT INCLUDE HOOK.

A SINGLE ARROWED LINE INDICATES THE EXTENT OVER WHICH THE REINFORCING STEEL IS TO BE DISTRIBUTED WITH AN EQUAL SPACING BETWEEN BARS.

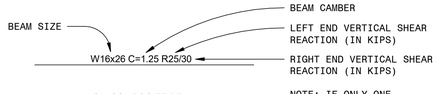
REFERENCE LINE OR OBJECT WHERE REINFORCING STOPS

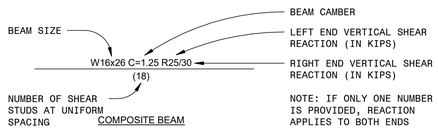


STEEL ANNOTATION STYLES

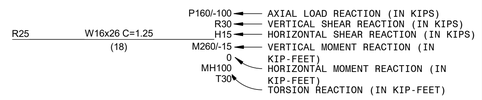


THE FOLLOWING STRUCTURAL ANNOTATIONS MAY APPEAR ON THE STEEL FRAMING PLANS. ALL LOADS INDICATED ARE FACTORED:





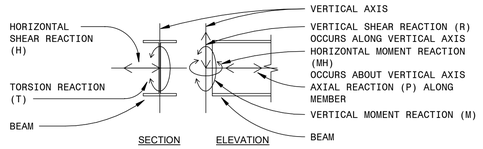
ADDITIONAL INFORMATION MAY BE SPECIFIED ON STEEL BEAMS FOR THE PURPOSES OF DELEGATED CONNECTION DESIGN. IN THOSE CASES, FORCES AND MOMENTS WILL BE PROVIDED AS APPROPRIATE AT THE ENDS OF THE BEAMS AS INDICATED BELOW.

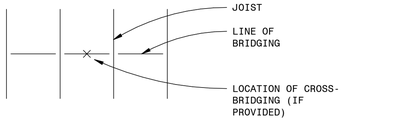


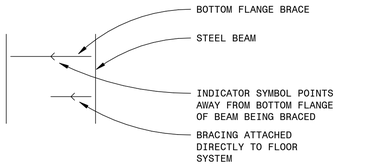
THE FOLLOWING DIAGRAM PROVIDES INFORMATION REGARDING THE ORIENTATION OF THE REACTIONS PROVIDED. THE DIAGRAM BELOW APPLIES TO ALL NON-SLOPING MEMBERS REGARDLESS OF THE INDIVIDUAL MEMBER ORIENTATION (FOR EXAMPLE, AN HSS ORIENTED LONG-SIDE HORIZONTAL). REFER TO DETAILS FOR ADDITIONAL INFORMATION ON LOADING OF SLOPED MEMBERS.

FOR ALL LOADING, REACTIONS ARE TO BE APPLIED AT THE CENTERLINE OF THE MEMBER AT THE WORK POINT, UNLESS NOTED OTHERWISE. IF ONLY A SINGLE VALUE IS SHOWN, THE LOAD SHALL BE ASSUMED TO ACT IN BOTH DIRECTIONS WITH EQUAL MAGNITUDE. FOR AXIAL LOAD REACTIONS, A POSITIVE VALUE INDICATES TENSION. FOR VERTICAL MOMENTS, A POSITIVE VALUE WILL CAUSE COMPRESSION IN THE TOP OF THE BEAM AND TENSION IN THE BOTTOM.

STEEL ANNOTATION STYLES (CONTINUED)







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Certificate of Authorization No. 3818
WPM Project No. 505-1903700

DYLAN S. RICHARD LICENSE No. 80997 STATE OF FLORIDA PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
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04	BID DOCUMENTS	2020-12-16

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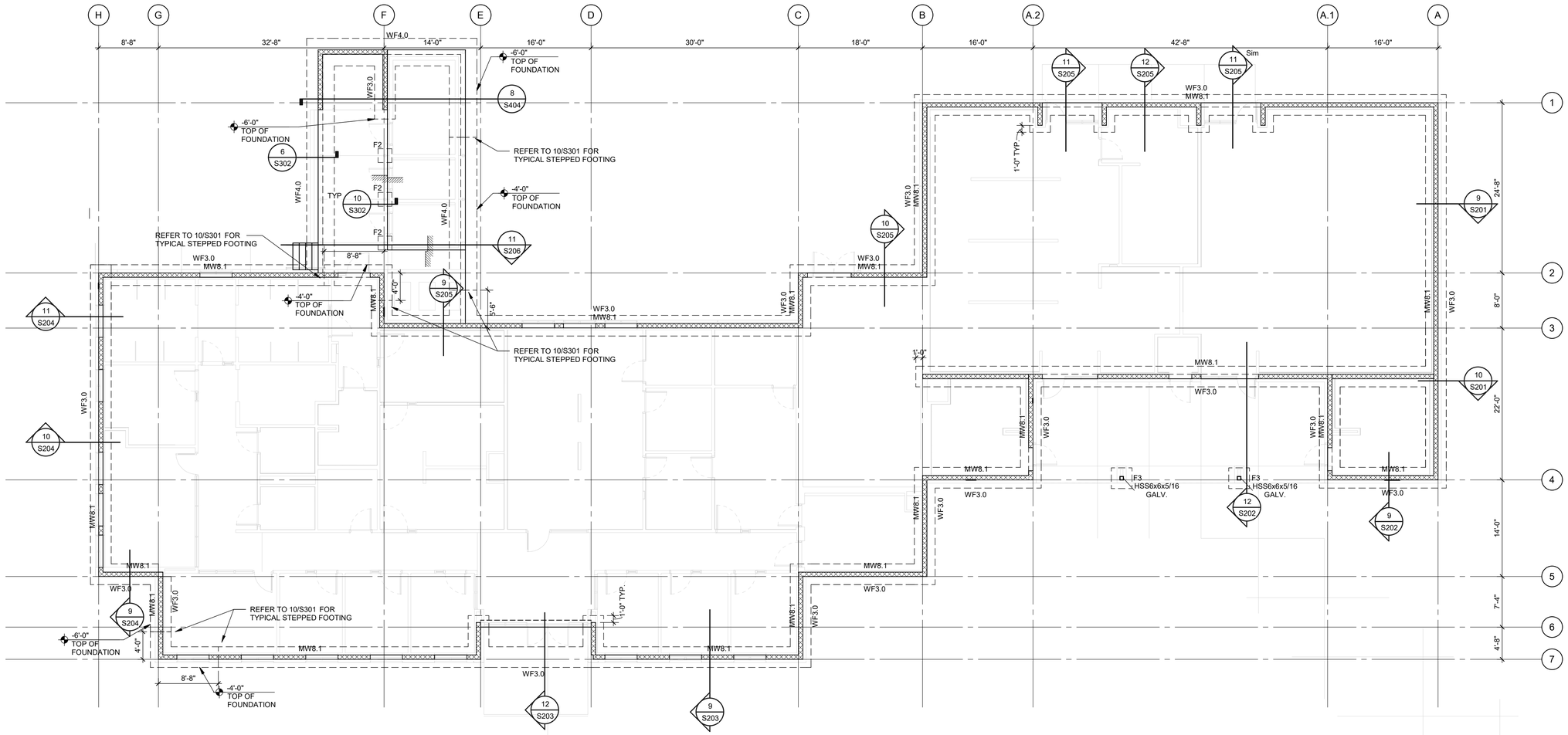
Sheet Information

STRUCTURAL SYMBOLS AND NOTATIONS

S004



FLOOR PLAN NOTES

1. CIVIL DRAWINGS ELEVATION 90.50' = DATUM ELEVATION 0'-00".
2. TOP OF FOUNDATION ELEVATION IS -2'-0", UNLESS NOTED OTHERWISE ON PLAN.
3. FLOOR STRUCTURE IS A 6" THICK NORMALWEIGHT CONCRETE SLAB-ON-GRADE REINFORCED WITH #3@6" EACH WAY.
4. PROVIDE 2-#4x4'-0" ADDITIONAL SLAB REINFORCEMENT AT ALL RE-ENTRANT CORNERS.
5. SPREAD FOOTINGS SHALL BE CENTERED ON THE CENTROID OF SUPPORTED COLUMN, UNLESS NOTED OTHERWISE.
6. WALL FOOTINGS SHALL BE CENTERED ON THE SUPPORTED WALL, UNLESS NOTED OTHERWISE.
7. REFER TO SHEETS S301 AND S302 FOR FOUNDATION AND SLAB-ON-GRADE SECTIONS AND DETAILS.
8. REFER TO SHEET S302 FOR FOUNDATION SCHEDULES.
9. REFER TO ARCHITECTURAL DRAWINGS FOR EXTENTS AND DIMENSIONS OF RAISED OR DEPRESSED SLAB AREAS, SLOPES, CURBS, AND DRAINS. REFER TO TYPICAL DETAILS FOR REINFORCEMENT REQUIREMENTS.
10. REFER TO MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS FOR SLAB PENETRATIONS AND UNDERGROUND UTILITIES.
11. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS AND DIMENSIONS. NOTIFY ARCHITECT AND STRUCTURAL ENGINEER OF ANY DISCREPANCIES.
12. ALL CMU WALLS BELOW GRADE TO BE FULLY GROUTED 3-COURSE BOND BEAM REINFORCED WITH 1-#5 CONTINUOUS IN EACH COURSE AROUND FULL PERIMETER OF BUILDING
13. PROVIDE 4" CMU AT LEAST 8" BELOW FINISHED GRADE FOR BRICK SUPPORT. REFER TO ARCHITECTURAL DETAILS FOR ADDITIONAL INFORMATION AND BRICK EXTENTS AND CIVIL DRAWINGS FOR FINISHED GRADES.
14. PROVIDE SOLID GROUT BETWEEN BRICK/4" CMU AND 8" CMU WALL BELOW FINISHED GRADE

1 FLOOR PLAN
1/8" = 1'-0"

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No.	Description	Date

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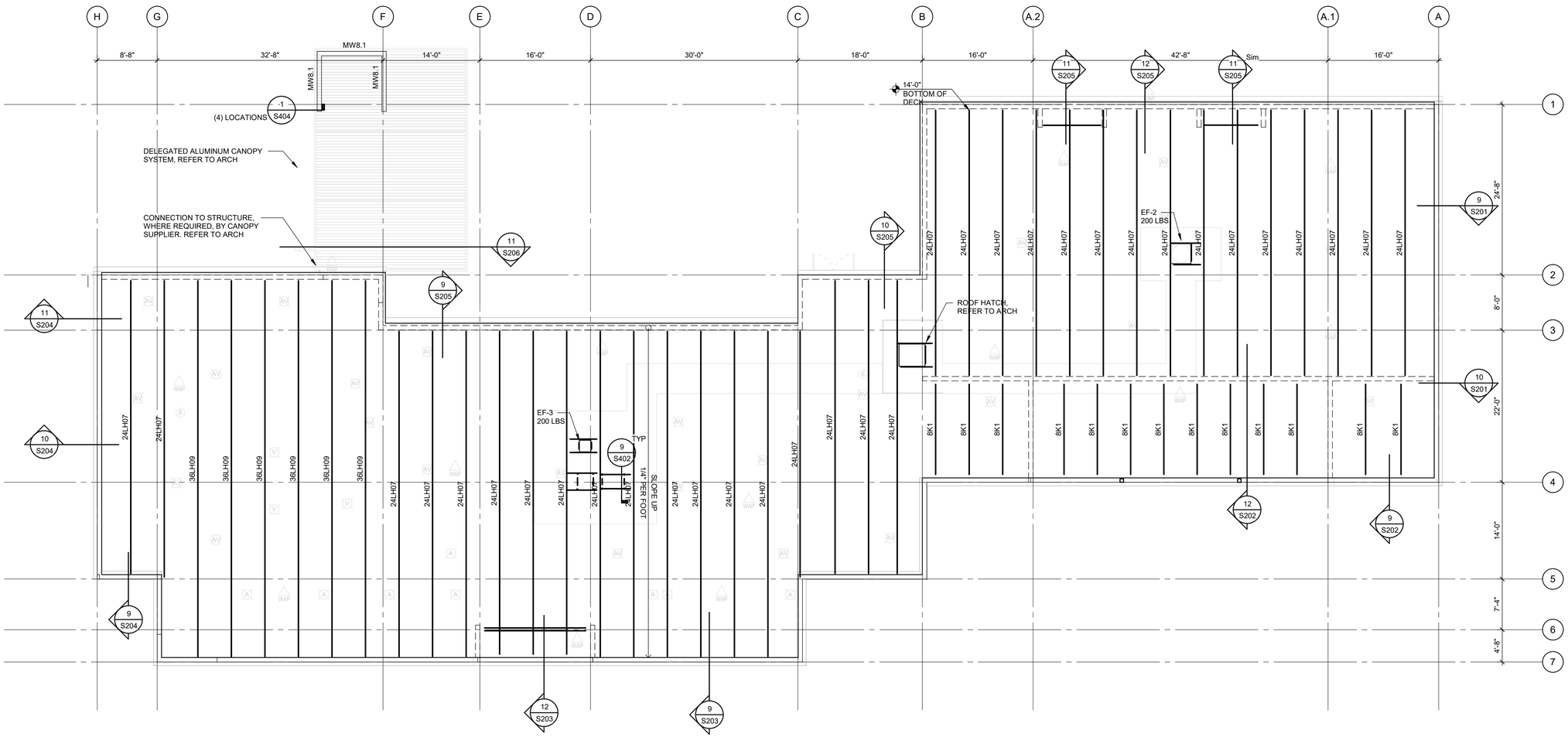
FLOOR PLAN

S101



PLAN NOTES

1. BOTTOM OF DECK ELEVATION IS AS NOTED ON PLAN. TOP OF STEEL ELEVATIONS FOR BEAMS AND GIRDERS SHALL BE DETERMINED FROM JOIST SEAT DEPTHS AND BOTTOM OF DECK ELEVATIONS, UNLESS NOTED OTHERWISE.
2. ROOF SYSTEM IS ROOF DECK SUPPORTED BY STEEL JOISTS AND BEAMS. ROOF DECK SHALL BE 1 1/2" DEEP, TYPE B, 18 GAGE GALVANIZED (G90) STEEL ROOF DECK. ROOF DECK SHALL BE PLACED WITH A TWO SPAN CONDITION MINIMUM. NO SINGLE SPANS ARE ALLOWED WITHOUT WRITTEN APPROVAL OF ENGINEER-OF-RECORD.
3. PROVIDE A CONTINUOUS 1/4" BENT PLATE AT ALL ROOF EDGES AND OPENINGS, UNLESS NOTED OTHERWISE.
4. ALL STEEL THAT IS PERMANENTLY EXPOSED TO THE EXTERIOR OR IS PERMANENTLY IN UNCONDITIONED SPACE SHALL BE HOT-DIPPED GALVANIZED.
5. DESIGN ALL ROOF JOISTS AND BRIDGING FOR NET WIND UPLIFT PRESSURES AS NOTED ON THE DRAWINGS. PROVIDE JOIST BRIDGING PER SJI REQUIREMENTS.
6. REFER TO THE S400 SERIES DRAWINGS FOR STEEL FRAMING SECTIONS AND DETAILS.
7. REFER TO MECHANICAL, ELECTRICAL, AND PLUMBING DRAWINGS FOR PENETRATIONS NOT SHOWN. REFER TO TYPICAL DETAILS FOR ADDITIONAL STEEL REQUIREMENTS AT OPENINGS.

1 ROOF PLAN
1/8" = 1'-0"

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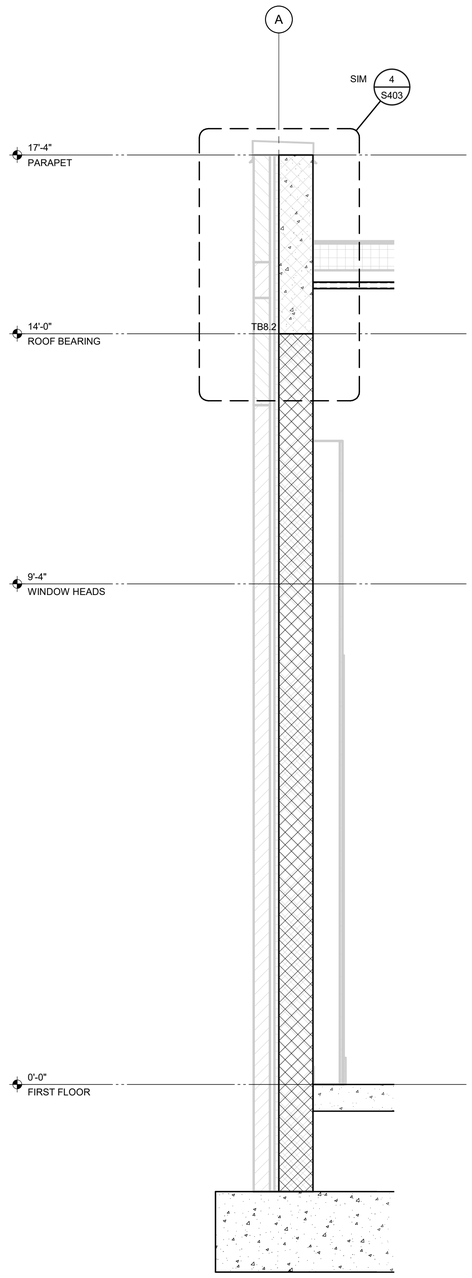
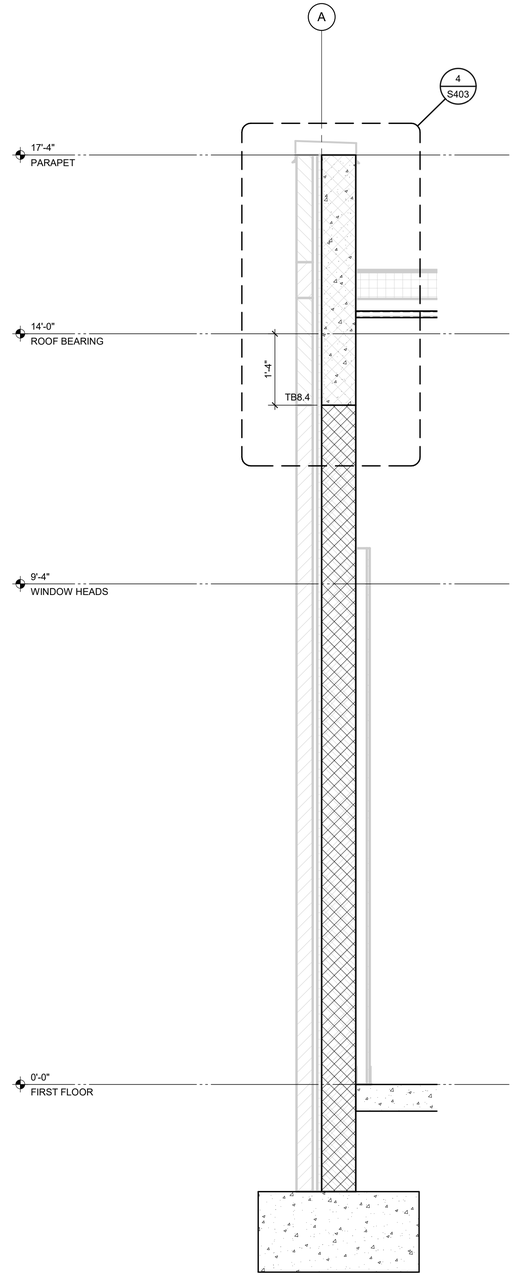
ROOF PLAN

S102



10 BUILDING SECTION
3/4" = 1'-0"



9 BUILDING SECTION
3/4" = 1'-0"

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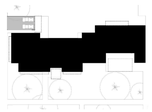

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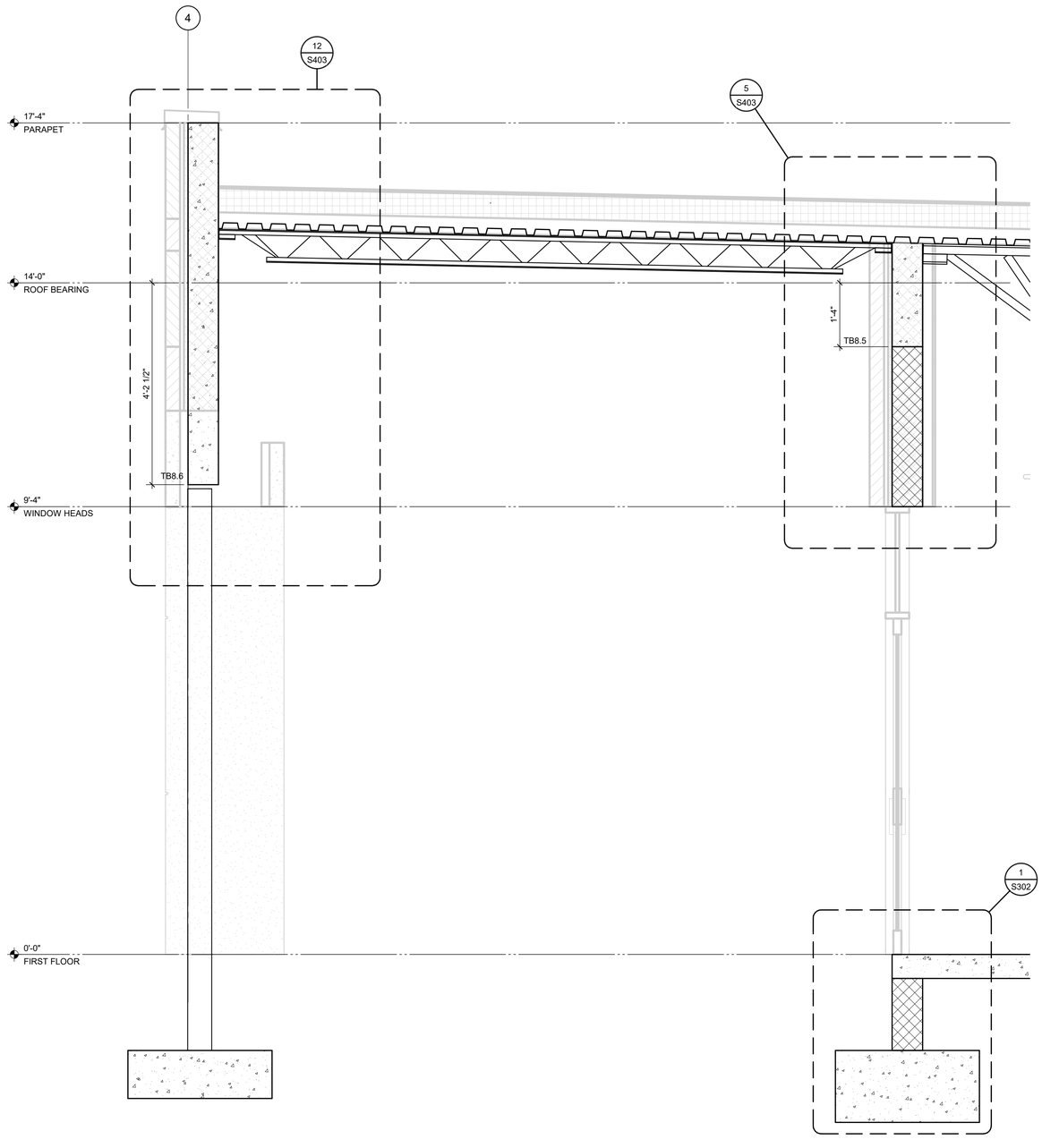
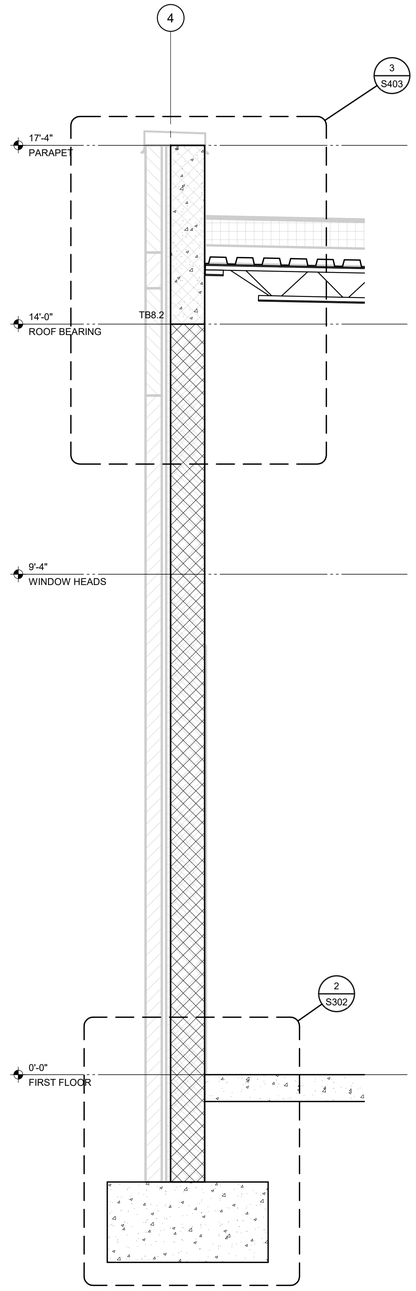
BUILDING SECTIONS

S201



12 BUILDING SECTION
3/4" = 1'-0"



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3/4" = 1'-0"

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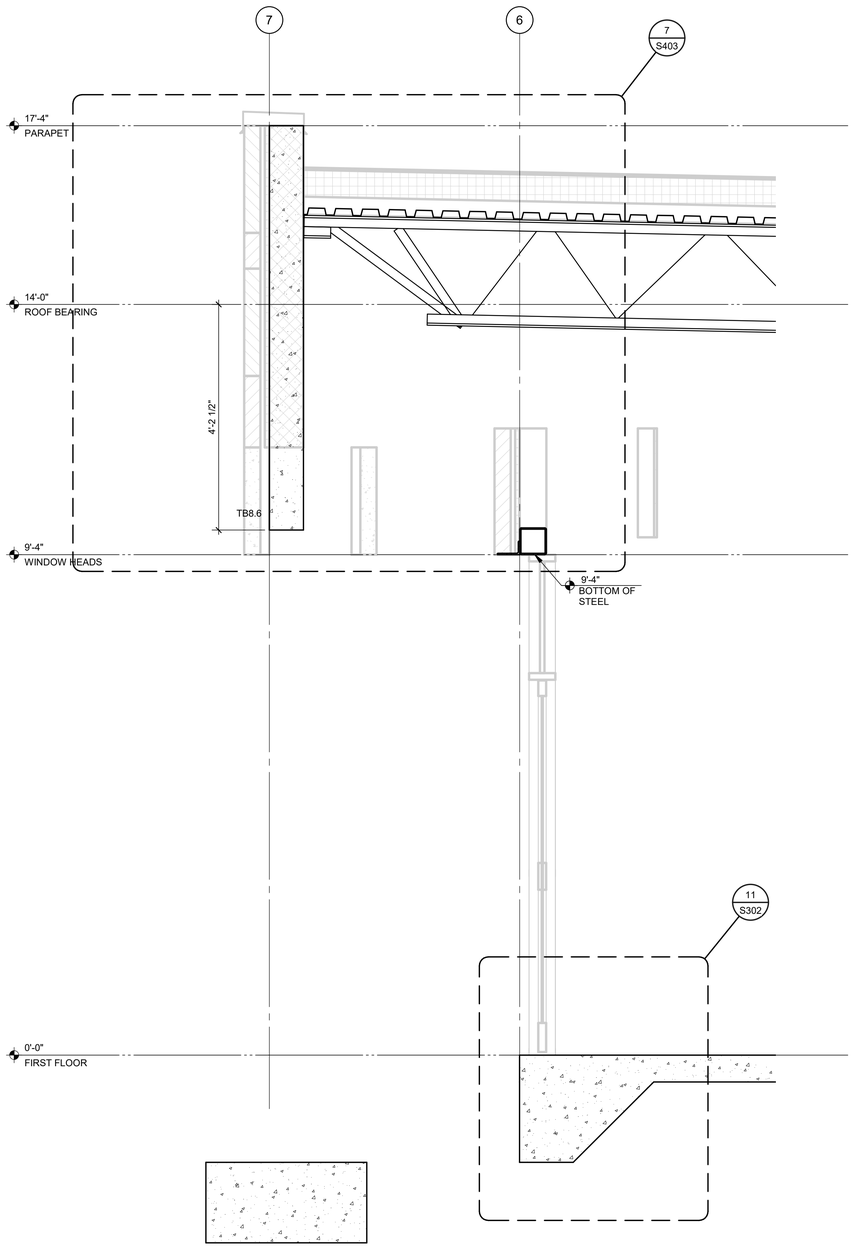
BUILDING SECTIONS

S202



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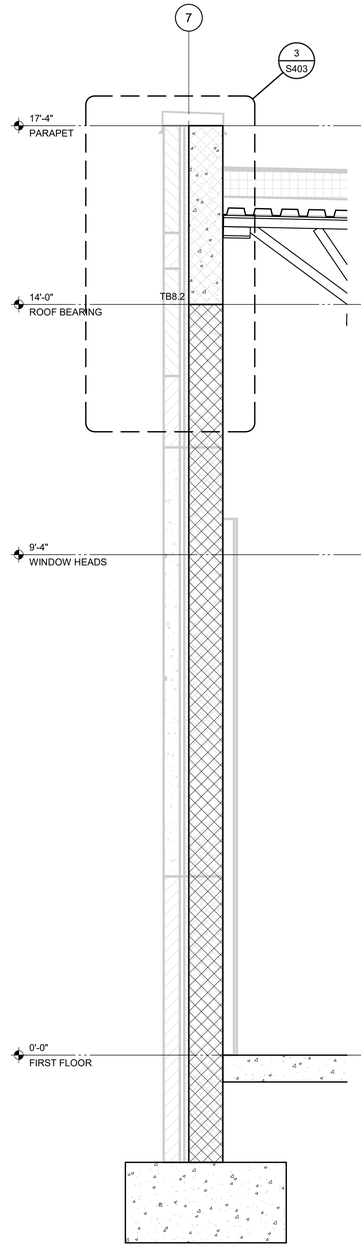

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3/4" = 1'-0"

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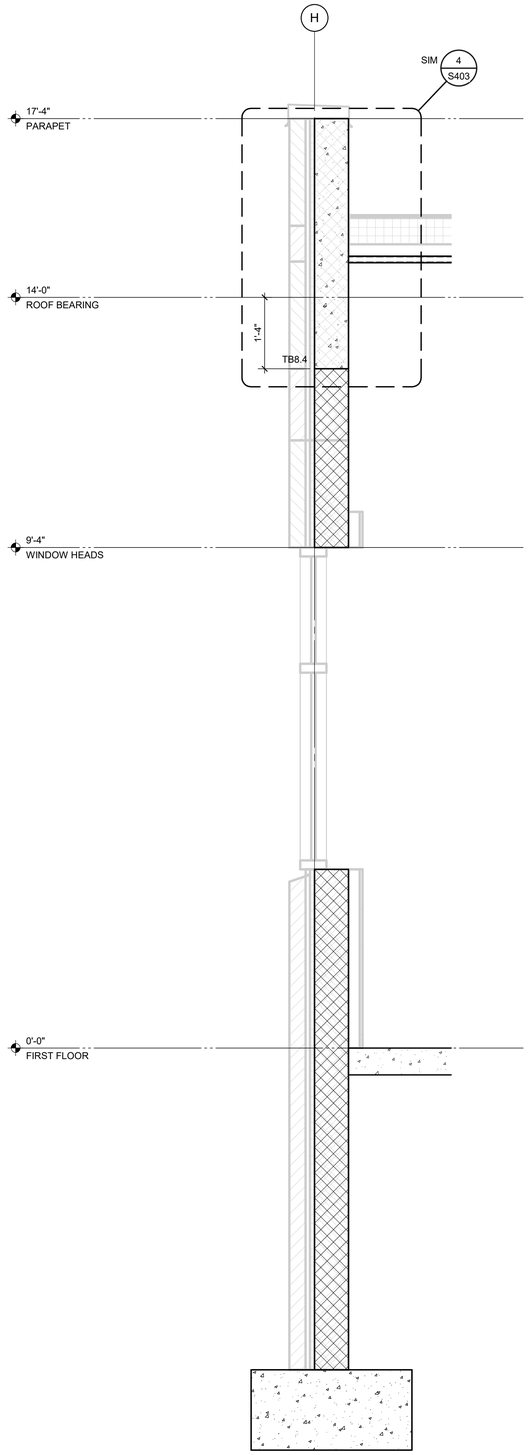
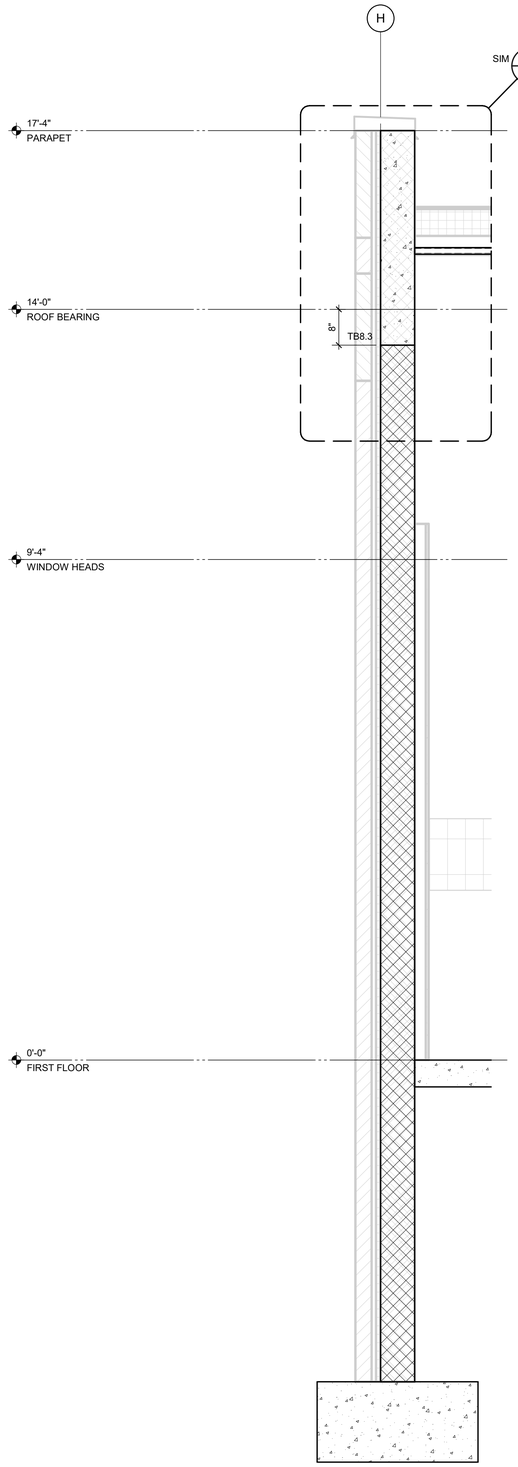
BUILDING SECTIONS

S203



11 BUILDING SECTION
3/4" = 1'-0"



10 BUILDING SECTION
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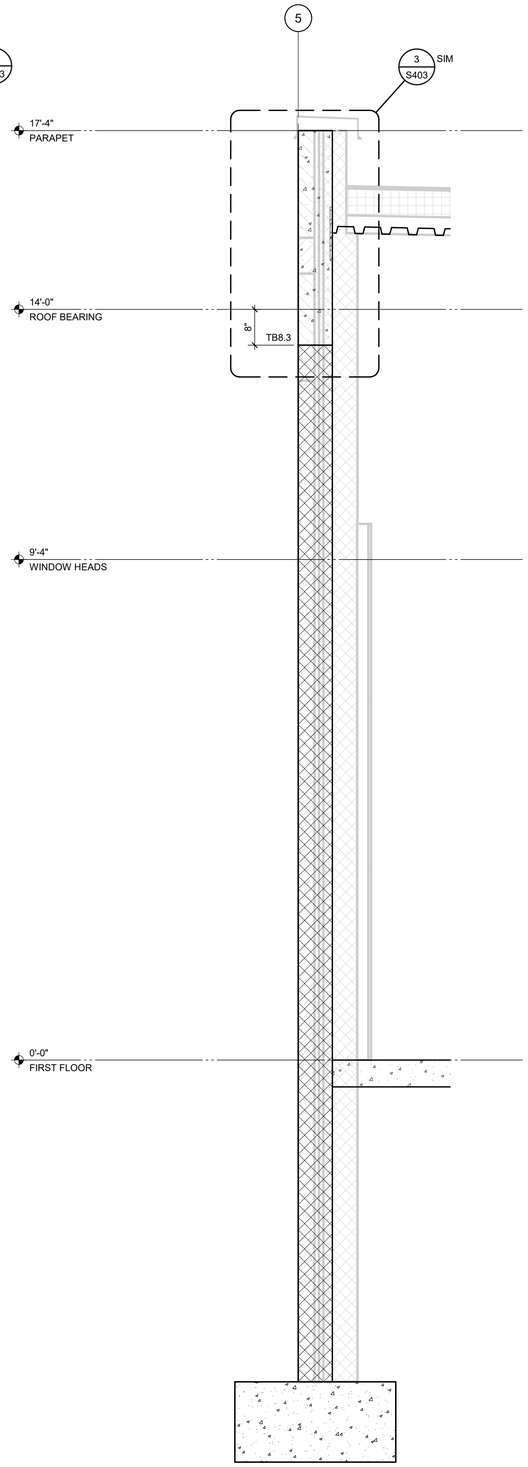

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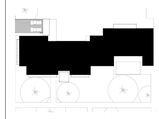

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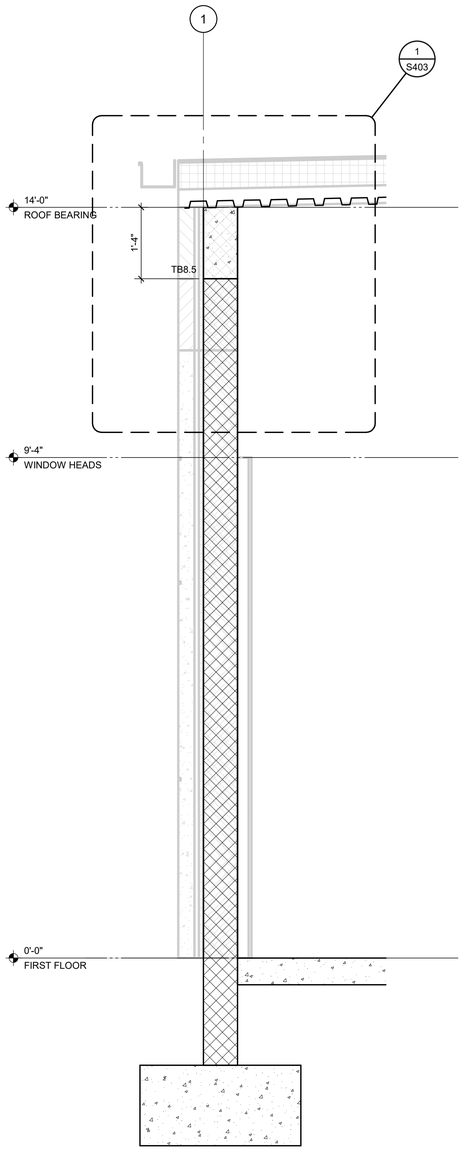
BUILDING SECTIONS

S204



12 BUILDING SECTION
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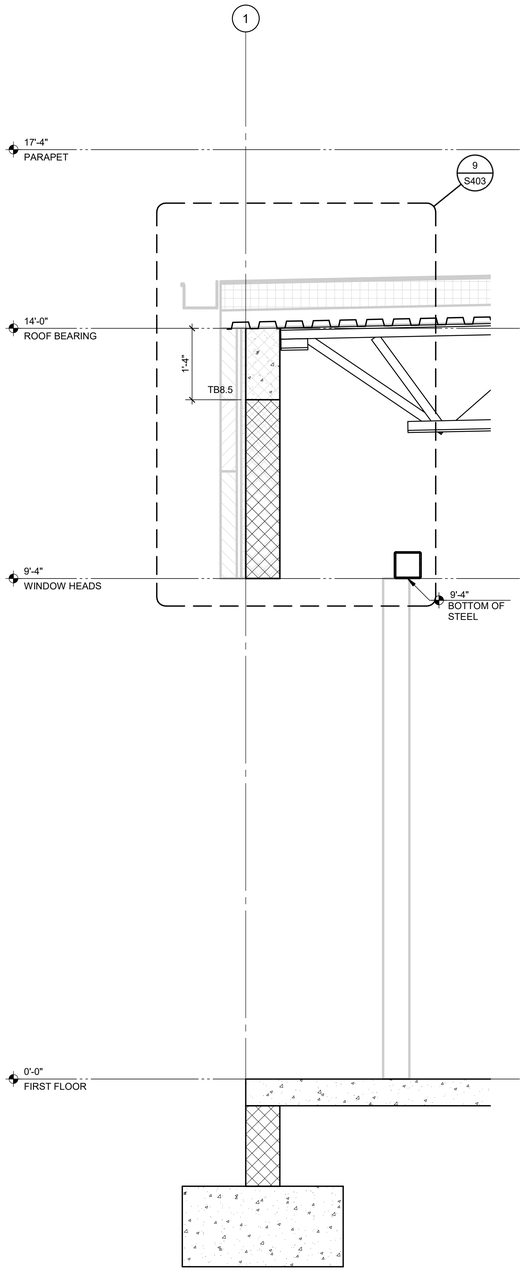

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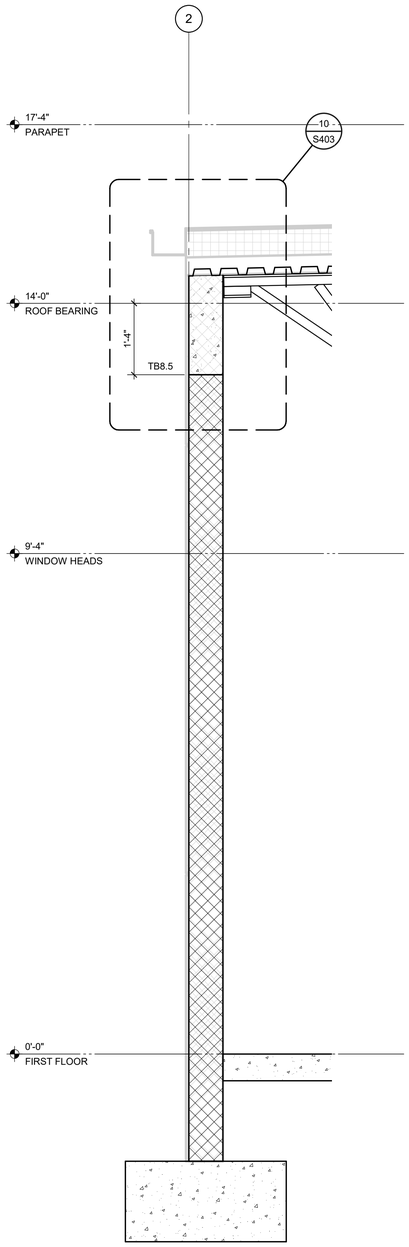

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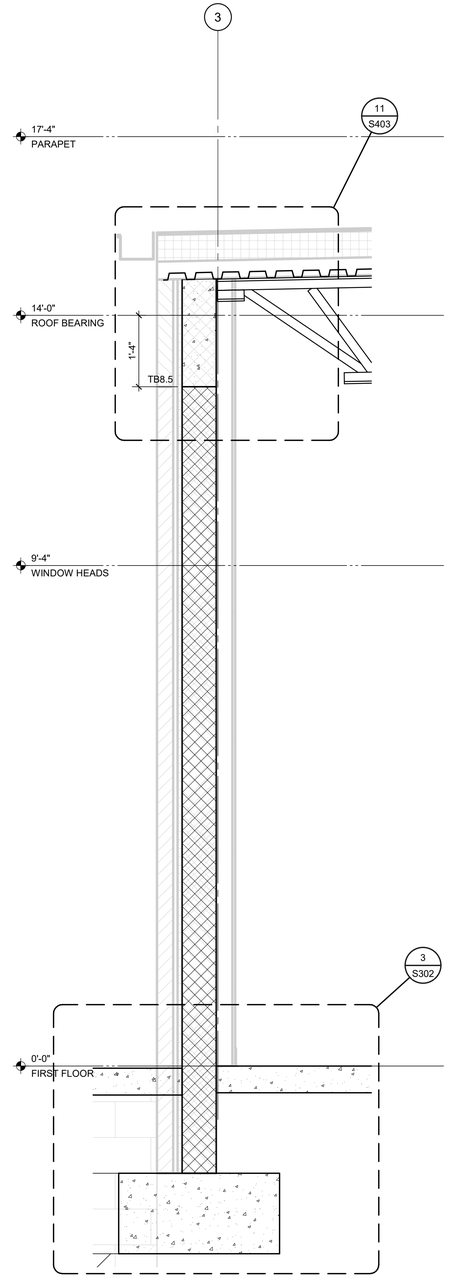

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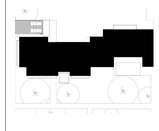

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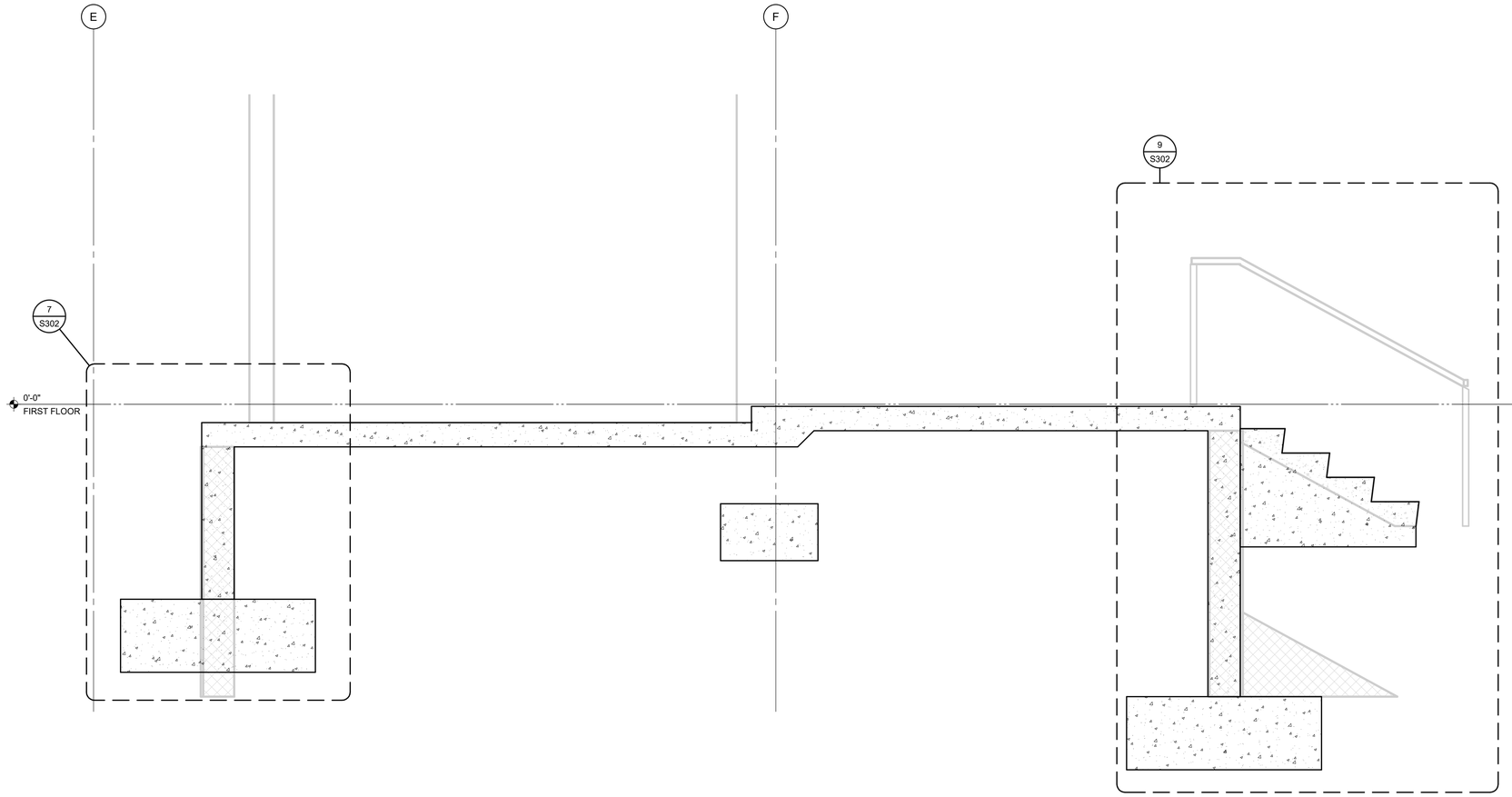
BUILDING SECTIONS

S205



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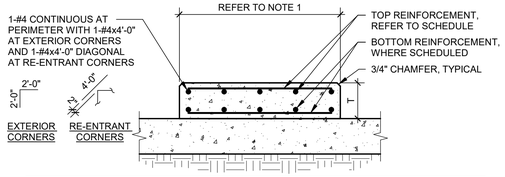
BUILDING SECTIONS

S206



HOUSEKEEPING PAD REINFORCEMENT SCHEDULE		
PAD THICKNESS	TOP REINFORCEMENT	BOTTOM REINFORCEMENT
T = 4"	WWR4x4-W2.9xW2.9 OR #3@12" EACH WAY	NONE
4" < T <= 6"	WWR4x4-W4xW4 OR #4@18" EACH WAY	NONE
6" < T <= 8"	WWR4x4-W6xW6 OR #4@12" EACH WAY	NONE
8" < T <= 12"	#4@18" EACH WAY	#4@18" EACH WAY
12" < T <= 16"	#4@12" EACH WAY	#4@12" EACH WAY

NOTES:
1. REFER TO ARCHITECTURAL, STRUCTURAL, OR MEP DRAWINGS FOR HOUSEKEEPING PAD PLAN DIMENSIONS AND THICKNESS (4" MINIMUM THICKNESS).
2. CONTRACTOR SHALL COORDINATE DIMENSIONS AND OTHER SPECIAL REQUIREMENTS WITH EQUIPMENT MANUFACTURERS AND PROVIDE WHERE REQUIRED WHETHER SHOWN ON STRUCTURAL DRAWINGS OR NOT.

4 TYPICAL HOUSEKEEPING PAD OVER SLAB-ON-GRADE

NO SCALE

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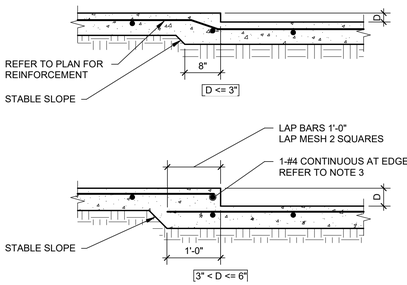
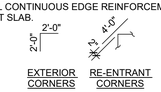


NOTES:
1. CONTRACTOR SHALL COORDINATE DEPTH AND LOCATION OF ALL FLOOR DEPRESSIONS WITH ARCHITECTURAL DRAWINGS.
2. PROVIDE ADDITIONAL 1-#4x4'-0" DIAGONAL TOP AT ALL RE-ENTRANT CORNERS.
3. PROVIDE #4x4'-0" CORNER BARS FOR ALL CONTINUOUS EDGE REINFORCEMENT THAT CAN NOT DEVELOP INTO ADJACENT SLAB.



12 TYPICAL SLAB-ON-GRADE DEPRESSIONS

NO SCALE

03300-FN-SOG-01
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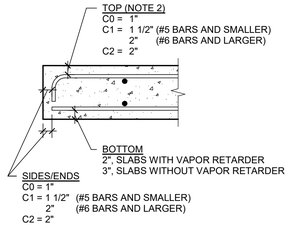

NOTES:
1. REFER TO "NOTES FOR TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL" FOR ADDITIONAL INFORMATION.
2. REFER TO "TYPICAL CONSTRUCTION AND CONTROL JOINTS IN SLAB-ON-GRADE" FOR MORE STRINGENT TOP COVER REQUIREMENTS FOR SLABS-ON-GRADE WITH CONSTRUCTION OR CONTROL JOINTS.

3 TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL IN SLABS-ON-GRADE

NO SCALE

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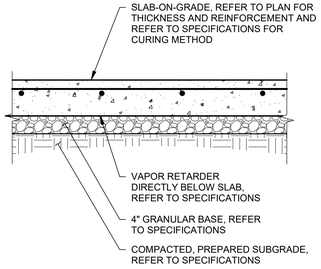

7 TYPICAL SLAB-ON-GRADE SUBGRADE PREPARATION

NO SCALE

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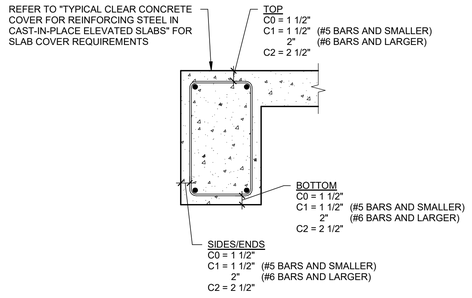

NOTES:
1. REFER TO "NOTES FOR TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL" FOR ADDITIONAL INFORMATION.

11 TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL IN CAST-IN-PLACE ELEVATED BEAMS AND GIRDERS

NO SCALE

03300-FJ1_COVER-12
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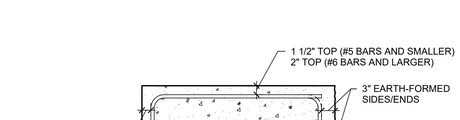

NOTES:
1. REFER TO "NOTES FOR TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL" FOR ADDITIONAL INFORMATION.

2 TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL IN SPREAD FOOTINGS AND MATS

NO SCALE

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NOTES:
1. CONCRETE PROFILES AND REINFORCING STEEL CONFIGURATIONS ARE SCHEMATIC AND ARE PROVIDED FOR ESTABLISHING TYPICAL CLEAR CONCRETE COVERS ONLY. REFER TO STRUCTURAL PLANS AND DETAILS FOR ALL OTHER INFORMATION.
2. ALL COVERS SHOWN ARE CLEAR FROM THE OUTERMOST SURFACE OF REINFORCING STEEL TO THE CLOSEST OUTER SURFACE OF THE CONCRETE, INCLUDING REVEALS, DRIP GROOVES, OR RUSTICATIONS.
3. WHERE COVERS ARE DIFFERENT AS A FUNCTION OF BAR SIZE, DETAILER SHALL ADJUST LOCATION OF TRANSVERSE REINFORCING STEEL AS REQUIRED SUCH THAT CLEAR COVERS ARE MET FOR BOTH TRANSVERSE AND LONGITUDINAL STEEL.
4. C0, C1, AND C2 REFER TO THE CORROSION EXPOSURE CLASS OF THE CONCRETE ELEMENT. REFER TO THE CLASSES OF CONCRETE MATRIX AND GENERAL NOTES FOR ADDITIONAL INFORMATION.

1 NOTES FOR TYPICAL CLEAR CONCRETE COVER FOR REINFORCING STEEL

NO SCALE

03300-GN-COVER-01
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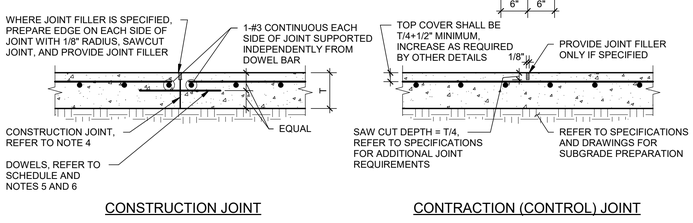
NOTES:
1. REFER TO PLAN FOR SLAB THICKNESS (T) AND REINFORCEMENT.
2. SLAB REINFORCEMENT SHALL BE CHAIRED BY SOIL SUPPORTED SLAB BOLSTERS.
3. LONG STRIP CONSTRUCTION METHOD SHALL BE USED IN PLACING CONCRETE FOR ALL SLABS-ON-GRADE UNLESS NOTED OTHERWISE. REFER TO "TYPICAL LONG STRIP CONSTRUCTION SCHEMATIC JOINT LAYOUT" FOR COMPLETE PLACING SEQUENCE. AT CONTRACTOR'S OPTION, LARGER SLAB AREAS MAY BE POURED PROVIDED THE EARLY-ENTRY DRY-CUT METHOD OF INSTALLING CONTRACTION JOINTS IS USED. REFER TO THE SPECIFICATIONS.
4. AT CONSTRUCTION JOINTS, BREAK BOND BETWEEN NEW AND PREVIOUSLY PLACED SLAB BY SPRAYING OR PAINTING EXPOSED SIDES OF JOINT WITH A CURING COMPOUND, BONDBREAKER, OR FORM OIL.
5. DOWELS SHOULD BE SMOOTH, ALIGNED, AND SUPPORTED SO THEY WILL REMAIN PARALLEL IN BOTH THE HORIZONTAL AND VERTICAL PLANES.
6. TO PREVENT A BOND BETWEEN THE DOWEL AND THE CONCRETE, LIGHTLY COAT THE EXPOSED END OF THE DOWELS WITH A PARAFFIN-BASED LUBRICANT, ASPHALT EMULSION, FORM OIL, OR GREASE IMMEDIATELY BEFORE PLACING CONCRETE ON THE SECOND SIDE OF THE JOINT. ALTERNATIVELY, USE A PLASTIC OR METAL SLEEVE SPECIFICALLY MANUFACTURED FOR THIS PURPOSE.
7. AT CONTRACTION (CONTROL) JOINTS, MAKE SAW CUT AS SOON AS SLAB IS ABLE TO SUPPORT WEIGHT OF WORKERS AND SAWING EQUIPMENT WITHOUT DAMAGE TO FINISH SURFACE OF SLAB. REFER TO SPECIFICATIONS.
8. PROVIDE CONTRACTION OR CONSTRUCTION JOINTS AT EVERY COLUMN LINE AND IN BETWEEN THE COLUMN LINES SUCH THAT THE JOINT SPACING DOES NOT EXCEED TABULATED DISTANCES.
9. FOR SLAB THICKNESS IN BETWEEN TABULATED VALUES, USE DOWEL INFORMATION FOR THICKER SLAB. MAXIMUM JOINT SPACING SHALL BE INTERPOLATED.

DOWEL AND JOINT SPACING SCHEDULE				
SLAB DEPTH	DOWEL SIZE	DOWEL LENGTH	DOWEL SPACING	MAXIMUM JOINT SPACING
5"	3/4"Ø	16"	12"	13'-0"
6"	3/4"Ø	16"	12"	14'-6"
7"	1"Ø	18"	12"	16'-0"
8"	1"Ø	18"	12"	17'-6"



6 TYPICAL CONSTRUCTION AND CONTROL JOINTS IN SLAB-ON-GRADE

NO SCALE

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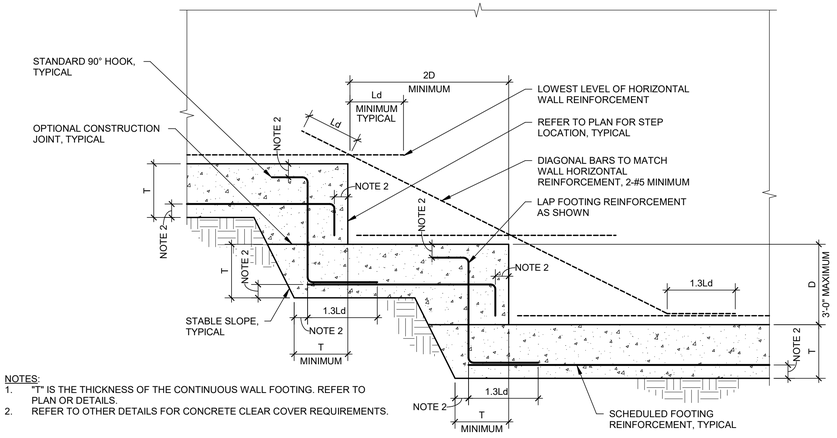

NOTES:
1. "T" IS THE THICKNESS OF THE CONTINUOUS WALL FOOTING. REFER TO PLAN OR DETAILS.
2. REFER TO OTHER DETAILS FOR CONCRETE CLEAR COVER REQUIREMENTS.

10 TYPICAL STEPPED CONCRETE WALL FOOTING

NO SCALE

03300-FN-STEP-12
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Certificate of Authorization No. 3818
WPM Project No. 505-1903700

DYLAN S. RICHARD LICENSE No. 80997 STATE OF FLORIDA PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-16

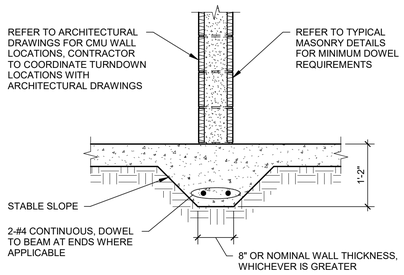
Revisions

No.	Description	Date

Sheet Information

FOUNDATION DETAILS

S301



4 TYPICAL INTERIOR SLAB-ON-GRADE TURNDOWN

NO SCALE

10300-FN-S00-04
DECEMBER 17, 2020
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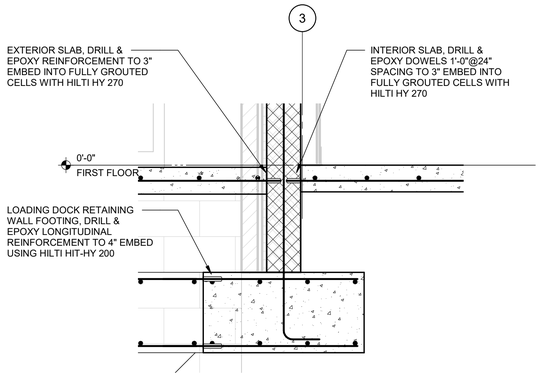
SPREAD FOOTING SCHEDULE					
MARK	LENGTH	WIDTH	DEPTH	REINF	REMARKS
F2	2'-0"	2'-0"	1'-2"	(3)-#4 EACH WAY BOTTOM	REFER TO 10/S302
F3	3'-0"	3'-0"	1'-0"	(4)-#5 EACH WAY BOTTOM	

WALL FOOTING SCHEDULE						
MARK	WIDTH	LENGTH	DEPTH	REINF TOP	REINF BOT	REMARKS
WF3.0	3'-0"	CONT	1'-6"	(4)-#5 LONG, #4@12" SHORT	(4)-#5 LONG, #4@12" SHORT	
WF4.0	4'-0"	CONT	1'-6"	(5)-#5 LONG, #4@12" SHORT	(5)-#5 LONG, #4@12" SHORT	

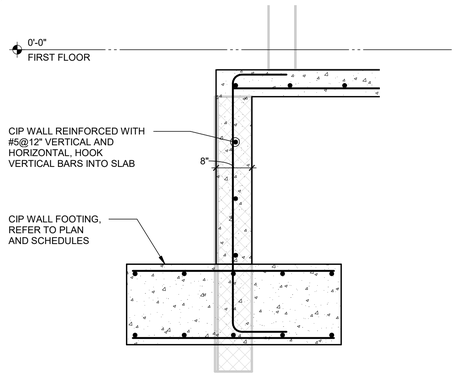
8 FOUNDATION SCHEDULES

NO SCALE



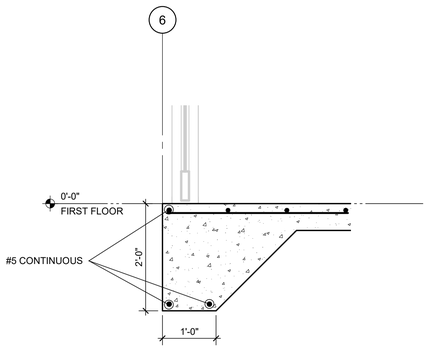
3 CMU WALL AT LOADING DOCK

3/4" = 1'-0"



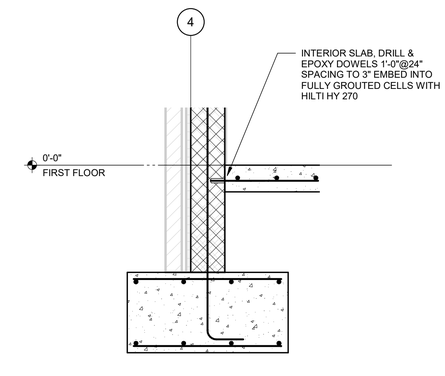
7 LOADING DOCK WALL

3/4" = 1'-0"



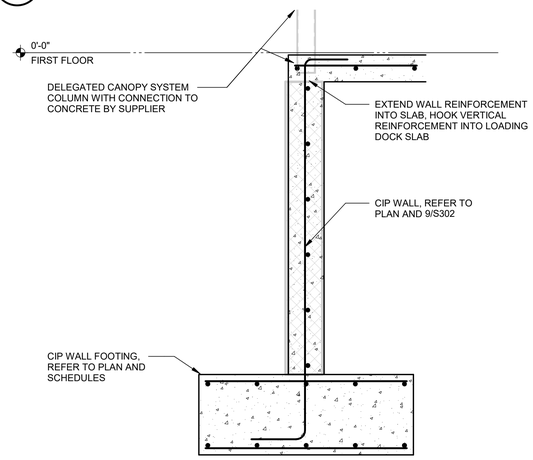
11 SLAB-ON-GRADE TURNDOWN

3/4" = 1'-0"



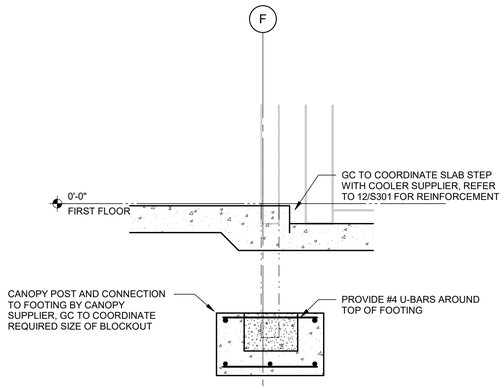
2 TYPICAL CMU WALL BASE

3/4" = 1'-0"



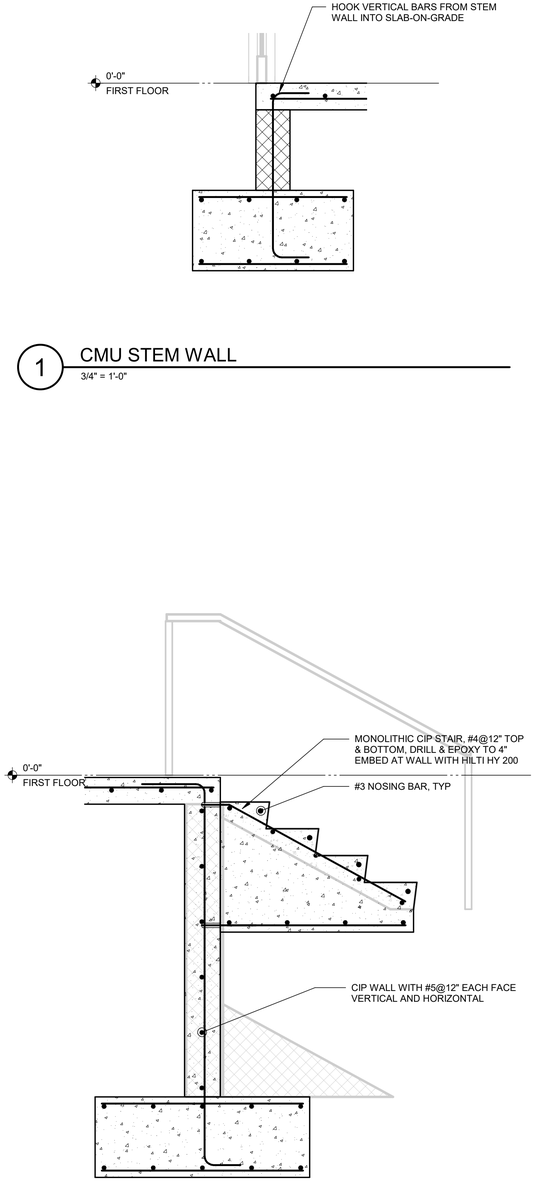
6 CANOPY BASE AT WALL

3/4" = 1'-0"



10 CANOPY POST BASE CONNECTION

3/4" = 1'-0"



1 CMU STEM WALL

3/4" = 1'-0"

9 LOADING DOCK STEPS

3/4" = 1'-0"

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No.	Description	Date

Sheet Information

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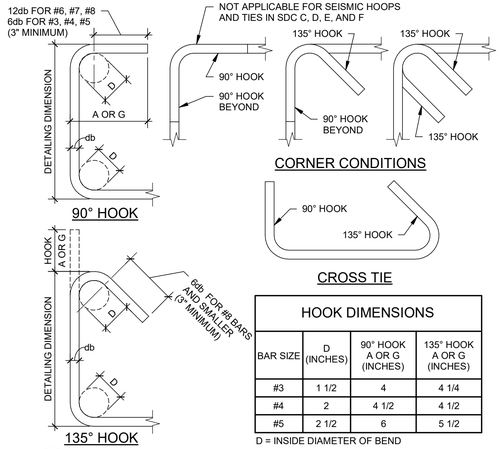
S302



HOOK DIMENSIONS			
BAR SIZE	D (INCHES)	90° HOOK A OR G (INCHES)	135° HOOK A OR G (INCHES)
#3	1 1/2	4	4 1/4
#4	2	4 1/2	4 1/2
#5	2 1/2	6	5 1/2

D = INSIDE DIAMETER OF BEND

4 TYPICAL STIRRUP, HOOP, AND TIE HOOKS

NO SCALE

03210-CL-REBAR-01A
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SLAB TENSION DEVELOPMENT AND LAP SPLICE LENGTHS

GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE

BAR SIZE	LAP CLASS	f'c = 3000 PSI		f'c = 4000 PSI		f'c = 5000 PSI		f'c = 6000 PSI		f'c = 7000 PSI		f'c = 8000 PSI	
		BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS
#3	A	12	13	12	12	12	12	12	12	12	12	12	12
	B	16	17	16	16	16	16	16	16	16	16	16	16
#4	A	17	22	15	19	13	17	12	16	12	14	12	14
	B	23	29	20	25	17	23	16	21	16	19	16	19
#5	A	25	32	21	28	19	25	18	23	16	21	15	20
	B	33	42	28	37	25	33	24	30	21	28	20	26
#6	A	33	43	29	37	26	34	24	31	22	28	21	27
	B	43	56	38	49	34	45	32	41	29	37	28	36
#7	A	53	69	46	60	42	54	38	49	35	46	33	43
	B	69	90	60	78	55	71	50	64	46	60	43	56
#8	A	66	86	57	74	51	67	47	61	44	56	41	53
	B	86	112	75	97	67	88	62	80	58	73	54	69
#9	A	80	104	69	90	62	81	57	74	53	68	49	64
	B	104	136	90	117	81	106	75	97	69	89	64	84
#10	A	96	125	83	108	75	97	68	88	63	82	59	77
	B	125	163	108	141	98	127	89	115	82	107	77	101
#11	A	113	146	98	127	87	114	80	104	74	96	69	90
	B	147	190	128	166	114	149	104	136	97	125	90	117

NOTES:
1. ALL SPLICE LENGTHS ARE IN INCHES.
2. THIS TABLE SHALL BE USED FOR SLABS ONLY. REFER TO OTHER DEVELOPMENT LENGTH TABLES FOR OTHER MEMBERS.
3. THE TENSION DEVELOPMENT LENGTH (Ld) IS EQUAL TO THE SCHEDULED "CLASS A" LAP SPLICE LENGTH.
4. A BOTTOM BAR IS DEFINED AS ANY BAR THAT DOES NOT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
5. OTHER BARS INCLUDE TOP BARS AND ALL OTHER BARS THAT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR. FOR TOP REINFORCEMENT IN SLABS THAT ARE 12" THICK OR LESS, TABULATED SPLICE LENGTHS FOR BOTTOM BARS SHALL BE USED.
6. FOR EPOXY-COATED BARS, MULTIPLY THE TABULATED SPLICE LENGTHS OF BOTTOM BARS BY 1.5 AND THE TABULATED SPLICE LENGTHS OF OTHER BARS BY 1.3.
7. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR BUT MAY NOT BE LESS THAN THE "CLASS A" SPLICE LENGTH OF THE LARGER BAR.
8. FOR CONCRETE STRENGTHS IN BETWEEN THOSE TABULATED HERE, USE DEVELOPMENT AND LAP SPLICE LENGTHS OF LOWER CONCRETE STRENGTH.

3 TYPICAL SLAB TENSION DEVELOPMENT AND LAP SPLICE LENGTHS

NO SCALE

03960-FL-DEL5P-03
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DEVELOPMENT LENGTHS OF STANDARD HOOKS IN TENSION

GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE

BAR SIZE	f'c=3000 PSI		f'c=4000 PSI		f'c=5000 PSI		f'c=6000 PSI		f'c=7000 PSI		f'c=8000 PSI		BAR SIZE
	Lhb	0.7 Lhb	Lhb	0.7 Lhb	Lhb	0.7 Lhb	Lhb	0.7 Lhb	Lhb	0.7 Lhb	Lhb	0.7 Lhb	
#3	9	7	8	6	7	6	6	6	6	6	6	6	#3
#4	11	8	10	7	9	7	8	6	8	6	7	6	#4
#5	14	10	12	9	11	8	10	7	9	7	9	7	#5
#6	17	12	15	11	13	10	12	9	11	8	11	8	#6
#7	20	14	17	12	15	11	14	10	13	10	12	9	#7
#8	22	16	19	14	17	12	16	12	15	11	14	10	#8
#9	25	18	22	16	20	14	18	13	17	12	16	12	#9
#10	28	20	25	18	22	16	20	14	19	14	18	13	#10
#11	31	22	27	19	24	17	22	16	21	15	19	14	#11
#14	38	-	33	-	29	-	27	-	25	-	23	-	#14
#18	50	-	43	-	39	-	35	-	33	-	31	-	#18

NOTES:
1. Ldh = DEVELOPMENT LENGTH OF STANDARD HOOKS IN TENSION (INCHES).
2. Ldh = Lhb UNLESS CONDITIONS OF NOTE 3 ARE SATISFIED.
3. Ldh = 0.7Lhb FOR #11 BARS AND SMALLER WHEN SIDE COVER (NORMAL TO PLANE OF HOOK) IS NOT LESS THAN 2 1/2 INCHES AND FOR 90° HOOKS COVER ON BAR EXTENSION BEYOND HOOK IS NOT LESS THAN 2 INCHES.
4. HOOKS ARE NOT CONSIDERED EFFECTIVE FOR DEVELOPING BARS IN COMPRESSION.
5. Ldh SHALL BE MULTIPLIED BY 1.2 FOR EPOXY-COATED HOOKED REINFORCING BARS.

1 TYPICAL DEVELOPMENT LENGTHS OF STANDARD HOOKS IN TENSION

NO SCALE

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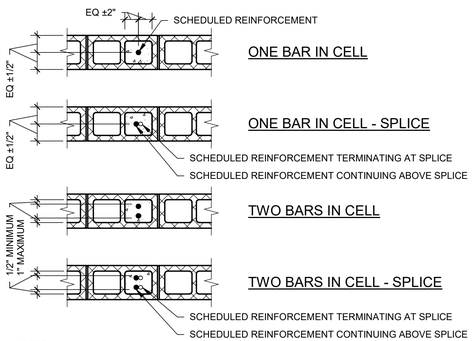

NOTES:
1. REINFORCEMENT MUST BE PLACED USING REINFORCING BAR POSITIONERS THAT LOCATE THE BAR AS SPECIFIED AND PREVENT MOVEMENT OF THE BAR DURING CONSTRUCTION.
2. SPLICED REINFORCEMENT MUST BE A CONTACT LAP SPLICE WITH SPLICED BARS ALIGNED PARALLEL TO THE WALL AS SHOWN.
3. THE ENGINEER MUST BE NOTIFIED PRIOR TO PLACEMENT OF REINFORCEMENT THAT IS REQUIRED TO BE PLACED OUTSIDE OF THE TOLERANCES OF THIS DETAIL SUCH AS TO AVOID INTERFERENCE WITH OTHER REINFORCEMENT, CONDUITS, OR EMBEDDED ITEMS.

8 TYPICAL CMU VERTICAL BAR PLACEMENT

NO SCALE

04200-WL-REBAR-01
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CMU WALL, PILASTER, AND COLUMN VERTICAL BAR TENSION DEVELOPMENT AND LAP SPLICE LENGTHS

GRADE 60 REINFORCEMENT, STANDARD BLOCK (f'm = 1500 PSI)

BAR SIZE	4" CMU	6" CMU		8" CMU		10" CMU		12" CMU	
	1 BAR /CELL	1 BAR /CELL	2 BARS /CELL	1 BAR /CELL	2 BARS /CELL	1 BAR /CELL	2 BARS /CELL	1 BAR /CELL	2 BARS /CELL
#3	19	16	19	16	17	16	17	16	17
#4	34	25	34	21	29	21	29	21	29
#5	NP	40	45	27	45	26	45	26	45
#6	NP	NP	NP	51	54	40	54	40	54
#7	NP	NP	NP	63	63	52	63	46	63
#8	NP	NP	NP	72	NP	72	72	63	72
#9	NP	NP	NP	NP	NP	NP	NP	81	81
#10	NP	NP	NP	NP	NP	NP	NP	NP	NP
#11	NP	NP	NP	NP	NP	NP	NP	NP	NP

NP = NOT PERMITTED

NOTES:
1. ALL DEVELOPMENT AND LAP SPLICE LENGTHS ARE IN INCHES.
2. THIS TABLE SHALL BE USED FOR ALL REINFORCED CMU WALLS, PILASTERS, AND COLUMNS UNLESS NOTED OTHERWISE IN DETAILS.
3. INCREASE TABULATED VALUES BY 50% FOR EPOXY COATED REINFORCEMENT.
4. WITH APPROVAL BY THE ENGINEER, WELDED SPLICES AND MECHANICAL SPLICES DEVELOPING AT LEAST 125% OF THE YIELD STRENGTH, Fy, OF THE BAR MAY BE SUBSTITUTED IN SOME LOCATIONS.
5. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR.
6. REFER TO "TYPICAL CMU VERTICAL BAR PLACEMENT" FOR BAR POSITIONING IN CELLS.

7 TYPICAL CMU VERTICAL BAR TENSION DEVELOPMENT AND LAP SPLICE LENGTHS

NO SCALE

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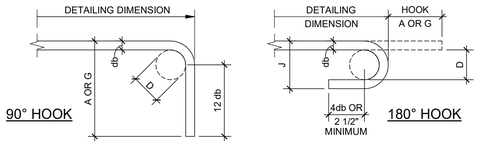

END HOOK DIMENSIONS				
BAR SIZE	FINISHED BEND DIAMETER D, (INCHES)	180° HOOKS		90° HOOK
		A OR G, (INCHES)	J, (INCHES)	A OR G, (INCHES)
#3	2 1/4	5	3	6
#4	3	6	4	8
#5	3 3/4	7	5	10
#6	4 1/2	8	6	12
#7	5 1/4	10	7	14
#8	6	11	8	16
#9	9 1/2	15	11 3/4	19
#10	10 3/4	17	13 1/4	22
#11	12	19	14 3/4	24
#14	18 1/4	27	21 3/4	31
#18	24	36	28 1/2	41

D = INSIDE DIAMETER OF BEND

6 TYPICAL END HOOK TYPES

NO SCALE

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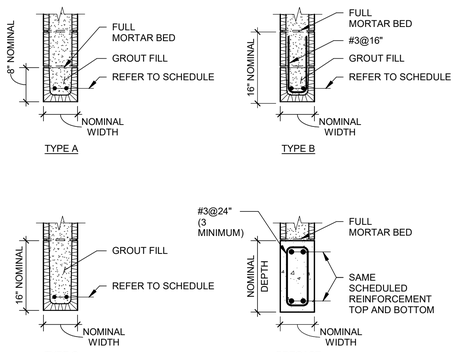

LOADBEARING CMU LINTELS				
CLEAR SPAN	REINFORCING REQUIREMENTS IN NOMINAL LINTEL SECTION			
	8x8	8x16	8x24	8x32
3'-4"	2-#5	UR	UR	UR
4'-0"	2-#5	UR	UR	UR
4'-8"	2-#5	UR	UR	UR
5'-4"	NA	2-#5	UR	UR
6'-0"	NA	2-#5	UR	UR
6'-8"	NA	2-#5	UR	UR
7'-4"	NA	2-#5	UR	UR
8'-0"	NA	2-#5	UR	UR
8'-8"	NA	NA	2-#5	UR
9'-4"	NA	NA	2-#5	UR
10'-0"	NA	NA	2-#5	UR
10'-8"	NA	NA	2-#5	2-#5
11'-4"	NA	NA	2-#5	2-#5
12'-0"	NA	NA	NA	2-#5

NOTES:
1. DEFINITIONS: UR = UNREINFORCED WALL (NO VERTICAL REINFORCEMENT IS REQUIRED, EXCEPT AS DETAILED ON DRAWINGS AT OPENINGS, ETC.)
   NA = NOT APPLICABLE, THICKER WALL REQUIRED FOR SPAN
2. REFER TO ARCHITECTURAL DRAWINGS FOR SIZE AND LOCATION OF OPENINGS.
3. PROVIDE 1" OF BEARING AT EACH JAMB FOR EACH FOOT OF CLEAR SPAN BUT NOT LESS THAN 7 5/8". REINFORCEMENT SHALL PROJECT A MINIMUM OF 6" ONTO THE BEARING.
4. MINIMUM MASONRY COMPRESSIVE STRENGTH OF GROUTED PRISM f'm=1500 PSI.
5. LINTELS SCHEDULED AS 16" HIGH MAY BE EITHER TYPE B OR TYPE C AS DETAILED BELOW.
6. PRECAST CONCRETE LINTELS AS SHOWN MAY BE USED WITH ARCHITECT APPROVAL. MINIMUM f'c=3000 PSI.
7. USE FOR RUNNING BOND ONLY.

11 TYPICAL LOADBEARING CMU LINTELS

NO SCALE

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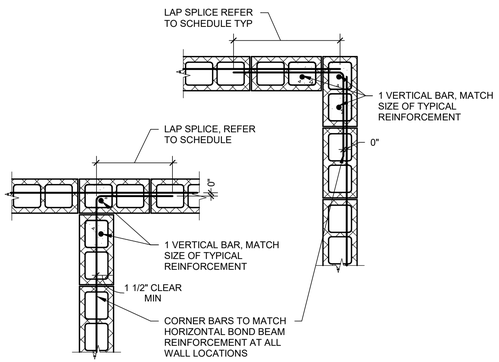

12 TYPICAL BOND BEAM AT WALL INTERSECTION

NO SCALE

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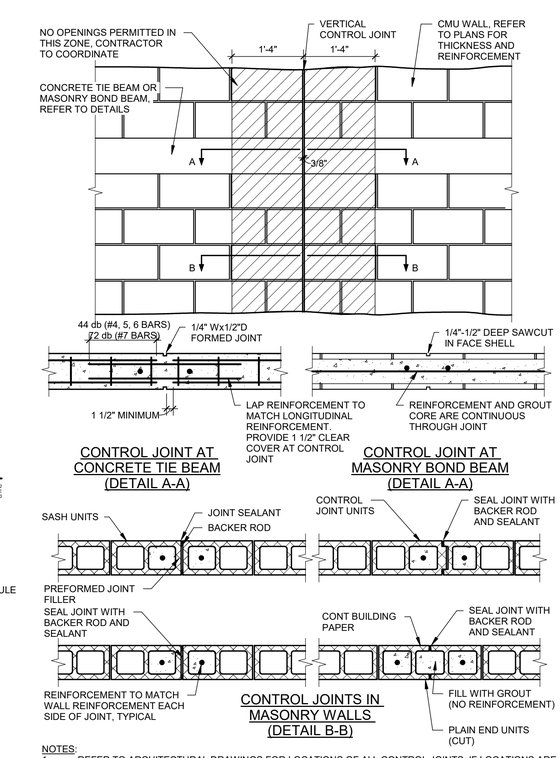

NOTES:
1. REFER TO ARCHITECTURAL DRAWINGS FOR LOCATIONS OF ALL CONTROL JOINTS. IF LOCATIONS ARE NOT SHOWN, CONTRACTOR SHALL SUBMIT PROPOSED LAYOUT FOR ARCHITECT AND ENGINEER APPROVAL. PLACE JOINTS IN ACCORDANCE WITH THE FOLLOWING GUIDELINES:
   A. MAXIMUM SPACING: 20 FEET
   B. MAXIMUM LENGTH/HEIGHT RATIO: 2 TO 1
   C. AT ALL CHANGES IN WALL HEIGHT GREATER THAN 4'-0"
   D. CHANGES IN WALL THICKNESS
   E. NEAR WALL INTERSECTIONS
   F. AT CORRESPONDING CONSTRUCTION JOINTS IN FOUNDATIONS, FLOOR, OR ROOF CONSTRUCTION
2. COORDINATE WATERPROOFING AND REQUIRED FIRE RATING OF CONTROL JOINTS WITH ARCHITECT.
3. STOP HORIZONTAL JOINT REINFORCEMENT 2" EACH SIDE OF JOINT. REFER TO DETAILS A-A FOR HORIZONTAL REINFORCEMENT AT TIE BEAMS AND BOND BEAMS.
4. USE HALF BLOCKS AT ALTERNATE COURSES SO JOINTS ARE CONSISTENT THROUGH WALLS.
5. FOUR OPTIONS ARE SHOWN FOR DETAIL B-B. ALTERNATE USED IS AT CONTRACTOR'S OPTION BUT SUBJECT TO APPROVAL BY ARCHITECT.
6. PROVIDE REINFORCED VERTICAL CELL EACH SIDE OF JOINT AS SHOWN. REINFORCEMENT TO MATCH OTHER WALL REINFORCEMENT.

9 TYPICAL CMU WALL VERTICAL CONTROL JOINTS

NO SCALE

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WPM Project No. 505-1903700

DYLAN S. RICHARD
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No. 80997
STATE OF FLORIDA
PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

Project Number	1918

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02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-16

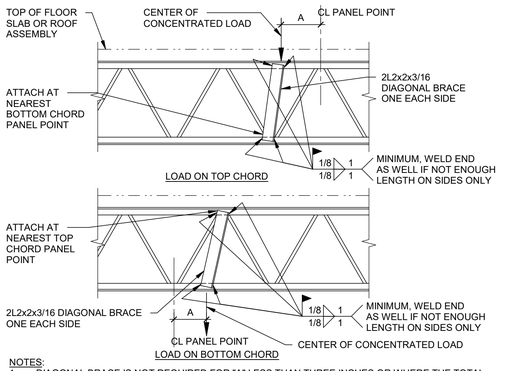
Revisions

No.	Description	Date

Sheet Information

FRAMING DETAILS

S401



NOTES:
1. DIAGONAL BRACE IS NOT REQUIRED FOR "A" LESS THAN THREE INCHES OR WHERE THE TOTAL OF ALL CONCENTRATED LOADS BETWEEN PANEL POINTS DOES NOT EXCEED 100 POUNDS.
2. PROVIDE DIAGONAL BRACE AT LOCATION OF CONCENTRATED LOADS SUCH AS PARTITIONS, HEAVY PIPES, MECHANICAL UNITS, HEAVY LIGHTS AND ANY OTHER CONCENTRATED LOADS AND AS NOTED ELSEWHERE IN THE STRUCTURAL DRAWINGS. LOADS MUST BE APPLIED CONCENTRICALLY TO JOIST BOTTOM CHORD.

4 TYPICAL STIFFENING OF JOIST FOR CONCENTRATED LOADS

NO SCALE

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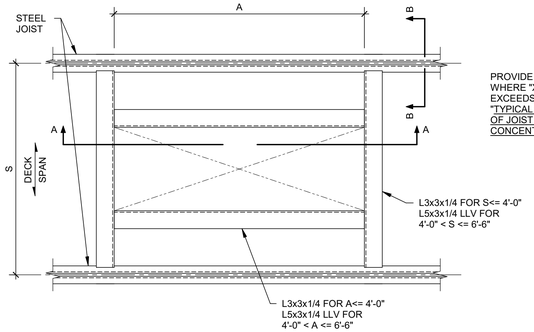

NOTES:
1. COORDINATE OPENING SIZES AND LOCATIONS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. ROOF DECK SHALL BE CONTINUOUS OVER FRAMED OPENINGS. DO NOT CUT OPENINGS UNTIL IMMEDIATELY BEFORE THEY ARE NEEDED.
3. VERIFY FRAMING WITH ENGINEER WHERE DIMENSIONS EXCEED MAXIMUM DIMENSIONS SHOWN IN THIS DETAIL.
4. REFER TO SPECIFICATIONS FOR OPENINGS WHERE THE LONGEST DIMENSION IS 10" OR LESS.

3 TYPICAL FRAMED OPENING IN ROOF DECK WITH JOIST CONSTRUCTION

NO SCALE

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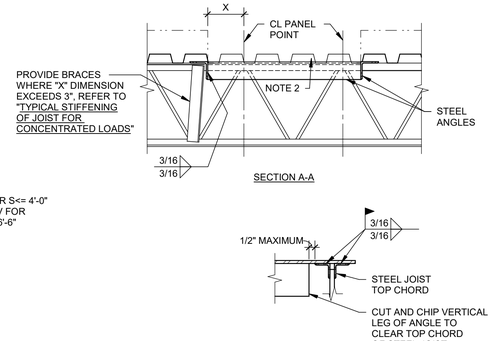
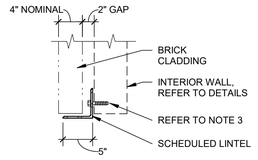


STEEL LOOSE LINTELS SUPPORTING BRICK ONLY	
CLEAR OPENING	MINIMUM ANGLE SIZE
≤ 6'-0"	L5x3 1/2x5/16
6'-8"	L5x3 1/2x5/16
7'-4"	L5x5x5/16
8'-0"	L5x5x5/16



TYPICAL SECTION

NOTES:
1. REFER TO ARCHITECTURAL DRAWINGS FOR SIZE AND LOCATION OF OPENINGS.
2. PROVIDE 1" OF BEARING AT EACH JAMB FOR EACH FOOT OF CLEAR SPAN BUT NOT LESS THAN 6".
3. WHERE MINIMUM BEARING CANNOT BE ACHIEVED, PLEASE PROVIDE 1/2"Ø x3" EMBED HILTI KWIK HUS-EZ SCREW ANCHORS SPACED @24" C-C AND WITHIN 3" OF END. ANCHORS TO BE INSTALLED INTO FULLY GROUTED CELLS, SUBMIT DETAILS FOR ENGINEER APPROVAL. MIN ANGLE SIZE L5x5x5/16 IF REQUIRED.
4. ALL LINTELS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
5. FOR MASONRY OPENINGS GREATER THAN 8'-0", REFER TO DETAILS ON DRAWINGS OR REFER TO ENGINEER.
6. BRICK HEIGHTS OVER OPENINGS GREATER THAN ONE HALF THE LINTEL SPAN SHALL BE SHORED UNTIL MORTAR HAS SET AND CURED.
7. USE FOR RUNNING BOND ONLY.

1 TYPICAL STEEL LOOSE LINTELS SUPPORTING BRICK ONLY

NO SCALE

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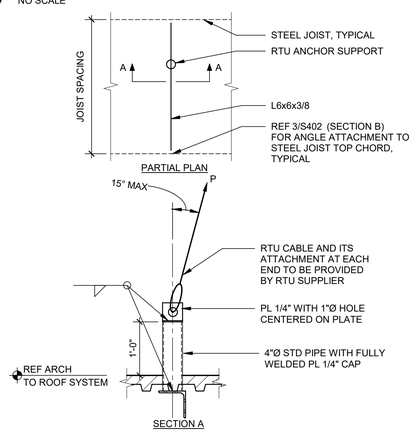
MASONRY WALL SCHEDULE			
	CMU TYPE	VERTICAL REINF	
MARK	WIDTH	SIZE	SPACING
MW8.1	7 5/8"	#5	@24"

TIE BEAM SCHEDULE				
			REINFORCEMENT	
MARK	WIDTH	DEPTH	LONGITUDINAL	SHEAR
TB8.1	7 5/8"	2'-8"	(4)-#5 EACH FACE	#3 STIRRUPS @12"
TB8.2	7 5/8"	3'-4"	(5)-#5 EACH FACE	#3 STIRRUPS @12"
TB8.3	7 5/8"	4'-0"	(5)-#5 EACH FACE	#3 STIRRUPS @12"
TB8.4	7 5/8"	4'-8"	(6)-#5 EACH FACE	#3 STIRRUPS @12"
TB8.5	7 5/8"	VARIES	#5@12" EACH FACE	#3 STIRRUPS @12"
TB8.6	7 5/8"	7'-6 1/2"		

11 WALL SCHEDULES

NO SCALE



NOTES:
1. RTU ANCHOR SUPPORT QUANTITY AND LOCATIONTO BE DETERMINED BY RTU SUPPLIER (CONTRACTOR TO COORDINATE).
2. LOCATE RTU ANCHOR SUPPORTS SUCH THAT "P" DOES NOT EXCEED 1,000 LBS MAX.
3. ALL STEEL ABOVE TOP OF ROOF SYSTEM TO BE GALVANIZED.

8 RTU ANCHOR SUPPORT

3/4" = 1'-0"

BEAM AND GIRDER TENSION DEVELOPMENT AND LAP SPLICE LENGTHS GRADE 60 REINFORCEMENT, NORMALWEIGHT CONCRETE													
BAR SIZE	LAP CLASS	f'c = 3000 PSI		f'c = 4000 PSI		f'c = 5000 PSI		f'c = 6000 PSI		f'c = 7000 PSI		f'c = 8000 PSI	
		BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS	BOTTOM BARS	OTHER BARS
#3	A	12	13	12	12	12	12	12	12	12	12	12	12
	B	16	17	16	16	16	16	16	16	16	16	16	16
#4	A	16	20	14	18	12	16	12	15	12	14	12	13
	B	21	26	19	24	16	21	16	20	16	19	16	17
#5	A	23	29	20	25	18	23	16	21	15	19	14	18
	B	30	38	26	33	24	30	21	28	20	25	19	24
#6	A	31	40	27	35	24	31	22	28	20	26	19	25
	B	41	52	36	46	32	41	29	37	26	34	25	33
#7	A	46	60	40	52	36	46	33	42	30	39	28	37
	B	60	78	52	68	47	60	43	55	39	51	37	49
#8	A	60	78	52	67	46	60	42	55	39	51	37	48
	B	78	102	68	88	60	78	55	72	51	67	49	63
#9	A	64	84	56	72	50	65	46	59	42	55	40	51
	B	84	110	73	94	65	85	60	77	55	72	52	67
#10	A	72	93	62	81	56	72	51	66	47	61	44	57
	B	94	121	81	106	73	94	67	86	62	80	58	75
#11	A	85	110	74	96	66	86	60	78	56	72	52	68
	B	111	143	97	125	86	112	78	102	73	94	68	89

NOTES:
1. ALL SPLICE LENGTHS ARE IN INCHES.
2. THIS TABLE SHALL BE USED FOR BEAMS AND GIRDERS ONLY. REFER TO OTHER DEVELOPMENT LENGTH TABLES FOR OTHER MEMBERS.
3. THE TENSION DEVELOPMENT LENGTH (Ld) IS EQUAL TO THE SCHEDULED "CLASS A" LAP SPLICE LENGTH.
4. A BOTTOM BAR IS DEFINED AS ANY BAR THAT DOES NOT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
5. OTHER BARS INCLUDE TOP BARS, FACE BARS, AND ALL OTHER BARS THAT HAVE MORE THAN 12" OF FRESH CONCRETE BELOW THE BAR.
6. FOR EPOXY-COATED BARS, MULTIPLY THE TABULATED SPLICE LENGTHS OF BOTTOM BARS BY 1.5 AND THE TABULATED SPLICE LENGTHS OF OTHER BARS BY 1.3.
7. WHEN LAP SPLICING BARS OF DIFFERENT SIZES, THE LAP LENGTH IS DETERMINED BY THE SMALLER BAR BUT MAY NOT BE LESS THAN THE "CLASS A" SPLICE LENGTH OF THE LARGER BAR.
8. FOR CONCRETE STRENGTHS IN BETWEEN THOSE TABULATED HERE, USE DEVELOPMENT AND LAP SPLICE LENGTHS OF LOWER CONCRETE STRENGTH.

7 TYPICAL BEAM AND GIRDER TENSION DEVELOPMENT AND LAP SPLICE LENGTHS

NO SCALE

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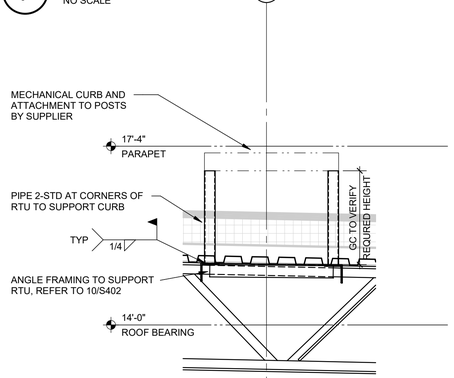
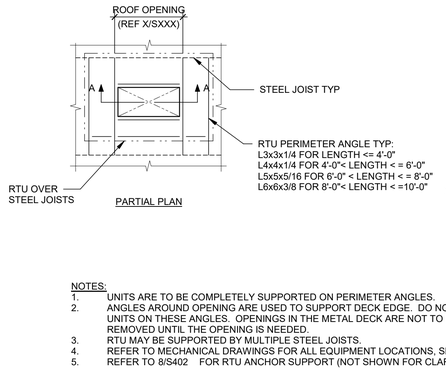


9 RTU POSTS

3/4" = 1'-0"



NOTES:
1. UNITS ARE TO BE COMPLETELY SUPPORTED ON PERIMETER ANGLES.
2. ANGLES AROUND OPENING ARE USED TO SUPPORT DECK EDGE. DO NOT SUPPORT UNITS ON THESE ANGLES. OPENINGS IN THE METAL DECK ARE NOT TO BE CUT AND REMOVED UNTIL THE OPENING IS NEEDED.
3. RTU MAY BE SUPPORTED BY MULTIPLE STEEL JOISTS.
4. REFER TO MECHANICAL DRAWINGS FOR ALL EQUIPMENT LOCATIONS, SIZES, AND WEIGHTS.
5. REFER TO 8/S402 FOR RTU ANCHOR SUPPORT (NOT SHOWN FOR CLARITY).

10 RTU SUPPORT AT JOIST FRAMING

3/4" = 1'-0"

5 TYPICAL STEEL JOIST PARALLEL BRIDGING AT CMU WALL

NO SCALE

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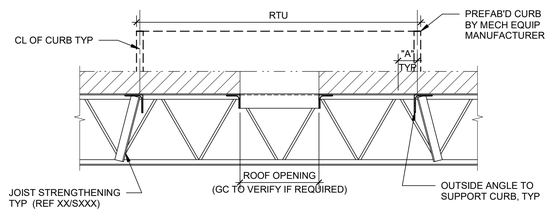
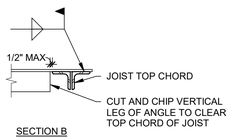
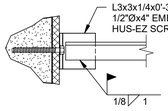
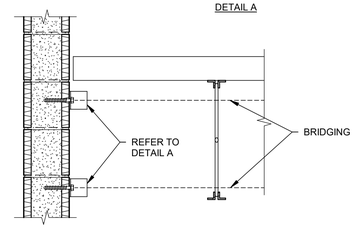






DETAIL A



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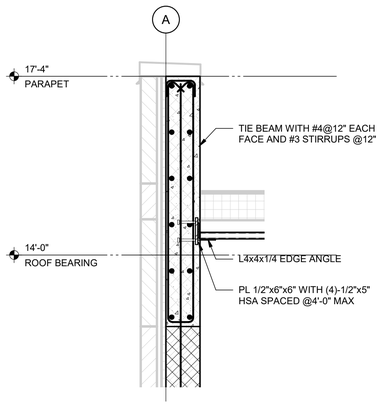
Revisions

No.	Description	Date

Sheet Information

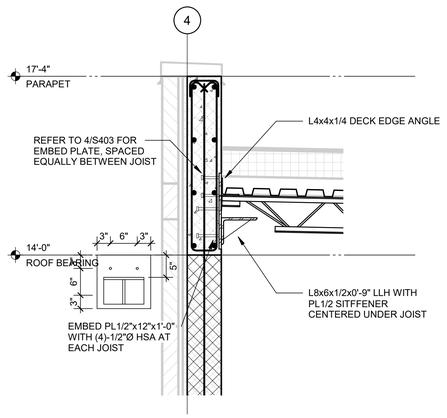
FRAMING DETAILS

S402



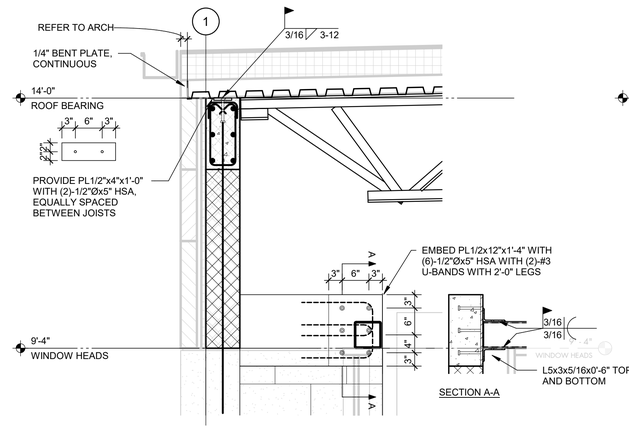
4 ROOF DECK CONNECTION

3/4" = 1'-0"



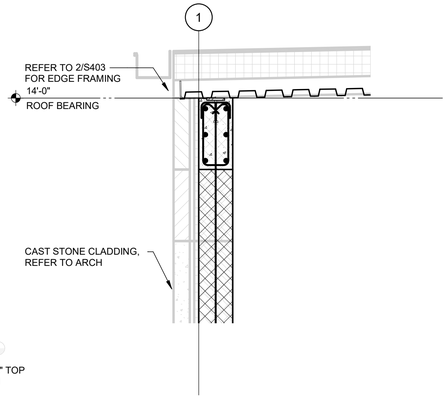
3 ROOF JOIST BEARING

3/4" = 1'-0"



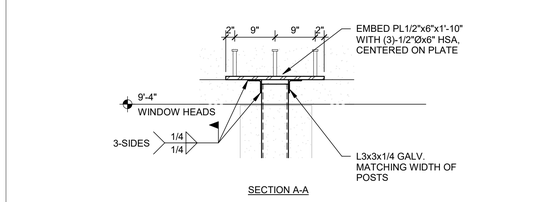
2 ENTRY FRAMING

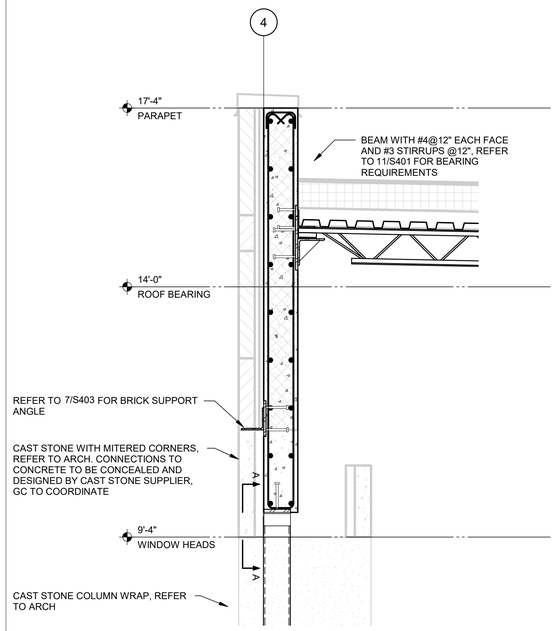
3/4" = 1'-0"



1 DECK BEARING ON WALL

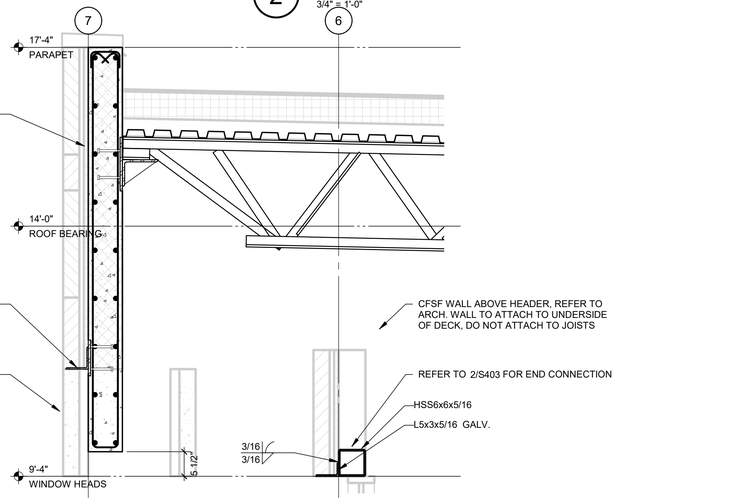
3/4" = 1'-0"





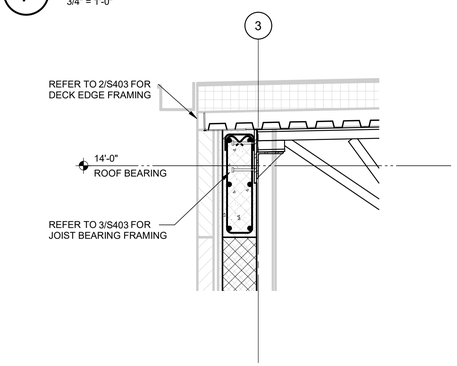
12 ENTRY FRAMING

3/4" = 1'-0"



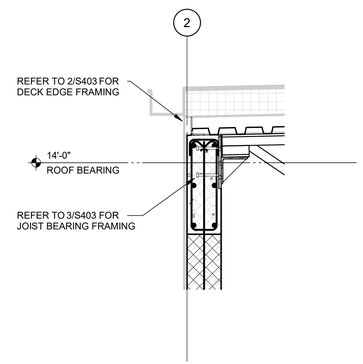
7 ENTRY FRAMING

3/4" = 1'-0"



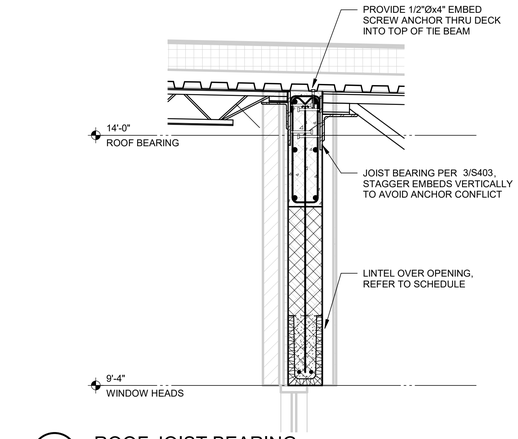
11 ROOF JOIST BEARING

3/4" = 1'-0"



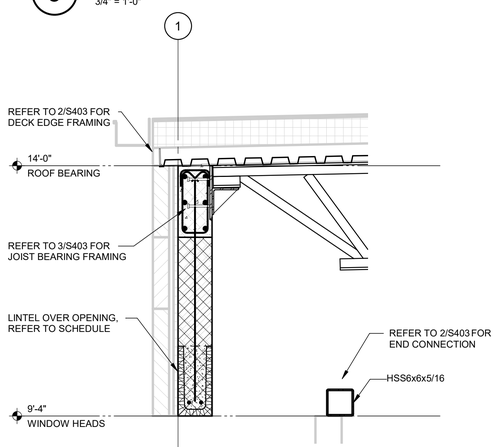
10 ROOF JOIST BEARING

3/4" = 1'-0"



5 ROOF JOIST BEARING

3/4" = 1'-0"



9 ENTRY FRAMING

3/4" = 1'-0"

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WPM Project No. 505-1903700

DYLAN S. RICHARD
LICENSED
No. 80997
STATE OF FLORIDA
PROFESSIONAL ENGINEER

To the best of the engineer's knowledge, the plans and specifications comply with the applicable minimum building codes.

Project Information

Owner

UF IFAS Blueberry Research Facility

UNIVERSITY OF FLORIDA
HULL ROAD
GAINESVILLE, FL

Project Number 1918

Distribution

No.	Description	Date
01	ADVANCED SCHEMATIC DESIGN	2020-03-26
02	DESIGN DEVELOPMENT	2020-06-12
03	100% CONSTRUCTION DOCUMENTS	2020-11-17
04	BID DOCUMENTS	2020-12-16

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FRAMING DETAILS

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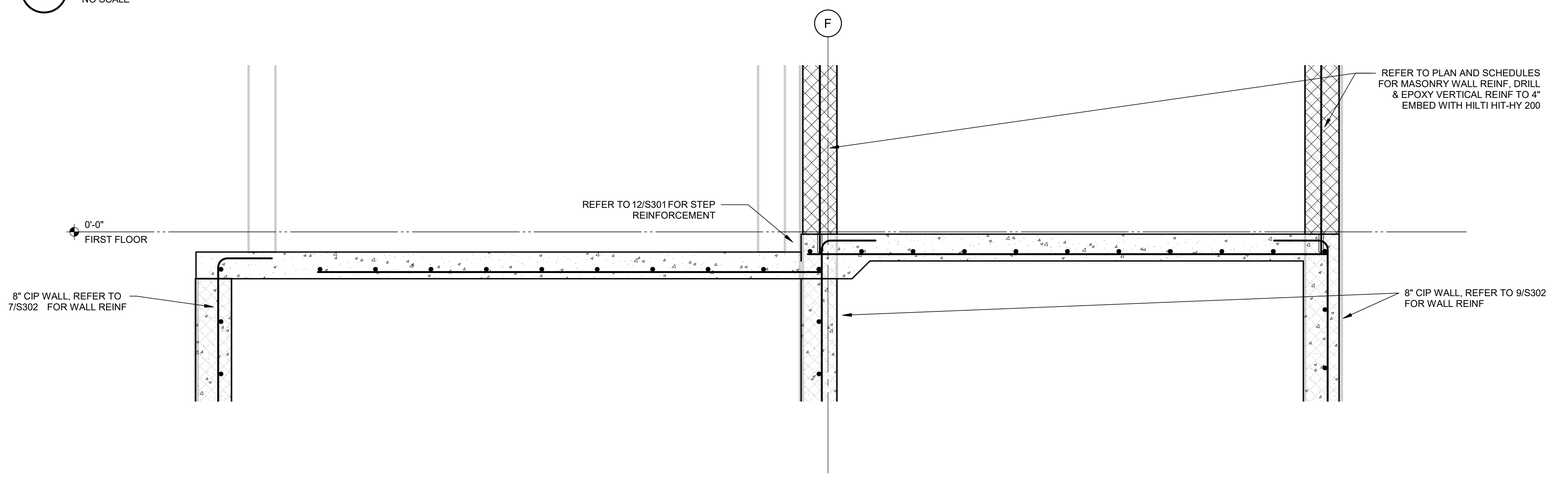
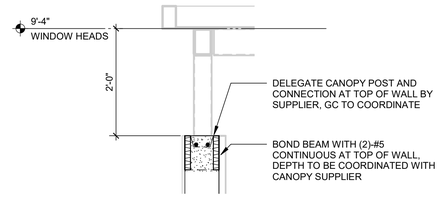
CLASSES OF CONCRETE MATRIX								
CONCRETE USAGE	MINIMUM COMPRESSIVE STRENGTH [f'c]	CONCRETE TYPE	EXPOSURE CLASSES	MAXIMUM W/CM RATIO	PERMISSIBLE AIR CONTENT	REQUIRED CEMENT REPLACEMENT	MAXIMUM AGGREGATE SIZE	ADDITIONAL REMARKS
GRADE BEAMS	4,000 PSI AT 28 DAYS	NWC	C1	N/A	N/A	40-70%	1-1/2"	
RETAINING WALLS	4,000 PSI AT 28 DAYS	NWC	C1	N/A	N/A	25-50%	1"	
SLABS-ON-GRADE INTERIOR	4,000 PSI AT 28 DAYS	NWC	-	0.45	N/A	0-50%	1-1/2"	
SLABS-ON-GRADE EXTERIOR	4,000 PSI AT 28 DAYS	NWC	C1	0.45	N/A	0-50%	1-1/2"	
TIE BEAMS	4,000 PSI AT 28 DAYS	NWC	-	0.45	N/A	15-50%	3/4"	

NOTES:
1. ALL CONCRETE SHALL BE CONSIDERED TO BE IN EXPOSURE CLASS F0, S0, W0, AND C0 ACCORDING TO ACI 318-14 UNLESS NOTED OTHERWISE IN TABLE ABOVE, IN NOTES BELOW, OR ELSEWHERE ON THE STRUCTURAL DRAWINGS.
2. CONCRETE SHALL BE PROPORTIONED TO COMPLY WITH ACI 318-14 TABLES 19.3.2.1, 19.3.3.1, AND 26.4.2.2b IN ADDITION TO THE NOTATIONS IN THE TABLE ABOVE AND THE STRICTER REQUIREMENTS SHALL GOVERN. REFER TO THE SPECIFICATIONS FOR OTHER REQUIREMENTS FOR VARIOUS EXPOSURE CLASSES RELATIVE TO CEMENT TYPE, AIR ENTRAINMENT REQUIREMENTS, CHLORIDE ION LIMITS, AND POZZOLAN LIMITS.

4 CLASSES OF CONCRETE MATRIX
NO SCALE



8 LOADING DOCK WALLS
3/4" = 1'-0"



1 CANOPY CONNECTION
3/4" = 1'-0"

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